NEW PALEOCURRENT MEASUREMENTS, CLAST POPULATION DATA, AND AGE DATES IN THE LATE EOCENE CASTLE ROCK CONGLOMERATE, EAST-CENTRAL COLORADO: REMAPPING THE FLUVIAL SYSTEM, AND IMPLICATIONS FOR THE HISTORY OF THE COLORADO PIEDMONT AND FRONT RANGE

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Cover Photo: Trough cross-bedding at Castlewood Canyon State Park by Stephen M. Keller

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ABSTRACT

The Castle Rock Conglomerate (CRC) is a late Eocene fluvial deposit flanking the east side of the Colorado Front Range and lying within the Colorado Piedmont. It may reach about 70 m (230 ft) in thickness, is nearly flat-lying, and is discontinuous, capping both high-relief mesas and gentle hills. The unit occurs in a south-southeast-to-southeast-trending swath 63 km (39 mi) in length and about 3 to 10 km (2 to 6 mi) in width, extending from north of the city of Castle Rock to southeast of the town of Elbert. The conglomerate has an arkosic, coarse sand and granule matrix with abundant pebble to boulder-sized clasts that decrease in abundance upward. Large trough cross-beds are common in the exposed upper portion of the unit. In this interval, a comprehensive survey of paleocurrent directions from trough cross-beds yielded 2,897 measurements from outcrop exposures. At each trough, the axis azimuth (paleocurrent direction) and several other parameters were measured. Length-azimuth rose diagrams and large-scale digital topographic maps allowed the paleocurrent data to be a really and stratigraphically grouped into 411 consolidated local paleocurrent directions. The result is a new and detailed paleocurrent map of the upper portion of the unit. The map shows the paleocurrent pattern within the main paleochannel belt, which previously has been recognized as occupying a south-southeast to southeast-trending paleovalley; and two, newly documented, northeast to east-flowing tributary paleochannnels that originated southwest of the main paleochannel belt. In the area of Castlewood Canyon State Park, the JA Ranch paleochannel widened northeastward to become an alluvial fan, now partially obscured by deposits of the main paleochannel belt. The Bucks Mountain trend joined the main paleochannel belt in an area east of Running Creek and west of Elbert. A possible third tributary system may have existed north of Castle Rock, and is suggested by a small number of measurements in three isolated areas: Castle Rock Butte, Cherokee Mountain, and the mesa north of Newlin Gulch. Clast surveys at 24 locations recorded the lithology, maximum dimension, and roundness of all clasts >2 cm (0.8 in) in maximum dimension (nearly 11,000 clasts). In order of decreasing lithologic abundance, the gravel fraction of the conglomerate consists of granitics, Wall Mountain Tuff, quartz, blue-gray quartzite, other quartzites, and probable Lower Paleozoic sedimentary rocks (including possibly the Fountain Formation). Consolidated histograms of the 15 clast surveys in the main paleochannel belt versus nine surveys in the tributaries indicate some marked differences between the two populations: notably a larger proportion of granitics and a lower proportion of tuff exist in the main paleochannel belt than in the tributaries. Histograms of local sets of main paleochannel belt clast surveys versus tributary surveys indicate other notable differences, especially in clast lithology and size distribution.

Blue-gray quartzite, hypothesized by previous workers to originate from Coal Creek Canyon south of Boulder, is common in the main paleochannel belt. Well-rounded volcanic clasts of probable dacitic composition were collected from the base of the main paleochannel belt in Castlewood Canyon State Park. Sensitive High Resolution Ion Microprobe (SHRIMP)-RG U-Pb zircon age dates of these clasts range from 46 to 55 million years ago (Ma). Potential source areas for these volcanic clasts lie along a northeast trend between Leadville and Boulder. All of the clast lithologies found in the conglomerate are found along the Front Range. Absent from the clast surveys is the suite of Mesozoic sedimentary rocks now exposed along the mountain front, suggesting that today's prominent hogbacks of these rocks were not exposed, or not within the CRC source areas during the late Eocene. The present study indicates that large quantities of granitic and volcanic material existed along the Front Range in the late Eocene. This material likely buried the Mesozoic section at the range front and left part of the Paleozoic section (mainly the Fountain Formation) exposed. Exhumation of the Mesozoic rocks occurred sometime after deposition of the CRC.

INTRODUCTION

The Castle Rock Conglomerate (CRC) is a fluvial unit of probable Late Eocene age that lies in the Colorado Piedmont, an erosional inlier of the Great Plains Physiographic Province. **Figure 1** is a location map of the project area with a generalized outcrop map of the CRC as mapped by the Colorado Geological Survey (CGS) on 7.5-minute geologic quadrangles (scale 1:24,000). **Plate 1** is a shaded relief map showing the extent of the CRC as mapped by the Colorado Geological Survey (CGS). The map covers an area extending northwest to southeast from Lone Tree to Calhan, and southwest to northeast from Larkspur to Kiowa. Also on Plate 1 are the outlines of Plates 3A through 3D, four small-scale maps of consolidated paleocurrent directions; these maps support later discussion of paleocurrent patterns in the CRC. **Plate 2** covers approximately

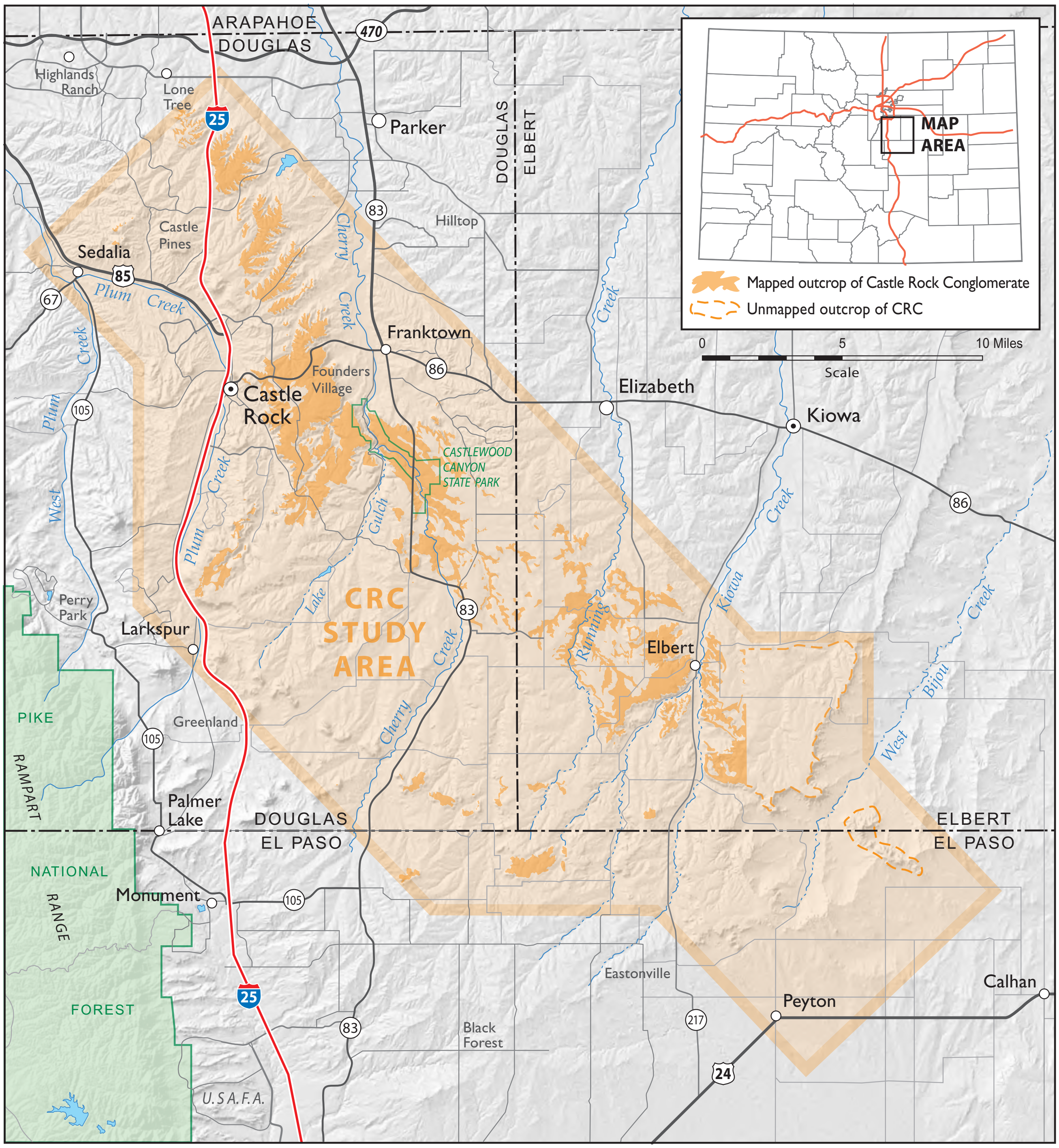


Figure 1. Location map of Castle Rock Conglomerate study area.

the same area as Plate 1, and is a generalized small-scale paleocurrent map of the stratigraphically upper portion of the CRC. The map shows an overview of paleocurrent directions in the unit, with the principal flow trends being the main paleochannel (red), the JA Ranch paleochannel and alluvial fan (blue), the Bucks Mountain trend (blue), and a possible tributary in the area of Cherokee Ranch, Castle Rock Butte, and mesa north of Newlin Gulch (blue). Plate 2 also displays the lines of section for cross sections A-A' through I-I'; the cross sections support later discussion of CRC paleocurrents. **Plates 3A through 3D** (indexed on Plate 1) are four small-scale maps of consolidated paleocurrent directions in the CRC, and together they cover nearly all of the CRC outcrop area. Each direction arrow has next to it the number of paleocurrent measurements represented, and the azimuth of the consolidated (or resolved) current direction. Red arrows belong to the southeast to south-southeast-trending main paleochannel belt. Blue arrows belong to the three identified northeast to east-trending tributaries: JA Ranch paleochannel and alluvial fan, Bucks Mountain trend, and possible third tributary north of Castle Rock. Lines of section for cross sections A-A' through I-I' also are shown, as well as location names within each cross section. Plates 3B through 3D display locations of the 24 clast surveys supporting the CRC paleocurrent study. The CRC was deposited in a system of channels and valleys that trend approximately northwest to southeast from the city of Lone Tree to the town of Calhan, as shown in Plate 2. The CRC consists of a coarse-grained arkosic sand and granule matrix with numerous pebble-to-boulder-sized clasts that decrease in abundance upward. Trough cross-beds of varying degrees of preservation are common in the upper part of the unit. The CRC may reach about 70 m (230 ft) in thickness, is nearly flat-lying, and is discontinuous, capping both high-relief mesas and gentle hills. The unit occurs in a south-southeast-to-southeast-trending swath 63 km (39 mi) in length and about 3 to 10 km (2 to 6 mi) in width. There are three principal results from the present study of the stratigraphically upper portion of the CRC:

1) a detailed paleocurrent map of the main, southeast-trending paleochannel belt in the CRC;

2) description and mapping of two (and a possible third) northeast-flowing tributaries to the main paleochannel belt; and

3) characterization of the lithology, particle size distribution, and roundness of the gravel fraction in the sediments.

The initial objective of this study was to map the paleocurrent pattern of the upper portion of CRC. There is no prior detailed map of flow directions in the unit, although earlier paleocurrent measurements by Morse (1979, 1985) indicated that the general paleoflow direction was east-southeast. On many mesas, buttes, and hills, and also along the sides of drainages, the upper portion of the CRC is eroded into ledges and other flat outcrops where local paleocurrent directions can readily be measured from trough cross-bedding found in flat-lying exposures. Such exposures are much less common below the edges of mesas and buttes, and in the lower parts of ravines and drainage courses, and so because of time constraints, these lower exposures were for the most part not included in the study. Landowners provided access to almost all areas where the CRC is mapped, and also to some yet unmapped exposures that were discovered during the course of the study. The few areas where access was denied are bracketed by areas of moderate to abundant paleocurrent data, and so their absence has not been disadvantageous to this investigation.

Early in the field work it was apparent that the majority of groups of paleocurrent measurements had azimuths ranging predominantly east-southeast to south-southeast, but that a significant minority trended from north-northeast to east-northeast. At several localities, one could step up or down along the ledge, going from one dominant direction to a different one. Therefore, an additional objective was included, which consisted of evaluating the paleocurrent distribution areally and vertically within the upper portion of the CRC, to test if distinct correlatable horizons contained different dominant paleocurrent directions, and to interpret such a pattern if discovered. This goal was accomplished by displaying groups of paleocurrent measurements on large-scale digital topography. Once having found that such differing horizons were present, another objective was added: to compare the CRC gravel fractions in horizons having different paleocurrent flow directions, to see if different source areas were indicated for different horizons. This task was accomplished by performing comprehensive clast surveys at selected locations, then characterizing the gravel according to lithology, maximum dimension, and roundness.

During the field work, coarse-grained volcanic clasts were discovered along vertical faces of the CRC at two locations. These clasts looked different than the often described clasts of Wall Mountain Tuff. They are well-rounded, coarser grained, tan to buff-colored, more vesiculated, and contain 1 cm (0.4 in) sized rectangular phenocrysts of feldspar. Thin section analysis suggests the composition of these clasts is dacitic. Two samples were collected from 1 m (3 ft) above the base of the CRC in Castlewood Canyon State Park and submitted to the USGS for Sensitive High Resolution Ion Microprobe (SHRIMP)-RG U-Pb zircon ages.

Data collection for our study was performed from 2008 through 2011, with some supplemental field work during 2015. Data collation and quality assurance, data reduction, database preparation, mapping, charting, assembly of cross sections and a structure contour map, and overall interpretation were carried out intermittently from late 2010 through mid-2013, with some additional work during 2015.

In paleocurrent analysis the directional properties of a sedimentary rock formation are measured and interpreted to characterize the flow systems that deposited the sediment. This characterization contributes to understanding certain features of the depositional environment and paleogeography of the formation, including paleoslope direction, direction of sediment supply, and inhomogeneity and anisotropy that are of primary origin. Interpretation of paleogeography from paleocurrent directions has been applied to petroleum, groundwater, and mineral exploration, and paleocurrent analysis also has contributed to structural, regional stratigraphic, and paleoecological investigations (Potter and Pettijohn, 1977). For the Castle Rock Conglomerate the measurement and interpretation of paleocurrent directions in the present study has resulted in a comprehensive map of fluvial paleoflow directions in the unit and improved the understanding of its paleogeography. Locally, in the portion of the Colorado Piedmont covered by the formation, the inhomogeneity and anisotropy of the unit (e.g., morphology, size, and distribution of large-scale bedforms such as the trough cross-bedding featured in this report) bear upon its transmissive properties and may be applied to defining the hydrogeologic framework in the relatively small area in which the formation is found. Regionally, with respect to the High Plains aquifer, east of the Castle Rock Conglomerate, the conglomerate contributes to understanding the depositional history and stratigraphic setting of the aquifer. It is considered "an important precursor deposit to the Miocene-Pliocene sediments comprising the High Plains aquifer, and likely is a close analog for deeply buried paleovalley fills underlying the Ogallala Formation farther to the east" (Smith and others, 2016).

CASTLE ROCK CONGLOMERATE OVERVIEW

Previous Work

The unit that would eventually be formally named the CRC was first mapped as part of the Hayden Survey (1874) where it was included in the upper part of the Monument Creek Group. Richardson (1915) suggested the name "Castle Rock Conglomerate" for its type locality on the prominent butte north of the town of Castle Rock. He described it as a cross-bedded, conglomeratic arkose of fluvial origin derived from the uplifted Front Range to the west and mapped its extent from Sedalia to Elbert, with a typical thickness of 15 m (50 ft) and reaching a maximum thickness of 91 m (300 ft). Clast types consisted of pebbles of red and gray granite, laminated gneiss, gray and white quartzite, white vein quartz, black and gray chert, and rhyolite and porphyry. The matrix is described as medium-to-fine-grained and composed of angular to subrounded fragments of quartz and feldspar cemented by silica. He noted the large range of clast sizes in the unit, from less than 2.5 cm (1 in) to greater than 30 cm (1 ft) in diameter, and suggested that "torrential streams" or "floating ice" may account for transport of these large clasts far from their source. Lastly, he described difficulty mapping the unit without clasts of rhyolite or titanothere bone fragments in areas where the clasts form a thin veneer over eroded Dawson Arkose.

Analyses by Desborough, and others (1970) indicated that the placer gold of Russellville Gulch, presumably derived from the CRC, was unusually pure with a fineness of 990. Compare this to Colorado's famous Cripple Creek Mine with an average fineness of 908 (Smith, 1941). On the basis of this fineness and their general northeastward paleocurrent measurements, the authors suggested the gold likely originated west of the Rampart Range and not from the Clear Creek area like some works proposed (Lovering and Goddard, 1950).

Desborough and others (1970) proposed that the dominant CRC paleoflow was northeast, based upon 149 paleocurrent measurements at 14 localities, and also upon the absence of gold of similar fineness in the Clear Creek watershed to the northwest. Their paleocurrent map indicates that the 14 groups of paleocurrents have widely divergent resultant directions, but also that there is a pattern: southeast of Cherry Creek the trends are east to south-southwest, and northeast of the creek the trends are mostly east-northeast to north-northwest. It is possible that these two groupings of locations represent different CRC horizons with different paleoflow directions, a concept that will be amplified further on in the present report.

Morse (1979, 1985) expanded on the work of Richardson (1915) by describing the stratigraphy of the unit and its clast size distribution, and providing paleocurrent measurements of cross-beds at 23 locations. Tabular and massive beds, in addition to cross-stratified bedforms and fining-upwards sequences, were documented in four stratigraphic sections. The distribution of the CRC was in a band, similar to that of Richardson (1915), but was extended further southeast to Calhan. The paleocurrent measurements (1,300 in total) were obtained mainly from the tabular bedforms, which indicated a bi-modal distribution at northeast and southeast. Tabular beds were found to be the most common bedform types and to have formed by bars; trough cross-beds are also noted, but in the upper part of the unit. Morse suggested three possible depositional environments for the CRC: an alluvial fan, a coarse-grained braided stream, and a "narrow braided plain deposit confined by valley walls" with sediments coming from the mountains to the west. On the basis of the fining-upward sequences, tabular and trough cross-beds, and ability to transport "Front Range clasts" up to 60 cm (2 ft) in diameter over large distances, Morse (1979, 1985) determined that the water depth ranged from about 2 to 5 m (6.6 to 16 ft) with velocities between 6 to 10 m/sec (13 to 22 mph). These velocities are similar to flows of 4 to 5 m/s (9 to 11 mph) measured during the 2013 Colorado Front Range flooding (Yochum and Moore, 2013), and flows of 6 to 7 m/s (13 to 15 mph) measured during the 1965 Colorado River Basin flooding (Matthai, 1969). Ultimately, the favored depositional environment was a southeast-flowing, coarse-grained braided stream deposit confined by valley sides that occasionally became inundated by high-energy floods.

Morse (1985) proposed that the CRC stream system was an ancestral course of the South Platte River, emerging from the Front Range at a location between Denver and Castle Rock, and then flowing southeast, occupying a wide, southeast-trending paleovalley. Later subsidence of the Denver Basin initiated an episode of stream piracy, diverting the stream system northeastward away from its old orientation and forming the present drainage pattern of the South Platte.

Evanoff (2007) concurred with Morse (1985) that the CRC was deposited primarily by northwest-to-southeast flow in a large, southeast-trending Castle Rock paleovalley, cut below the surface of the Wall Mountain Tuff and down into the Dawson Arkose. Evanoff (2007) also stated that paleocurrent measurements from the largest CRC cross-bed sets support the southeast flow direction, but proposed a different place of origin for the CRC stream system than did Morse. Bluish-gray quartzite and stretched-pebble conglomerate clasts in the CRC indicate a Front Range origin from similar lithologies in Coal Creek Canyon, approximately 50 km (31 mi) northwest of the northernmost occurrence of CRC. (We note also that this quartzite location is on trend with a hypothetical northwestward extension of the swath of present-day CRC occurrences.) Coal Creek Canyon quartzite clasts as large as 2 m (7 ft) in diameter, found in the northernmost CRC exposures, indicate very large discharges in the ancient CRC stream system. The CRC is one of a series of latest Eocene conglomerates reaching from central Wyoming to South Park, Colorado. The presence of large blocks in these conglomerates suggests that a series of large storms may have transported the blocks for great distances (Evanoff, 2007).

Thorson (2011) recognized that the Evanoff hypothesis requires the paleochannel slope to be reversed from depositionally southeast-trending to tectonically northwest-dipping, requiring an uplift of about 670 m (2,200 ft) in the southern Denver Basin since the Eocene.

Thorson (2011) proposed a north-to-northwest-sloping erosion surface whose paleovalleys were filled with CRC. The erosion surface occupied an area extending approximately from Sedalia at the northwest to Elbert at the southeast, and was based upon reconstructing CRC paleovalleys using the near-flat upper surfaces of CRC deposits, and the mapped or projected edges of exposed paleovalleys. In the present study, Thorson's north to northwest paleovalley system is somewhat supported, but with important differences. Based upon extensive paleocurrent measurements, the present study proposes that the dominant portion of the CRC is the southeast- to south-southeast-flowing main paleochannel belt, extending from Rueter-Hess Reservoir at the northwest to Fremont Fort at the southeast; this is in agreement with Evanoff (2007). Instead of Thorson's north- to northwest-trending paleovalley system, there are proposed two major northeast-flowing tributaries to the main paleochannel belt. These are the JA Ranch paleochannel and alluvial fan, extending approximately from Hunt Mountain northeast to Castlewood Canyon State Park; and the Bucks Mountain trend, extending approximately from Bucks Mountain northeast to Elbert. These tributaries occupy much the same area as Thorson's (2011) paleovalley system.

Keller and Morgan (2013, 2016) gave early accounts of their comprehensive paleocurrent study of the upper portion of the CRC. The work included approximately 3,000 paleocurrent measurements (mainly from trough cross-bedding) and 24 surveys of gravel-fraction lithology, size, and roundness (approximately 11,000 clasts >2 cm (0.8 inches)). That study is fully presented in the present report, and the major conclusions are unchanged. Keller and Morgan (2013, 2016) found that generally southeast-trending measurements comprised about two-thirds of their paleocurrent data, and generally northeast-trending measurements about one-third. Grouping the measurements both areally and stratigraphically, they identified different and correlatable CRC horizons having markedly juxtaposed general paleocurrent directions, and locally having marked differences in gravel-fraction characteristics. Based upon this evidence they proposed a dominant, southeast-flowing main paleochannel belt having two major northeast-flowing tributaries. They also proposed that the main paleochannel belt may have ended as a network of distributary streams, on the basis of the increasing width of the main paleochannel belt in the southeast (downstream) direction and corresponding increasing variability in paleocurrent directions.

Koch (2013a) proposed that the CRC can subdivided into two mappable lithofacies: a northern facies containing quartzite and quartzite metaconglomerate from Coal Creek Canyon, and a western facies derived mainly from the Pikes Peak Granite. The western edge of the northern facies is a "quartzite line," presumably meaning the western extent of Coal Creek Canyon quartzite occurrence in the CRC. Also, the facies are distinguished on the basis of preliminary laser ablation age analysis of CRC sandstone. The northern facies has zircon ages of 1.7-1.4 Ga and the western facies has dominant zircon ages of 1.0 Ga. (The authors of the present report infer that these ages suggest different source areas for the two facies.) The two facies are interstratified along a paleo-Cherry Creek corridor, postulated as part of the late Eocene axial drainage of the Denver Basin. This corridor concept is similar to the that of the CRC paleovalley of Morse (1985) and Evanoff (2007), and to the main paleochannel belt of Keller and Morgan (2013, 2016). The northern CRC facies of Koch (2013a) has a consistent south-southeast paleocurrent direction. The western facies paleocurrents indicate northerly flow and also east-southeasterly flow, the latter attributed to the filling of north-trending paleovalleys and subsequent spilling of sediment eastward into the south-southeast-flowing axial drainage. The western facies of Koch (2013A) may correspond to the northeast-flowing tributaries of Keller and Morgan (2013, 2016). Koch (2013b) used petrographic comparison of the in-place quartzite of Coal Creek Canyon with quartzite clasts in the CRC to support the former as the source of the latter. An andalusite/sillimanite high-grade metamorphic facies was found to occur in both quartzites, and CRC quartzite clasts containing andalusite/sillimanite reportedly are found as far southeast as Paint Mines Interpretive Park, south of Calhan and approximately 130 km (81 mi) southeast of the quartzite occurrence at Coal Creek Canyon.

Geologic mapping at a 1:24,000 scale has been performed by CGS in the area covered by this study, as follows alphabetically. The CRC areas shown on Plates 1 through 3 are based upon the maps listed below:

- Black Forest quadrangle (Thorson, 2003)
- Castle Rock North quadrangle (Thorson, 2005)
- Castle Rock South quadrangle (Thorson, 2004a)
- Cherry Valley School quadrangle (Thorson, 2004b)
- Dawson Butte quadrangle (Morgan and others, 2004)
- Eastonville quadrangle (Morgan and Barkmann, 2011)
- Elbert quadrangle (Morgan and others, 2012)
- Elizabeth quadrangle (Morgan, 2009)
- Ponderosa Park quadrangle (Thorson, 2004c)
- Russellville Gulch quadrangle (Thorson, 2006)
- Sedalia quadrangle (Morgan and others, 2005).

Outcrop Area

Most of the CRC occurs within an elongate, southeast-trending swath of outcrops, altogether about 63 km (39 mi) in length and ranging between about 3 and 10 km (2 and 6 mi) in width, with the width gradually increasing southeastward until the swath ends near Calhan. The outcrops begin at the mesa just north of Newlin Gulch and extend southeast to the buttes at Fremont Fort (Plate 1). Small outliers of the unit occur at Hunt Mountain, just east of Interstate Highway 25 (I-25), and also between Bucks Mountain and Running Creek, east of Colorado Highway 83. At the mesa north of Newlin Gulch the width of the trend is about 3 km (2 mi), at Castlewood Canyon State Park (CCSP) the width is about 8 km (5 mi), and at the town of Elbert the width is about 10 km (6 mi). The largest and best-exposed occurrences of the unit are in the portion that begins at Hidden Mesa Open Space, about 4 km (2.5 mi) northeast of Castle Rock, and extends through CCSP southeast to Running Creek, about 3 km (2 mi) east of the boundary between Douglas and Elbert Counties.

The northwestern portion of the main CRC outcrop area begins at the mesa just north of Newlin Gulch and extends about 10 km (6 mi) southeast to the mesa just north of McMurdo Gulch (Plate 3A). Because of the lack of favorable exposure and also because trough cross-beds are scarce in many of the exposures, only seven paleocurrent measurements were collected in this portion, and six of these are within a small area of the mesa north of Newlin Gulch. Between Newlin Gulch and McMurdo Gulch, a distance of about 8 km (5 mi) in the southeast direction, there are three mesas mapped as CRC. All three are comparable in size to the mesas at Hidden Mesa Open Space and CCSP, where trough cross-beds are abundant, but there is very little favorable exposure and only one paleocurrent measurement was collected at these locations. The scarcity of measurements is caused by surficial deposits masking the CRC, causing unfavorable conditions for the development of bare bedrock ledges and other flat outcrops. Located east of the exposures discussed above is an isolated occurrence of CRC at Cherokee Mountain, a small butte located about 11 km (7 mi) northwest of Castle Rock (Plate 3A). Twelve paleocurrent measurements were collected there.

In the portion of the CRC outcrop extending from Hidden Mesa Open Space southeast to the southern boundary of CCSP (Plate 3B), the unit caps several large, closely spaced mesas. Outcrops are extensive along the mesa rims, in flat exposures located back from the rims, and in lower shelves along the steep drainages separating the mesas. In this region, the mapped occurrences are as large as several square km and trough cross-beds are locally abundant. From the CCSP southern boundary southeast to Running Creek the topography is more subdued, the width of the CRC swath increases, and many unconnected occurrences are elongate in the northwest-southeast direction (Plate 3C). The conglomerate is found mainly as ledges along northeast-flowing drainages instead of as rims along prominent mesas. Outcrops are not as numerous or extensive as they are at CCSP and environs, and the abundance of trough cross-beds somewhat decreases. From Running Creek southeast to the west rim of Bijou Basin there are scattered small exposures of the CRC (Plates 3C and 3D), and paleocurrent measurements are abundant at some of these locations. The southeastern extent of in-place CRC is at the buttes at Fremont Fort, just south of the Bijou Basin rim (Plate 3D).

Two considerably smaller areas of CRC are located southwest of the main outcrop area. The first area is a band of unconnected outcrops that begins at Hunt Mountain (JA Ranch property), located about 11 km (7 mi) south of the town of Castle Rock, and extends northeast for about 12 km (7.5 mi) to CCSP where it connects to the main paleochannel area (Plate 3B). This band widens from about 2 km (1.2 mi) at its southwest end to about 6 km (4 mi) near CCSP. In its southwest portion the outcrops are smaller than in the northeast portion, and are elongated in a northeast-southwest direction.

The second area is south of the first. It lies between Bucks Mountain and Running Creek and consists of an east-west-trending band of small conglomerate exposures unconnected to the main outcrop area (Plate 3C). The western end of this band is at Bucks Mountain, a small mesa adjacent to the east of Highway 83 and about 3 km (2 mi) north of the Douglas County southern boundary. The outcrops extend to Running Creek, 10 km (6 mi) east of Bucks Mountain. Many of these exposures are elongated east-west, and total width of the band varies from about 1 to 2 km (0.6 to 1.2 mi). The easternmost extent of the Bucks Mountain occurrences lies about 3 km (2 mi) southwest of the main outcrop area of CRC.

Description

Morse (1979, 1985) performed a field study of the CRC and related the unit to the paleogeography of the southern Denver Basin; he believed the conglomerate to be of lower Oligocene age. His research included sedimentology, stratigraphy, and paleocurrents of the conglomerate, and some of his results as they pertain to our own work on the conglomerate are given here. The CRC was deposited mainly on a surface eroded up to 90 m (295 ft) into the upper part of the late Paleocene to early Eocene Dawson Formation, with some deposition being on the Wall Mountain Tuff. The conglomerate is characterized as highly cross-bedded, with cross-bedding dipping east to southeast and parallel to the main swath of conglomerate outcrop. Planar cross-bedded gravel is stated to be predominant over trough cross-bedded gravel and massive gravel (Morse 1979, 1985), with epsilon cross-stratification (i.e., on the flanks of point bars) being rare. The conglomerate was deposited by braided streams, and torrential flooding is evidenced by the transport of large boulders for long distances away from their sources in the Front Range. The source area for the conglomerate is believed to lie west and northwest of the mapped conglomerate, in an area where the Precambrian Pikes Peak Granite and metamorphic Idaho Springs Formation are exposed.

According to Morse (1979, 1985) the CRC is composed of very coarse conglomerate with interbeds of arkosic grit and sandstone and minor beds of olive-green mudstone. It can be distinguished from the underlying Dawson Arkose by the presence of Wall Mountain Tuff clasts, most of which are pebble-to boulder-sized, but some of which are slump blocks up to about 2.5 m (8 ft) in length. The conglomerate's maximum exposed thickness is approximately 70 m (230 ft), but because of erosion the original thickness is not known. The unit was deposited by a moderately deep and moderately sinuous braided stream, having high flow velocities.

In four measured sections in the CRC, Morse (1979, 1985) identified a planar cross-bed facies, a trough cross-bed facies, and a massive gravel bed facies. The first two facies, which pertain to our study, are summarized as follows. Large-scale planar cross-beds with planar foresets constitute 85% of the total length of the four measured sections. The sets range from about 0.3 to >3 m (1 to >10 ft) in thickness and consist of moderately well sorted sand and gravel. The foresets dip from 18° to 30°; usually the foresets are tangential (asymptotic) with the basal contact, but some terminate abruptly at the contact. In plan view, the planar cross-beds appear as straight lines that can be followed for up to 20 m (66 ft). Morse (1979, 1985) attributed the planar cross-beds to the migration of either transverse bars or sand waves (straight-crested dunes). Channel accretion was also cited as a possible method of formation for planar cross-beds, although it is stated that epsilon cross-beds are rare in the unit.

Large-scale trough cross-beds with curved foresets constituted only 10% of the total length of the measured sections presented in Morse (1979, 1985). The sets range in thickness from 0.25 to 1 m (0.8 to 3.2 ft), are tangential to their basal contacts, and are arcuate in plan view, with arc widths ranging from 3 to 5 m (9.8 to 16 ft). The average size of the trough cross-bedded sediment is 5 to 15 mm (0.2 to 0.6 in), and the gravel is better sorted than the planar cross-bedded sediment. According to Morse, cobbles and large pebbles are not found in the trough cross-bed facies. Morse (1979, 1985) postulated that the CRC contains fining-upward sequences about 2.5 to 9 m (8 to 30 ft) thick, with the massive gravel facies at the bottom, the planar cross-bed facies in the middle, and the trough cross-bed facies at the top. The present study has found that trough cross-bedding is the dominant bedform in the uppermost CRC; planar (tabular) cross-bedding is rare, although prominent where it does occur.

Morse (1979, 1985) measured paleocurrent directions from 1,307 cross-beds at 23 locations within the CRC. The great majority of the data were stated to be from planar cross-beds and only 10% were from trough cross-beds. At approximately half of the locations, the paleocurrent distribution was bimodal, with the modes being approximately northeast and approximately southeast. Differences in channel patterns and sediment accumulation between high-water and low-water stages were proposed as a possible explanation of this bimodal distribution.

FIELD WORK

Data collection for the present study was performed by CGS personnel intermittently during 2008 through 2012, and for a short period in 2015. Mr. Stephen Keller, part-time CGS Geologist from 2008 to 2011, collected the majority of the paleocurrent measurements. Mr. Matthew Morgan, CGS Senior Research Geologist, assisted with a substantial part of the data collection, mapped many of the outcrop locations, and also provided support and ongoing review for the project activities. Dr. Vincent Matthews, former CGS Director and Dr. David Noe, former CGS Senior Science Advisor, participated in project field reviews and provided technical guidance. Mr. Beau Taylor, former CGS Junior Geologist, and Mr. Brock Bauer, CGS volunteer, assisted Mr. Keller in collecting the CRC clast survey data during the 2011 field season.

Paleocurrent Data Collection

The CRC is exposed in two principal modes. The first mode is in flat to gently sloping surfaces that occur most prominently along the circumferences of mesa rims, but which at lower elevations also can be found on hilltops, within drainages and along ledges bordering the drainages, and in isolated flat outcrops removed from drainages. The second mode is in sheer to very steeply sloping exposures at mesa cliffs and along drainages. In the first mode, both the large-scale trough cross-beds (the great majority of measurements for this study) and large-scale planar cross-beds (found only rarely) are exposed in flat or nearly flat erosional surfaces, and the true paleocurrent directions are readily determined because the bedforms are observed in plan view. In the second mode, usually only the apparent paleocurrent directions can be measured. Therefore, the investigators determined that data would be collected from the first mode of exposure, and intended that the study should cover all available flat-lying and gently sloping occurrences in the upper portion of the CRC. Additionally, each occurrence would be completely traversed on foot with the goal of capturing as many paleocurrent measurements as the field geologist would be able to find.

The CRC occurs in a swath of discontinuous exposures of varying width. This band extends from the mesa north of Newlin Gulch in Douglas County southeast to the buttes of Fremont Fort in Elbert County. The investigators visited and traversed 257 field stations throughout the areal extent of the conglomerate using mainly CGS 1:24,000-scale geologic maps as a guide. Only a few of the larger mapped exposures could not be traversed due to access being denied by the landowner. These unvisited exposures all are fairly close to other areas where data coverage is adequate, and thus the data gaps do not hinder the paleocurrent interpretation overall. Many small private land holdings could not be visited because the owners could not be contacted after several attempts, but these properties mostly were adjacent or close to properties where access was possible. Of the 257 stations, paleocurrent measurements were collected at 197 stations, and at 60 stations no trough cross-beds or planar cross-beds were found. The stations were on both public and private lands; they were locations of convenience chosen because of ease of access and/or because the station was on the property of a particular landowner. Where a conglomerate exposure was extensive, several stations were used to cover the area. The investigators made every attempt to visit all of the flat to gently-sloping exposures that are large enough and sufficiently intact to permit paleocurrent measurements. A few small areas probably have been overlooked, but the authors are confident that the uppermost portion of the CRC, to the extent that it is exposed in flat-lying or gently sloping areas, is adequately represented by the paleocurrent database in this study.

The greater part of the CRC, and also the majority of paleocurrent measurements, occur in the following six USGS 7.5-minute topographic quadrangles, listed from northwest to southeast: Castle Rock North, Castle Rock South, Russellville Gulch, Cherry Valley School, Elizabeth, and Elbert. For the first four quadrangles the mapped outline of the conglomerate was transferred from recent CGS geologic maps to topographic maps, and the latter served as the field maps for data collection (7.5-minute topographic maps also were used as field maps for quadrangles not yet mapped or published by the CGS). In the Elizabeth and Elbert quadrangles Mr. Morgan performed geologic mapping during the same field seasons that Mr. Keller collected paleocurrent data. In both these quadrangles, Mr. Morgan collected some paleocurrent measurements during the mapping and advised Mr. Keller as to the remaining CRC locations to be covered. The Bijou Basin and Peyton quadrangles, at the southeast end of the CRC area, have not been mapped by the CGS. They contain a number of exposures that were identified and traversed as part of this project, and these exposures yielded a fair number of paleocurrent measurements. Also included in the project were the Dawson Butte, Sedalia, and Eastonville quadrangles (all mapped by the CGS) and the Parker quadrangle (mapped by the USGS). The few exposures of CRC in these quadrangles were traversed as part of the study, and a small number of paleocurrent measurements were collected.

The investigators gained access to public lands by meeting in advance with the appropriate state or county agency. Permission for most of the private holdings was gained by visiting ranches, farms, and residences without prior contact, securing permission, and then traversing the property the same day or within a few days thereafter. Advance permission was obtained for many properties where either the residents were not home during an initial visit or where the property did not contain a residence. There were only a few denials of access by private landowners, although there were many small properties that the investigators could not access because attempts at contact were unsuccessful. Also, there were many outcrops where neither trough nor planar cross-beds were found, or where they were present but not exposed sufficiently for paleocurrent azimuth measurements.

Most of the paleocurrent measurements were collected by a geologist working alone, but a few areas, notably including CCSP and the drainage of Running Creek, were covered by two geologists working separately but staying in contact by means of mobile phone. After having selected a field station and obtained access permission, the geologist would plan the traverse and go to a starting point within the station. This starting point became the station's map registration point, with location determined by a handheld GPS unit. The geologist would plot the point on the field map (using UTM coordinates in NAD27 to correspond with the UTM system used on the maps) and record the station coordinates, date, and start time in the field notebook. Station numbers were assigned in the order in which the stations were visited, and each number was prefixed with an abbreviation indicating the 7.5-minute topographic quadrangle containing the station. During each traverse the geologist walked the ledge, rim, or flat outcrop of conglomerate with the objective of finding all large-scale trough cross-beds (and occasional large-scale planar cross-beds) within it. Nearly all of the cross-beds observed during this study were at a large scale, having dimensions in meters (the great majority) or tens of meters (rare). As field work progressed, the mapped outlines of CRC on the field maps were filled in with plotted stations, and the field maps roughly indicated the progress of the ongoing data collection.

In plan view, most of the CRC troughs are easy to identify. Where there is some local relief in the exposures (usually on the order of 0.5 m (1.6 ft) the troughs resemble nested paraboloids or nested "spoons," and where the exposures are flat, the pattern is of nested parabolas. Where the beds differ in resistance to weathering, rib and furrow structures can form. The open end of the trough roughly indicates the local paleocurrent direction: the open end faces "downstream." For each trough, the UTM coordinates were recorded, using the apex of the closed end of the trough as the location point. The axis of the trough cross-bed is a line beginning at the apex of the trough and extending along the middle of the trough. The azimuth of the trough axis (paleocurrent direction) was measured using a Brunton compass. Bedding inclinations were measured along the trough axis; however, measurements could not be made where the exposures were flat. The axial length and the width of the trough shape were approximately measured by pacing (the geologist's pace was approximately 1 m (3 ft)). Trough width was measured perpendicular to the axis, and at the open end of the trough. In each trough, for the largest clast greater than pebble size, the longest dimension and the lithology usually were recorded. If no such clasts were present, the approximate particle size range was recorded. Each trough cross-bed was given a subjective ranking as to quality of erosional expression: poor, fair, good, or very good. The "poor" rating was used frequently for partially obscured exposures where an azimuth could still be measured; and the rare "very good" was used where the feature was well expressed in relief. No trough cross-bed was included in the study unless both limbs of a trough shape were clearly evident and the axis could be identified. There were rare exposures where the trough cross-beds were arcs of circles rather than parabolic shapes with distinct limbs; these were not recorded because a unique axis could not be identified. During most traverses the general paleocurrent direction of a station area became apparent to the geologist after a few measurements. While walking an exposure it was important to examine it from different perspectives. At some localities the erosional expression of trough cross-beds was obscure looking "upstream" with respect to paleocurrent while being readily apparent looking "downstream."

Within the study area some large-scale planar cross-bed exposures also were observed, but their numbers were few. For these the following features were measured and recorded: UTM coordinates, azimuth in the direction of inclination of bedding, inclination of bedding, length (dimension transverse to inclination of bedding), width (dimension parallel to inclination of bedding), quality of exposure, and lithology and greatest dimension of largest clast.

A large number of digital photographs were taken to support the study. All photos were recorded in the field notebooks, each with its field station number and the photo subject. Each photo jpg file was titled with the subject of interest and the station number. In their field notebooks the geologists recorded subjects of interest in addition to the bedform measurements and features, and also recorded logistical information such as start and stop dates and times for the field stations, meetings with landowners and public agencies, adverse weather conditions, etc. During the progress of the work the hard-copy field notebooks were regularly backed up by photocopies. At the end of the CRC paleocurrent project field work, 2,897 trough cross-bed measurements and 42 planar cross-bed measurements had been collected.

Early in the field work it became apparent that there were two distinct populations of paleocurrent directions in the trough cross-bed measurements. After data collection was completed, approximately two-thirds of the azimuths ranged from east to south-southwest, but mostly from southeast to east-southeast. Approximately one-third of the azimuths ranged from northwest to east-northeast, but mostly from north to east-northeast. The minority population was mainly found in two tributary paleochannels postulated to have joined the main paleochannel belt from the southwest, and evidence for this pattern is presented further on in this report.

Clast Survey Data Collection

Twenty-four clast surveys were performed on flat exposures of trough cross-beds in the upper portion of the CRC. The survey locations extended from near Gateway Mesa Open Space southeast to near Fremont Fort. Many of the surveys were located in pairs and groups, so that the gravel of the southeast-flowing main paleochannel belt could be compared with that of the postulated northeast-flowing JA Ranch paleochannel and (in one instance) the Bucks Mountain trend. Other locations were chosen to characterize the main paleochannel belt gravel in areas where no evidence of tributaries was found.

Each clast survey was limited to the area of a single trough; the surveys ranged in size from 20 to 154 m^2 (215 to 1,658 ft^2), with a mean of 80 m^2 (860 ft^2). The data collection was on a 1-m (3.3-ft) grid of cells, laid out using two metric tapes and a collapsible stainless steel frame of 1 m^2 (11 ft^2), with the long dimension of the grid set parallel to the trough axis. Grid cells were designated alphanumerically. The frame was moved from cell to cell throughout the grid, and in each cell all clasts equal to or greater than 2 cm (0.8 in) in maximum dimension were quickly characterized according to lithology (20 categories), roundness (angular having an index of 1, and well-rounded having an index of 5), and maximum dimension: 2 to 3 cm (0.8 to 1.2 in), 3 to 4 cm (1.2 to 1.6 in), etc. For each survey location the following were recorded on data collection forms: UTM coordinates (NAD27) and trough axis azimuth, grid cell alphanumeric designations, and data for all clasts falling within each cell. The surveys did not capture clasts smaller than 2 cm (0.8 in), mainly because of time constraints, but also because most clasts smaller than 2 cm (0.8 in) appeared to be granitic and quartz pebbles. The number of clasts per survey varied from 138 to 1,439, with a mean of 450, and the 24 surveys recorded a total of 10,804 clasts.

Spreadsheet software was used to compile and tabulate the lithologic, roundness, and size data from the field collection forms. For lithology the 20 field categories were consolidated into seven: Wall Mountain Tuff, granitics, quartz, blue-gray quartzite, other quartzites, sedimentary, and other rock types (the last being very rare). For each survey a mean clast size and a mean roundness value were calculated, weighted according to the number of clasts occurring within each increment of parameter values (e.g., numbers of clasts at 2 to 3 cm (0.8 to 1.2 in), 3 to 4 cm (1.2 to 1.6 in), etc. A set of three histograms (lithology, roundness, and size) was generated for each survey, with each histogram displaying the percentages of clasts distributed over the range of parameter values.

BEDFORMS AND CROSS-BEDDING

Background on Fluvial Bedforms

Harms and Fahnestock (1965), in their research on fluvial bedforms of the Rio Grande near El Paso, Texas, described subaqueous dunes and associated trough cross-bedding. They found that the erosional scours (troughs) on the downstream sides of dunes are elongate parallel to the current direction, and that the nested, scoop-shaped, infilling laminae or beds of the troughs plunge in the downstream direction. The troughs can be symmetrical or asymmetrical; in the latter, the thickness of infilling beds is greater on one side of the trough axis than on the other, due to more sand being supplied to the thicker side. They also noted that only the youngest trough cross-bed sets exist as nearly complete forms, having eroded the older sets beneath them. In the Rio Grande troughs, the inclination of infilling beds, measured along the trough axis, ranges from 18° to 30°.

Harms (1975) summarized flume studies of unidirectional bedforms in a size-velocity diagram for a flow depth of about 20 cm (8 in) and flow velocities increasing from 0 to 200 cm/sec (0 to 0.6 ft/s). For sediment sizes ranging from 0.6 to 2.0 mm (0.02 to 0.08 in), and for velocities ranging approximately from 30 to 100 cm/sec (1.0 to 3.3 ft/s), the succession of fluvial bedforms according to increasing velocity is from lower flat bed to sand waves (elsewhere termed straight-crested dunes) to dunes. In actual streams where sand is the dominant sediment size, three commonly preserved bedforms have the following sequence according to increasing flow velocity: ripples, sand waves (straight-crested dunes), and dunes. It should be noted that ripples are less common in coarse and very coarse sand than in medium sand and finer particle sizes. Harms (1975) described dunes as downstream-migrating bedforms that are three-dimensional, being arcuate in plan view and triangular in profile. They have gentle upstream sides and steep downstream sides, with sediment accumulation occurring on the downstream sides. Dunes are characteristic of a stream having both a large suspended sediment load and large bed load. The sand waves and dunes of Harms (1975) now are commonly termed two-dimensional dunes and three-dimensional dunes, respectively. Three-dimensional dunes are the dominant bedform in the stratigraphically upper portion of the CRC. The downstream side of a three-dimensional dune is an erosional scour that fills with successive laminae or beds as the dune migrates downstream. Seen in a cross section parallel to flow direction and along the axis of the scour or trough, the successive beds curve gently concave-upward and have asymptotic basal contacts. The lower contact of a trough cross-bed set often is an undulating surface. The trough-filling beds are inclined in the downstream direction and commonly within a range of 25° to 30° as measured along the trough axis. The beds are tangential against the basal contact with the underlying deposit. The steeper portions of the curved beds are upstream and the gentler, asymptotic portions are downstream (Harms 1975). **Figure 2** illustrates migrating three-dimensional dunes and large-scale trough cross-bedding.

Planar cross-bedding, termed tabular cross-stratification in Harms (1975), is formed by migrating sand waves (straight-crested dunes). The sand wave is oriented transverse to the current direction, with a gentle slope facing upstream and a steeper slope facing downstream. Sediment moves over the upstream slope and accumulates in successive layers on the downstream side. The direction of inclination of the downstream-side beds, measured perpendicular to the sand wave crest, indicates the current direction. In plan view, planar cross-beds are expressed as subparallel or sinuous lines oriented transverse to current direction. Bedding inclination usually is 30° or more, and basal contact of the bedding is commonly abrupt rather than tangential.

In a review of flume experiments on bedform stability, Southard (1991) presents a concise overview of bedforms in general, and the following discussion is drawn from his article. Bedforms are topographic features that form during sediment transport over a wide range of flow conditions, with bedform size exceeding sediment grain size by orders of magnitude. Bedforms are most common in sand but also can be produced in silt and gravel. The term bed state refers to the set of one or more types of bedforms that are produced by a given mean flow over the sediment, and the main determinants of bed state are the velocity and depth of flow and the grain size of sediment. For practical reasons, flume experiments have covered only portions of the ranges of velocity, depth, and

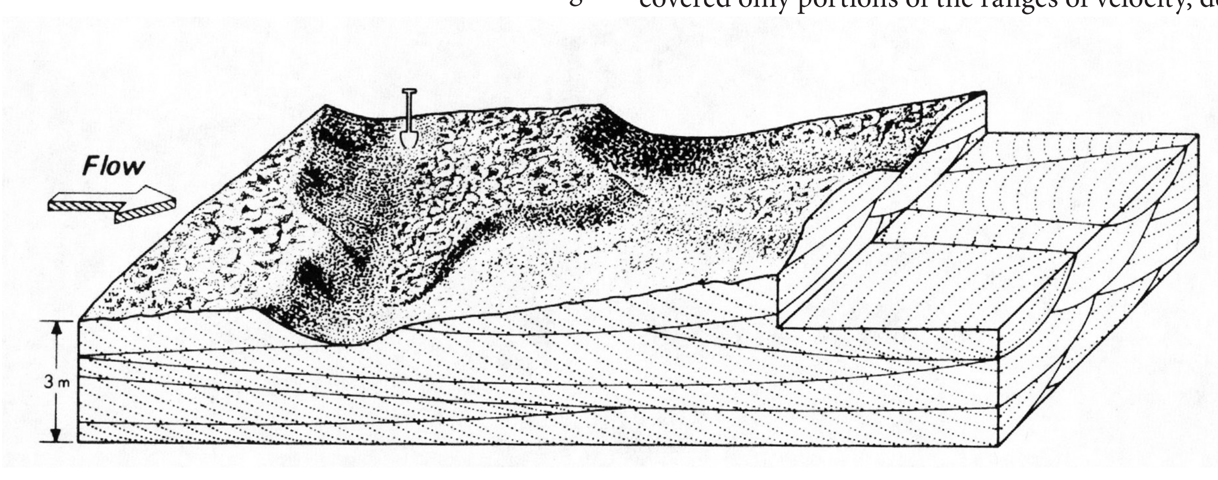


Figure 2. Large-scale trough cross-stratification formed by migrating dunes (from Harms, 1975). (Used with permission of Rocky Mountain Section, Society for Sedimentary Geology.)

grain size that exist in natural flows, but this accumulated work does indicate the types and successions of bed states associated with different flow and sediment conditions.

Bedforms have the following general characteristics: they vary in size from the cm to the km scale, most are transverse to flow, and most are irregular in detail but more regular in overall appearance. In fluvial flow, most bedforms migrate downstream by losing sediment on the upstream side and accumulating it on the downstream side. If flow conditions change, the bed state will adjust to the change, and stream deposits will contain different bedforms in the latter flow condition than in the former. Fluvial bedforms are ripples, dunes, planar beds (elsewhere termed flat beds), and antidunes. In the upper portion of the CRC, dunes are abundant and one occurrence of planar beds has been observed; no ripples or antidunes were found (note that antidunes are only rarely observed in general). In fluvial systems there is a large size difference between ripples, which usually are spaced at 10 to 20 cm (4 to 8 in) and are less than a few cm in height, and dunes, where these parameters are orders of magnitude larger. Straight-crested dunes are rare, and form under lower flow discharges, and sinuous or disconnected dunes form in stronger flows, with the latter being quite variable in the relief between troughs and crests. Almost all the dunes of the upper portion of the CRC appear to be disconnected. Even in large and well exposed ledges and flat outcrops no evidence of sinuous, connected dune crests was found.

Southard (1991) includes a bedform stability diagram for unidirectional flow at rates from 0.2 to 2.0 m/s (0.6 to 6.6 ft/s) and sediment sizes from 0.5 to 9.0 mm (0.02 to 0.35 in). The diagram indicates that for sediment sizes from 0.8 to 2.0 mm (0.03 to 0.08 in), and with velocity increasing from 0.4 to 2.0 m/s (1.3 to 6.6 ft/s), the progression of bedform development with increasing velocity is: lower plane (flat bed), dunes, upper plane, and antidunes.

Carling (1999) surveys and summarizes more than 50 years of hydraulic and sedimentologic research on subaqueous gravel dunes (sediments in which the median grain size is >2 mm (>0.1 in). The median grain size has not been estimated for the CRC dune cross-bed sets that are the subject of the present study. At most locations within the stratigraphically upper portion of the CRC, the median grain size probably is less than 2 mm because the sediments are dominated by medium to coarse sand. At some coarser-grained CRC exposures this threshold may be exceeded and the bedforms could be termed gravel dunes. Carling (1999) found that in the literature, three-dimensional gravel dunes, typified by trough cross bedding as in the CRC, have been reported with grain sizes up to 60 mm (24 in), length ranging from less than 0.6 m to greater than 100 m (2 to 328 ft), and height ranging from 0.1 to 16 m (0.3 to 52 ft). A few troughs in the upper portion of the CRC are longer than 50 m (164 ft), and the height, although not formally measured as part of the present study, can be 1 to 2 m (3.3 to 6.6 ft). Carling also states that dune length scales with water depth. His bedform stability diagram shows that subaqueous dunes form in a field where median grain size ranges from 0.2 to >33 mm (0.01 to 0.13 in), and where velocity ranges from 0.3 to 3.0 m/s (0.7 to 6.7 mph). On a continuum of increasing velocity in streams dominated by coarse sand and gravel, dunes can be preceded by lower-stage plane beds and succeeded by antidunes. Antidunes are dune-like bedforms in which stratification dips upstream; because of their instability they are observed only rarely (Nichols, 2009).

A bedform stability diagram in Nichols (2009) indicates that where the stream sediment is dominated by coarse to very coarse sand, the progression of bedform phases at flow velocities increasing over a range of approximately 30 to 120 cm/s (1 to 4 ft/s) is as follows: lower flat (planar) beds, dunes, upper flat beds, and antidunes. This diagram is presented as **Figure 3**.

This is in accord with a similar diagram in Southard (1991). The sand waves of Harms (1975) appear to be the straight-crested dunes presented in Nichols (2009), and the stability diagram does not distinguish between the straight-crested

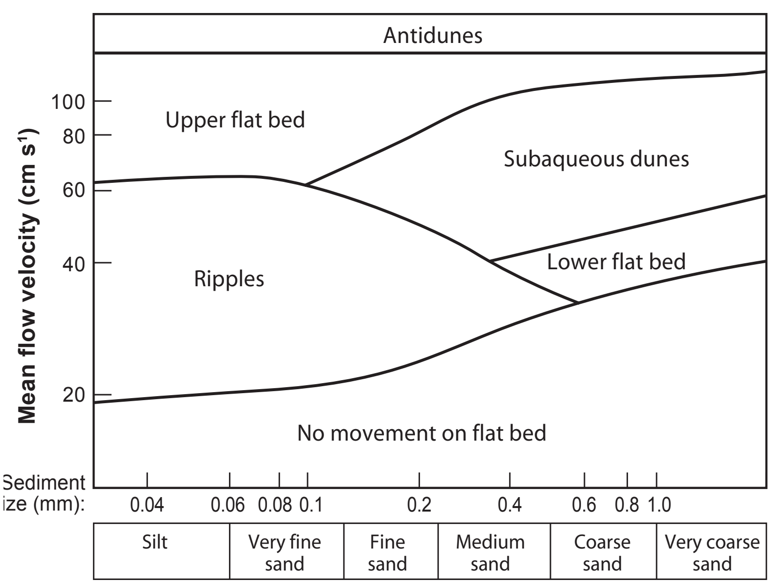


Figure 3. Bedform stability diagram (from Nichols, 2009). (Used with permission of John Wiley & Sons Ltd.)

dunes that form planar cross-beds and the arcuate dunes that form trough cross-beds. Stream depth controls the height and length of dunes. Generally, stream depths of a few meters can produce dunes that are tens of centimeters in height, and streams tens of meters deep can produce dunes that are meters in height. Dunes can range in length from approximately 60 cm (24 in) to over hundreds of meters, and in height from a few centimeters to tens of meters (Nichols, 2009).

Bedforms and Cross-Bedding in Upper Portion of Castle Rock Conglomerate

Three-dimensional subaqueous dunes, as evidenced by abundant trough cross-bedding, are the dominant bedforms observed on ledges and flat outcrops in the upper portion of the CRC (per 2,897 measurements of trough axis azimuths). Forty-two large-scale planar cross-bed occurrences also were found; their directions of bedding inclination are oriented either approximately parallel or approximately transverse to the paleocurrent direction as indicated by nearby trough data. In the former case the planar cross-bedding may have been formed by sand waves (straight-crested dunes), as proposed by Morse (1979, 1985), and in the latter case possibly by sediment accumulation along the flanks of bars whose long directions were approximately parallel to the general paleocurrent direction. Flat-lying planar bedforms were found at only one location, along Cherry Creek in the southeast part of CCSP. The occurrence is well exposed, with the horizontal beds overlain and underlain by adjacent sets of trough cross-beds. No evidence for ripple bedforms was observed in the upper portion of the conglomerate. This may be because of the low proportion of sediment finer than medium sand, a condition which is not favorable for ripple formation. **Figure 4a** shows trough cross-bed sets in a nearly vertical conglomerate face oriented approximately parallel to the general paleocurrent direction, which is southeast or left to right across the photo. Curved bedding and basal asymptotic contacts are visible. **Figure 4b** shows trough cross-bedding in a conglomerate face oriented transverse to the general southeast paleoflow direction, with flow being toward the viewer. This pattern of successive

Figure 4a. Trough cross-bed sets in longitudinal section, northeast side of Cherry Creek, Castlewood Canyon State Park, showing curved beds and asymptotic lower contacts; flow direction southeast, from left to right; 823473, 4352885 UTM NAD 83.

Figure 4b. Trough cross-beds in cross section, Castlewood Canyon State Park; flow direction southeast, toward viewer; 523200, 4353200 UTM NAD 83.

troughs is characteristic of trough cross-bedding viewed parallel to the paleoflow direction. Both photos are on the east side of Cherry Creek in the southeast part of CCSP.

In plan view the CRC troughs appear as areas of nested parabolic laminae and beds. The troughs appear to be lunate in shape. Closed elliptical troughs are reported in the literature (Harms and Fahnestock, 1965), but the troughs observed in the present study are open in the downstream direction. **Figure 4c**, at a location about 2 km (1.2 mi) northwest of Elbert, shows a very good exposure of trough cross-bed sets in relief; the general paleoflow direction is southeast, or from right to left across the photo. Large high-relief exposures like this are uncommon. **Figure 4d** is more typical of trough exposures on ledges and flat outcrops; the paleoflow direction is approximately southeast and away from the viewer. **Figure 4e** shows an exceptionally large and well-exposed trough located southeast of the intersection of Colorado Highway 83 and Russellville Road. The paleoflow direction is southeast, approximately along a line from the backpack to upper-right corner of the photo.

In the paleocurrent database of the present study, trough lengths (measured along the trough axis) range from 0.6 to 74 m (2 to 243 ft) with a mean length of 7.7 m (25 ft); 74% of troughs range from 2 to 10 m (6.6 to 33 ft), 6% are less than 2 m (6 ft), and 20% are greater than 10 m (33 ft). Maximum trough width, measured at the open end of the trough and perpendicular to the downstream end point of the trough axis, ranges from 0.6 to 29 m (2 to 95 ft); 77% range from 2 to 8 m (6.6 to 26 ft), 7% are less than 2 m (6 ft), 14% range from 8 to 14 m (26 to 46 ft), and 2% range from 14 to 29 m (46 to 95 ft). The mean length to width ratio of the troughs is 1.4. In 45% of the troughs, the exposures were flat and bed inclination could not be measured. In the remaining 55%, the inclination of trough cross-beds, measured along the trough axis, ranged from 2° to 38° with a mean of 15°. Seventy-one percent ranged between 9° and 24°, 21% were less than 9°, and 8% ranged between 24° and 38°. Many of these exposures were only of fair or poor quality; the axis azimuth and the trough length and width could be measured with confidence, but the bedding inclination measurements were not as reliable.

In the upper portion of the CRC, most of the troughs are roughly symmetrical, but a small number are asymmetrical, with one limb being markedly thicker, as observed by Harms and Fahnestock (1965). This makes measuring the trough axis azimuth somewhat less certain

Figure 4c. Trough cross-beds exposed in relief, 2 km (1mi) northwest of Elbert; flow direction southeast, from right to left; ; 538041, 4342410 UTM NAD 83.

Figure 4d. Trough exposed in flat outcrop, west rim of Bijou Basin, 8 km (5 mi) south-southeast of Elbert; flow direction southeast, away from viewer; 544613, 4333217 UTM NAD 83.

Figure 4e. Very large trough exposed in relief, southeast of Colorado Highway 83 and Russellville Road; flow direction southeast, toward upper right ; 526172, 4344956 UTM NAD 83.

than for a symmetrical trough, but the general direction of the trough axis is still apparent. In the conglomerate ledges and flat outcrops there are abundant complete trough cross-bed traces, but many others are only partial, having been eroded by younger trough sets. Around the parabolic traces marking the outermost bed or lamina of a complete trough, the truncated beds of older, eroded troughs are commonly present. This effect also was noted by Harms and Fahnestock (1965).

Large-scale planar cross-beds in ledges and flat outcrops of the upper portion of the CRC are uncommon, but are prominent in expression. The exposures vary in relief from approximately 0.5 to 2 m (1.6 to 6 ft), exposure lengths vary from 3 to 44 m (10 to 144 ft), widths vary from 3 to 18 m (10 to 59 ft), and the length to width ratio is usually approximately 2:1. (Note that for these planar cross-beds the width is parallel to flow direction.) The foreset inclinations mostly vary from 4° to 24°, with one measurement of 30°. Generally, the sediment in the planar cross-beds ranges in size from medium sand to granules 2 to 4 mm (0.08 to 0.16 in) or from coarse sand to pebbles of 1 cm (0.4 in), and clasts greater than 1 cm (0.4 in) are rare. This contrasts with the sediment in ledge and flat outcrop exposures of trough cross-beds, where the ranges are from medium sand to granules or from coarse sand to cobbles.

The orientations of 36 of the planar cross-bed exposures can be compared with nearby paleocurrent directions as indicated by trough axes. Twenty of these exposures are oriented such that their foreset beds face downstream along the local paleocurrent direction; these resemble the planar cross-bed gravel facies described by Morse (1979, 1985), and may be straight-crested dunes. Fourteen of the exposures are oriented nearly perpendicular to the local paleocurrent direction, and may have been formed by sediment accumulation along the flanks of bars whose long directions were oriented along the direction of stream flow. Along Running Creek in Elbert County, there is a location where two of these occurrences lie close together, with inclinations in opposite directions and each approximately perpendicular to the local paleocurrent direction, suggesting that the occurrences are on opposite sides of a bar. **Figure 4f** shows a large occurrence of planar cross-beds at Hidden Mesa Open Space. The beds incline southwest, at approximately perpendicular to the dominant flow direction, which is southeast and away from viewer. **Figure 4g** shows trough cross-bedding overlain by planar cross-bedding, at a location about 6 km (3.7 mi) west of Elbert. Paleoflow in the trough cross-beds is north, away from viewer, and the planar cross-beds are inclined east.

On the west side of Cherry Creek, in the southeast

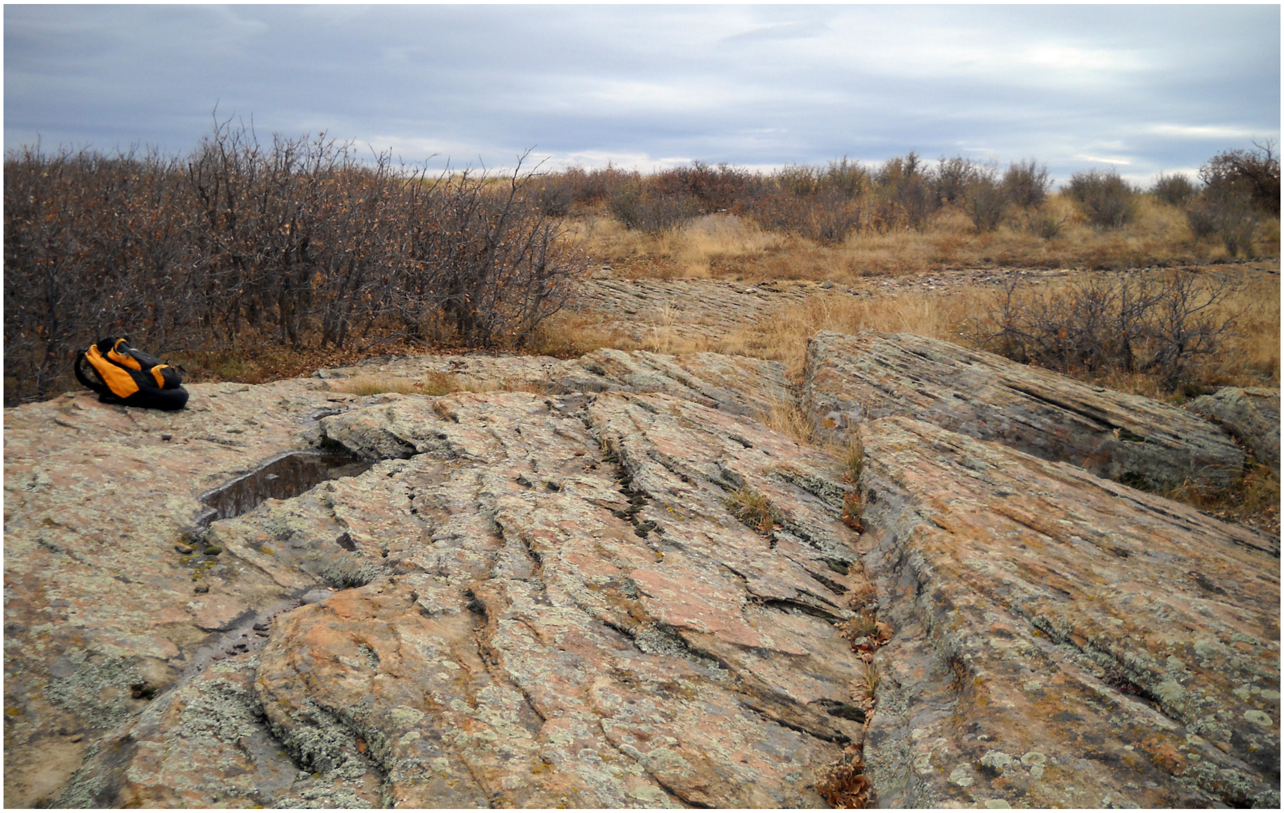


Figure 4f. Planar cross-beds at Hidden Mesa Open Space; beds incline southwest, at approximately perpendicular to local flow direction, which is southeast, away from viewer; 517246, 4361380 UTM NAD 83.

Figure 4g. Trough cross-beds formed by southeast flow (away from viewer) overlain by east-inclining planar cross-beds; 6 km (4 mi) west of Elbert ; 534121, 4341872 UTM NAD 83.

portion of CCSP, there is an exposure of nearly flat-lying planar beds (as distinguished from planar cross-beds) that contrast sharply with the trough cross-bed sets adjacent above and below (**Figure 4h**). The exposure is approximately 10 by 30 m (33 by 98 ft) in area and 2 m (6.6 ft) in thickness. Bedding is 3 to 5 cm (1.2 to 2 in), and the sediment is moderately sorted medium sand to coarse sand with rare pebbles up to 2 cm (0.8 in). The exposure is not completely flat; the beds incline approximately 5° to the east. A lower flat-bed phase can develop in coarse to very coarse fluvial sand when the flow velocity is high enough to move the sediment, but not sufficient to develop dunes. An upper flat bed phase can develop when the velocity is too high for dunes, but not high enough to form the standing waves that create antidunes. Whether the single occurrence of planar beds found in the upper portion of the CRC possibly represents the upper or lower flat bed phase is not clear. The horizontal beds are bounded above and below by sets of trough cross-beds. If the planar beds are a lower flat bed phase, the velocity sequence would alternate higher (dunes), then lower (lower flat beds), then higher (dunes). If the planar beds are an upper flat bed phase, the velocity sequence would be lower (dunes), higher (upper flat beds), then lower (dunes).

This study did not aim to expand upon the work of Morse (1979, 1985) on the various gravel facies presented in his measured sections. Also, this study did not attempt to measure paleocurrent directions in the steep, less accessible middle and lower portions of the conglomerate exposed in Castlewood Canyon State Park and elsewhere. At these locations the opportunities to easily collect paleocurrent directions are much fewer than on ledges and flat outcrops. The present study indicates that trough cross-bedding, at least in the upper portion of the CRC, is probably more common than previously recognized. Also, our 24 clast surveys, each of which was confined to the areal extent of a single trough, indicate that clasts of large pebble to small cobble size make up a minor but notable portion of trough cross-bed sediment in at least part of the trough cross-bed gravel facies. The clast survey results will be presented further on in this report.

Trough axis azimuths were used as indicators of local paleocurrent directions. Two overall paleocurrent trends are recognized: southeast to south-southeast and north to east-northeast. It is proposed that these two trends are not a bimodal distribution in a single population (Morse, 1979, 1985), but rather represent two different populations of paleocurrents. This new interpretation is based upon grouping the paleocurrent measurements both areally and within different conglomerate horizons. One population is from the southeast-to-south-southeast-flowing main paleochannel belt, and the other is from the northeast-to

Figure 4h. Possible lower-stage flat beds, west side of Cherry Creek, Castlewood Canyon State Park; flow direction southeast, away from viewer; 523374, 4332754 UTM NAD 83.

east-flowing JA Ranch paleochannel, Bucks Mountain trend, and a possible third tributary north of Castle Rock.

Interpretation of Paleo-currents

Methods

The paleocurrent database for this study is a spreadsheet file containing the data for the large population of trough cross-beds surveyed, plus the much smaller number of planar cross-beds also measured. The database in its entirety constitutes **Appendix 1**, and an example of the database content is presented in **Table 1**. Most of the data were collected in field notebooks and subsequently transcribed manually into the spreadsheet; a small portion of the data was recorded on a portable computer and later transferred electronically to the paleocurrent database. The spreadsheet was started at the end of the inaugural 2008 field season and updated yearly at the end of each of the 2009, 2010, and 2011 seasons. Proofing and correcting the database with respect to the field notebook data took place after each field season. The posted map locations for all field stations were verified against the coordinates entered in either a field notebook or a portable computer.

The paleocurrent database contains the data for all 2,897 trough cross-beds and 42 planar cross-beds collected in the set of 257 field stations. The data are grouped by field stations and the field stations are listed in numerical order, which also is the order in which the field stations were visited. As an example of database content and format, Table 1 presents the data for field station RG040, located near the southeast corner of Prairie Canyon Ranch (Plate 3B). In this table, each field station has an initial row for location and date, and UTM coordinates appearing in this row are usually for the first data collection point in the field station traverse. Each trough cross-bed occurrence occupies a row, and the data category columns are the UTM coordinates, azimuth of trough axis, inclination of beds along the axis, length of trough, width of trough, quality of exposure, and longest dimension and lithology of largest clast in the trough.

After each field season, preliminary

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
RG040, Russellville Gulch quad, 526346E/4349737N, T9S, R65W, Sec. 5, NW, 19Sep08								
526346	4349737	152	NA	5	2	good	15	Twm
526338	4349747	125	23	3	2	poor	11	granitic
526277	4349719	159	NA	4	2	poor	4	granitic
526624	4349705	118	NA	3	3	poor	4	granitic
526249	4349701	134	25	5	5	very good	10	granitic
526249	4349697	157	18	5	2	poor	5	Twm
526245	4349702	154	22	5	3	poor	2	granitic
526113	4349716	165	NA	7	6	fair	4	granitic
526090	4349711	144	NA	13	5	fair	8	granitic
526070	4349735	149	NA	8	5	poor	5	Twm
526001	4349725	164	21	12	10	fair	11	granitic
526044	4349748	167	17	21	6	fair	8	Twm
526051	4349763	156	19	13	5	poor	6	granitic
526068	4349790	153	16	5	3	poor	18	Twm
526057	4349799	135	NA	6	5	poor	9	Twm
526044	4349824	184	23	6	4	poor	7	Twm
526035	4349810	135	21	5	5	poor	8	granitic
525981	4349745	130	20	5	5	fair	NA	NA
525990	4349732	162	19	11	6	fair	NA	NA
525984	4349718	172	18	9	5	fair	NA	NA
525837	4349861	157	16	5	5	fair	26	Twm
525030	4349881	193	18	8	4	fair	NA	NA
525877	4349930	186	8	12	11	poor	17	Twm
525852	4349942	217	22	15	9	very good	29	Twm

Note: Header for each field station presents station number; U.S. Geological Survey 7.5-minute topographic quadrangle containing station; UTM coordinates; township, range, section, and quarter-section; and date of data collection

NA = not available for measurement

Table 1. Excerpt from database of 2,897 paleocurrent field measurements from trough cross-beds, upper portion of Castle Rock Conglomerate; data from station RG040, east side of Cherry Creek near east boundary of Prairie Canyon Ranch.

length-azimuth rose diagrams (using lengths of trough axes) were generated for the paleocurrent directions collected at each field station.

The field topographic maps covering the study area were enlarged from 1:24,000 to 1:12,000, and at the end of each field season the enlarged maps were updated with reduced rose diagrams corresponding to the field stations. These maps became a valuable aid in assessing the progress and results of the field work. It was recognized that the field stations presented the data only in a rough fashion, in groups corresponding to discrete private land parcels or portions of public land. The investigators planned that the paleocurrent data should be posted and interpreted at much greater resolution using large-scale digital maps. Large-scale maps would display the paleocurrent groups both areally and according to different elevations (horizons within the conglomerate), the consistency or variation within a single group, and the variations between discrete groups.

The paleocurrent database, together with commercial mapping software and digital, metric, topographic maps obtained from the USGS Seamless Data Warehouse, was used to generate 95 new, large-scale maps of paleocurrent measurements. The contour interval for these maps was 4 m (13 ft). By carefully reviewing the new maps it was possible to reorganize the paleocurrent data into a consolidated database of 411 areally and vertically discrete groups. A new set of length-azimuth rose diagrams was prepared to correspond to the consolidated groups. These are the paleocurrent direction arrows appearing on Plates 3A through 3D. The new set of paleocurrent rose diagrams constitutes **Appendix 2**. The consolidated database includes paleocurrent group numbers, mean resultant azimuths from the new rose diagrams, number of paleocurrent measurements in each group, and approximate area of each group (expressed as the radius of a circle of equivalent area). The consolidated paleocurrent database constitutes **Appendix 3**, and an example of the database content is presented in **Table 2**.

The new large-scale maps incorporated all of the 2,897 field measurements of trough cross-bed azimuths in the paleocurrent database, and revealed a sharper picture of the vertical (i.e., by CRC horizon) as well as areal grouping of both of the paleocurrent trends. On each of the maps the lower and upper elevation ranges for each group were recorded, for assembling cross sections to be used in examining for different flow directions at different horizons. The consolidated database was refined to distinguish between 283 groups belonging to the southeast to south-southeast trend and 128 groups belonging to the northeast to east trend. An example of the result is represented by Table 2, an excerpt from the consolidated database. This database is the basis for our hypothesis of a main paleocurrent channel belt having several tributaries.

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approximate Area of Location (square meters)	Approximate Size of Location Expressed as Radius of an Equivalent Circle (meters)
RG039	526522	4349736	183	67	3	380	11
RG040A	525030	4349881	193	NA	1	NA	NA
RG040B	526044	4349748	166	82	16	64000	143
RG040C	526338	4349747	145	34	7	8000	50
RG041A	525697	4349826	182	64	5	3900	35
RG041B	526100	4349545	161	76	3	3000	31
RG042A	522596	4355275	57	58	3	2800	30
RG042B	522599	4355170	155	53	4	2550	28
RG042C	522740	4355068	132	85	9	11200	60
RG042D	522655	4354998	58	NA	1	NA	NA
RG043A	521671	4355282	117	93	6	6000	44
RG043B	521608	4355107	68	14	3	1050	18
CRS046	515728	4348829	122	62	7	1200	20
CRS047	515400	4348023	186	25	3	200	8
CRS048	515995	4349482	64	NA	1	NA	NA
CRS049	518034	4351692	52	67	3	4200	37
CRS050	518272	4351634	141	8	2	300	10
CRS051A	518099	4351366	11	61	3	2500	28
CRS051B	518167	4351464	76	9	2	600	14
CRS052	517768	4351132	115	NA	1	NA	NA
CRS053	515700	4350580	69	65	5	200	8
CRS054	516166	4352377	347	NA	1	NA	NA
CRS055	515313	4354055	25	NA	1	NA	NA
CRS056	515525	4354812	336	95	6	4000	36
CRS057	519116	4352924	31	2	2	70	5
CRS058	515674	4355524	54	85	5	5000	40
CRS059A	515067	4355611	0	5	2	125	6
CRS059B	515248	4355639	106	41	3	425	12
CRS060	515302	4355965	50	103	7	18680	77
CRS061	518894	4356933	186	96	8	12920	64
CRS062	518931	4357132	184	36	5	2000	25
CRS063	518520	4357855	217	32	2	550	13
CRS064	516660	4356160	116	58	5	3000	31

NA = not available for measurement

Table 2. Excerpt from database of 411 consolidated local paleocurrent directions, derived from paleocurrent database of 2,897 measurements from trough cross-beds, Castle Rock Conglomerate.

Data Compilation to Create Paleocurrent Maps and Cross Sections

Plates 3A through 3D are small-scale paleocurrent maps of the CRC, presenting most of the known occurrences of the CRC and the general pattern of paleocurrent directions in the upper portion of the unit. The map displays the south-southeast-to-southeast-flowing main paleochannel belt, two north-to-east-northeast-flowing tributaries, the JA Ranch paleochannel and Bucks Mountain trend, and a possible third tributary north of Castle Rock.

These maps show the 411 consolidated paleocurrent directions of the consolidated database. The arrows plotted on the map are paleocurrent directions from the database. The majority of the directions range from southeast to south-southeast (red arrows) and lie within the main paleochannel belt, and a smaller number range from north to east-northeast (blue arrows) and lie within the postulated tributaries. Beside each arrow are posted (from Appendix 3) its location number, paleocurrent azimuth and the number of local field measurements supporting the azimuth value.

Figures 5 through 12 are eight examples of the 95 large-scale paleocurrent maps used to group the field data according to local paleocurrent trends. Location GM3A (**Figure 5**), at Gateway Mesa Open Space south of Colorado Highway 83 and east of Castle Rock, is discussed as an example. Location GM3A consists of three discrete areas of paleocurrent measurements, and within each area are

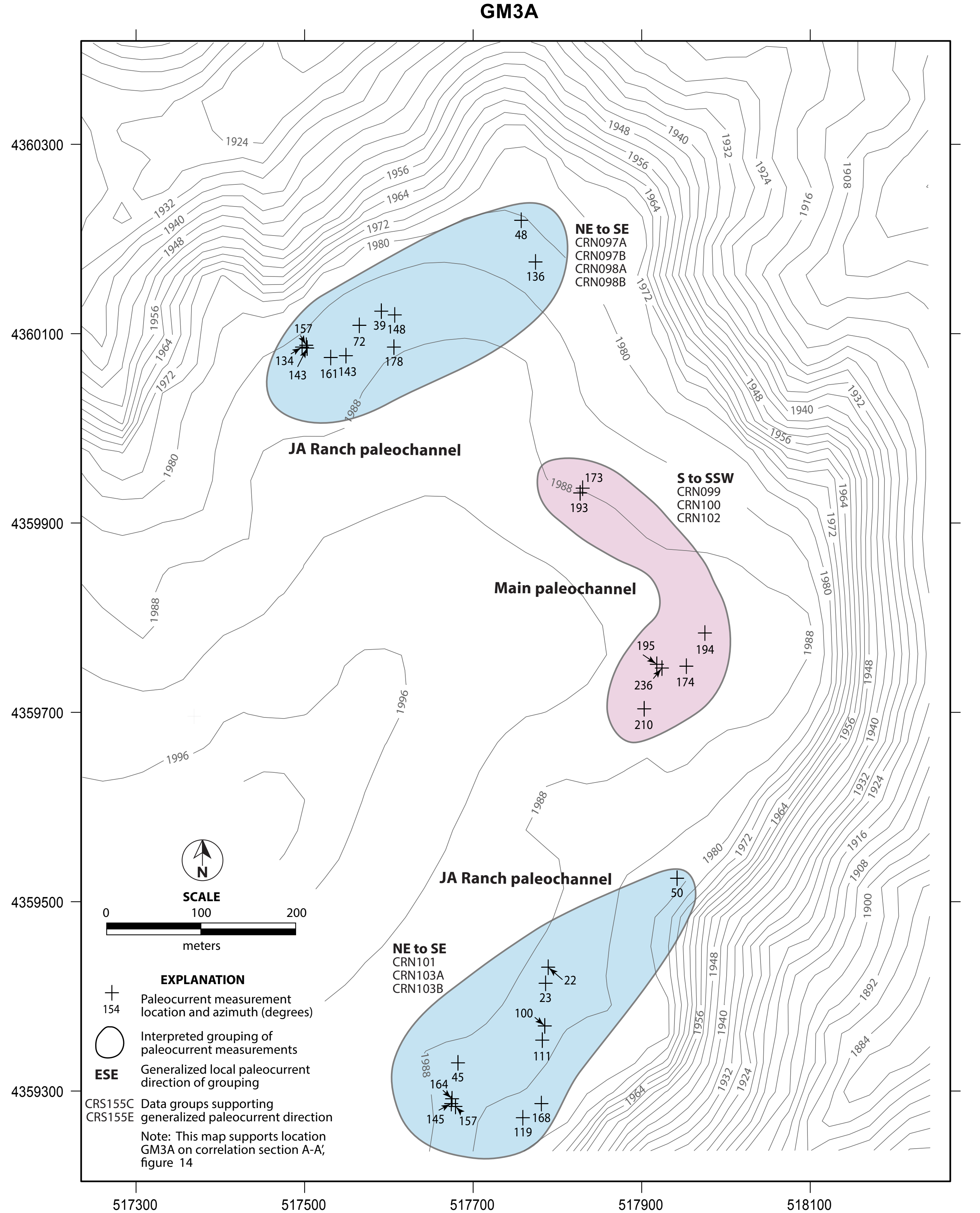


Figure 5. Large-scale paleocurrent map of location GM3A, showing exposures of Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel; supports cross sections A-A' and D-D' (Figures 14 and 17).

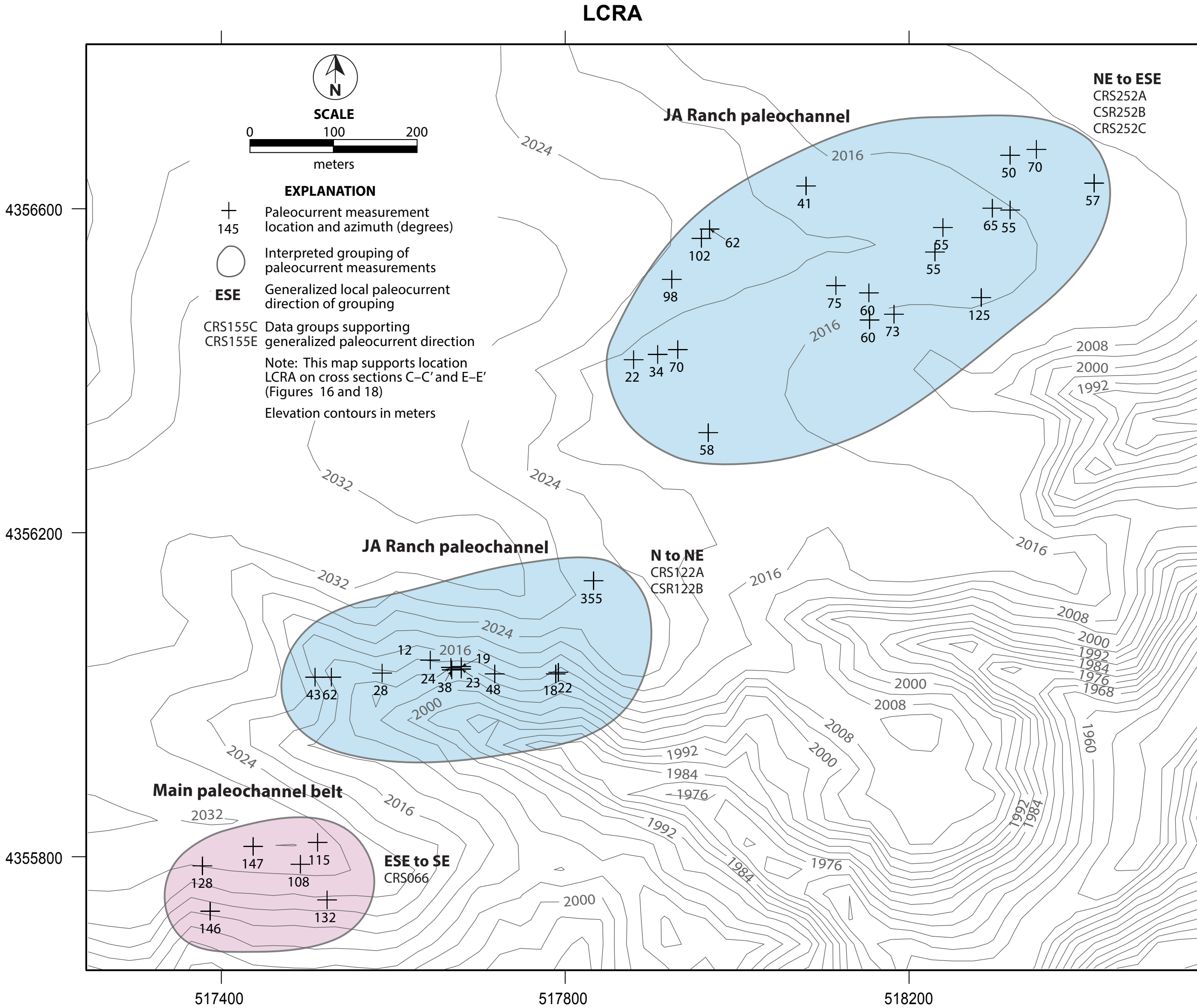


Figure 6. Large-scale paleocurrent map of location LCRA, showing exposures of Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel; supports cross sections C-C′ and E-E′ (Figures 16 and 18).

the individual paleocurrent data points with their azimuth values. Paleocurrents in the central area (red) which is at a higher elevation, trend from south to south-southwest and are part of the main paleochannel belt. Paleocurrents in the north and south areas (blue), which are at lower elevations, trend from northeast to southeast and are part of the JA Ranch paleochannel, which is tributary to the main paleochannel. The areas shown on Figure 5 correspond to supporting paleocurrent rose diagrams assembled from the field measurements.

Figures 13a through 13h present eight of the many length-azimuth rose diagrams supporting the red and blue areas shown on the large-scale paleocurrent maps (Figures 5 through 12). Two rose diagrams are presented for each of the maps in Figures 5, 6, 7, and 10. Each rose diagram has a group number from the consolidated database (Appendix 3); each specifies the large-scale map which it supports, and the group numbers of the diagrams also are posted on the four maps. These rose diagrams are a small portion of the diagrams plotted from the consolidated database, and display a moderate to strong directional consistency, as often is observed within local groups of measurements in the upper portion of the CRC. Each paleocurrent arrow on Plates 3A through 3D is supported by a rose diagram like those in Figure 13, except for those arrows representing the relatively small number of

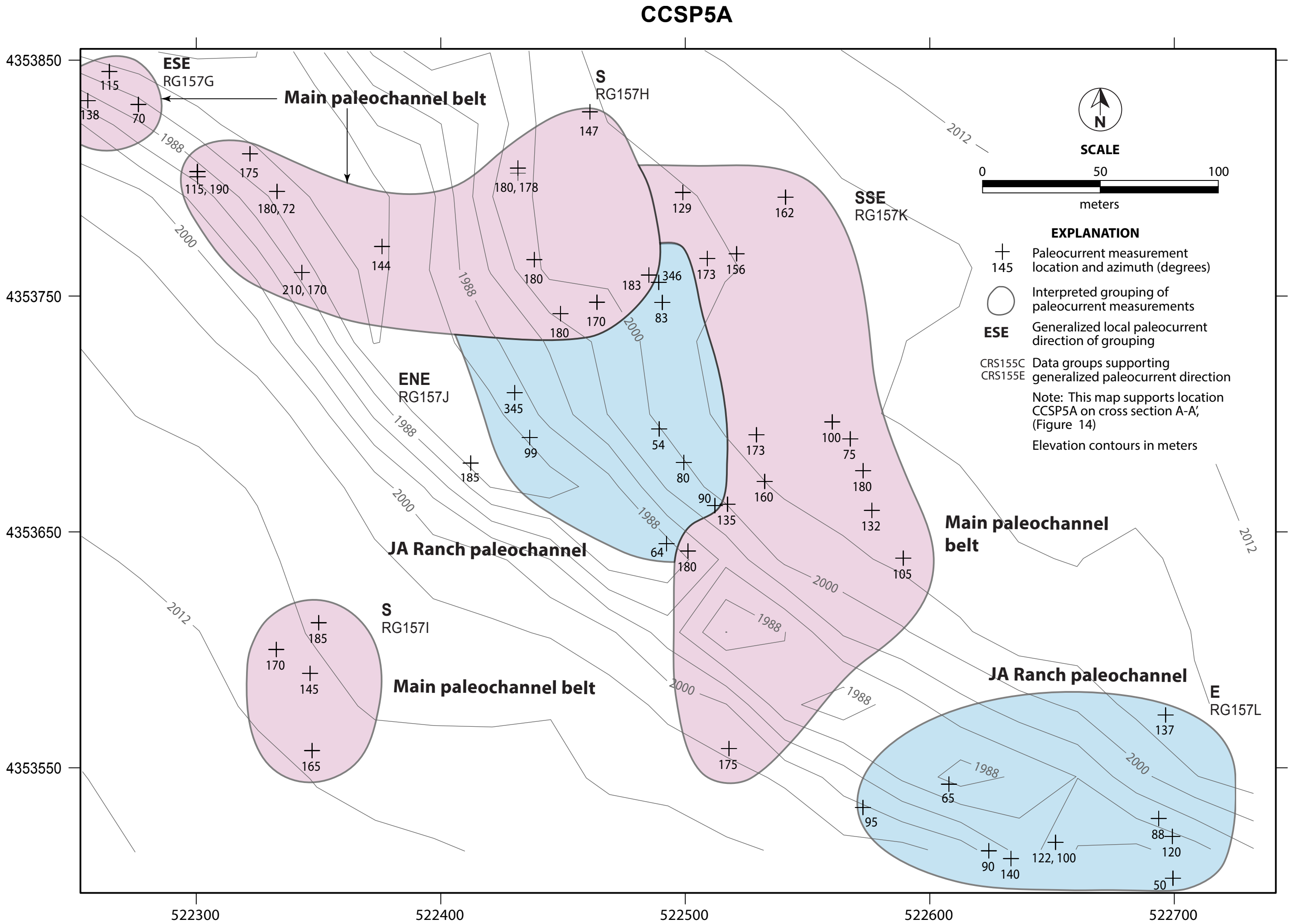


Figure 7. Large-scale paleocurrent map of location CCSP5A, showing exposures of Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel; supports cross section A-A' (Figure 14).

conglomerate exposures where only a single paleocurrent measurement was found.

GM3A and all such locations were plotted on a series of 19 working cross sections within the upper portion of the CRC. These are correlation cross sections; they are scaled vertically but not horizontally. The cross sections served to test for horizons (groups of correlatable outcrops) sharing a paleocurrent trend and also for different correlatable horizons having contrasting paleocurrent trends. **Figures 14 through 20** present seven of these cross sections (A-A' through G-G'), and their lines of section are shown on the small-scale paleocurrent maps (Plates 3A through 3D). Location GM3A on the large-scale paleocurrent map in Figure 3 again will be used as an example. Recall that paleocurrents in the north and south areas within GM3A trend northeast to southeast and the central area trends south to south-southwest. The topography shows that the north and south areas are within the same lower horizon and that the central area is within a directly overlying upper horizon. Cross section A-A' (**Figure 12**), containing location GM3A, is oriented northwest-southeast, and extends approximately 11 km (7 miles) from Hidden Mesa Open Space to Prairie Canyon Ranch. The GM3A column in this section represents location GM3A on Figure 5, and the top of the column is the highest ground surface elevation at GM3A. This holds for all the locations presented in the cross sections. For GM3A, the upper and lower elevations of both the northeast to east-trending and southeast to south-southeast-trending horizons are posted in the column, as derived from Figure 5. The approximate range of paleocurrent directions is given for each horizon; the horizons are colored to indicate general paleocurrent direction (southeast or northeast) and the supporting paleocurrent measurement groups are listed for each horizon. The result is a representation of two adjacent horizons having two different paleocurrent trends. Each of the large-scale paleocurrent maps (Figures 5 through 12) supports a cross section, and all the paleocurrent areas

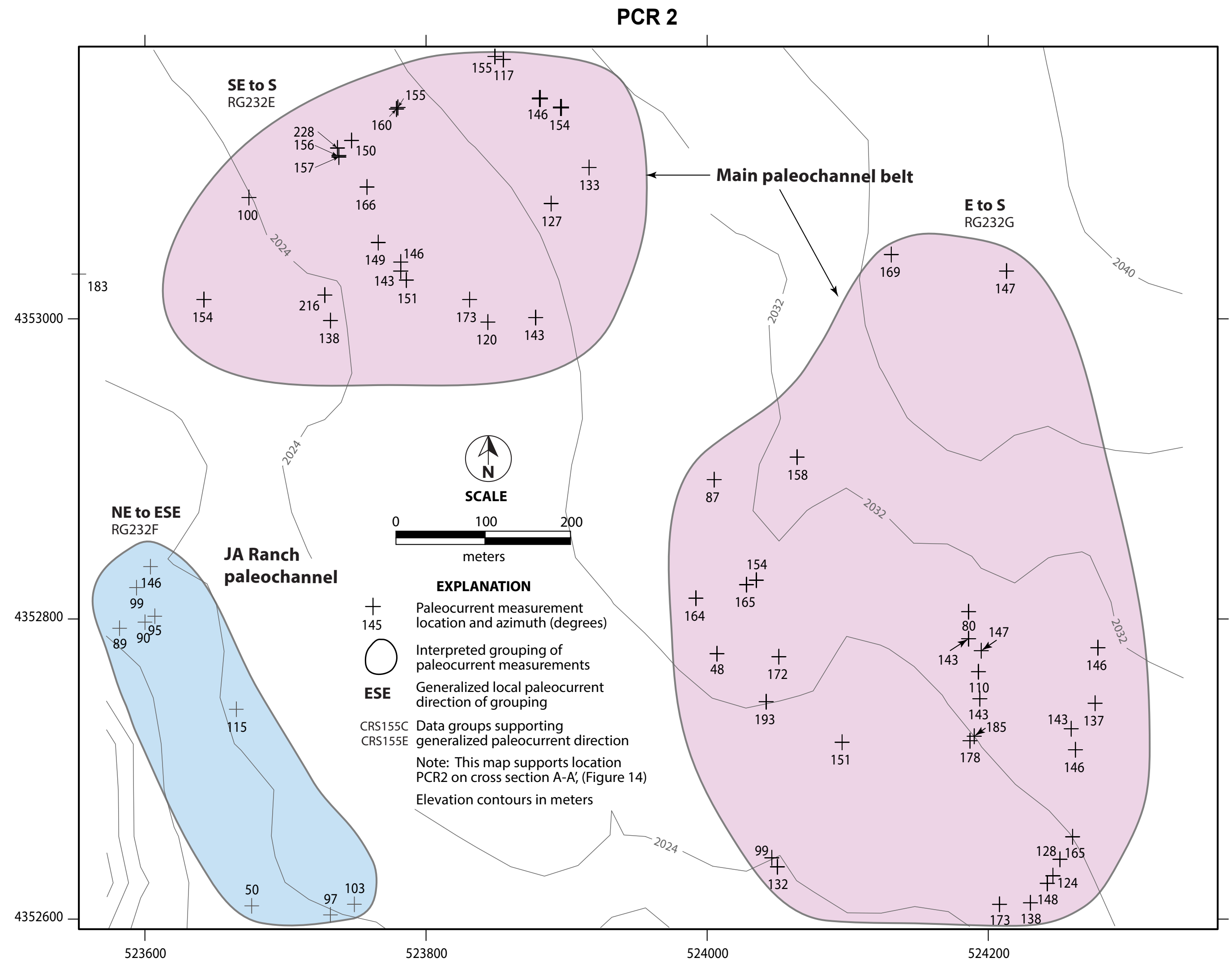


Figure 8. Large-scale paleocurrent map of location PCR2, showing exposures of Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel; supports cross section A-A' (Figure 14).

on Figures 5 through 12 appear on the sections.

At each location like example GM3A, a sensible consolidation of all the paleocurrent areas at the location was attempted, such that its corresponding column in a cross section, while being somewhat generalized, would be as representative as possible.

Results of Spatial Correlation

The large-scale paleocurrent maps (Figures 5 through 12) indicate that within the upper portion of the CRC there are different correlatable horizons with distinctly different paleocurrent trends. At many places, two of these horizons can be seen to correspond to a main paleochannel belt above and a tributary paleochannel immediately below. It was sometimes observed that a pair of separate areas, each having a different paleocurrent trend and apparently lying within different horizons, would appear to somewhat "overlap" vertically. The overlap was ascribed to channeling of the lower horizon by the upper, resulting in an irregular, eroded surface on the lower. For instances like this, the elevation of the upper/lower contact was approximated in the generalized location column.

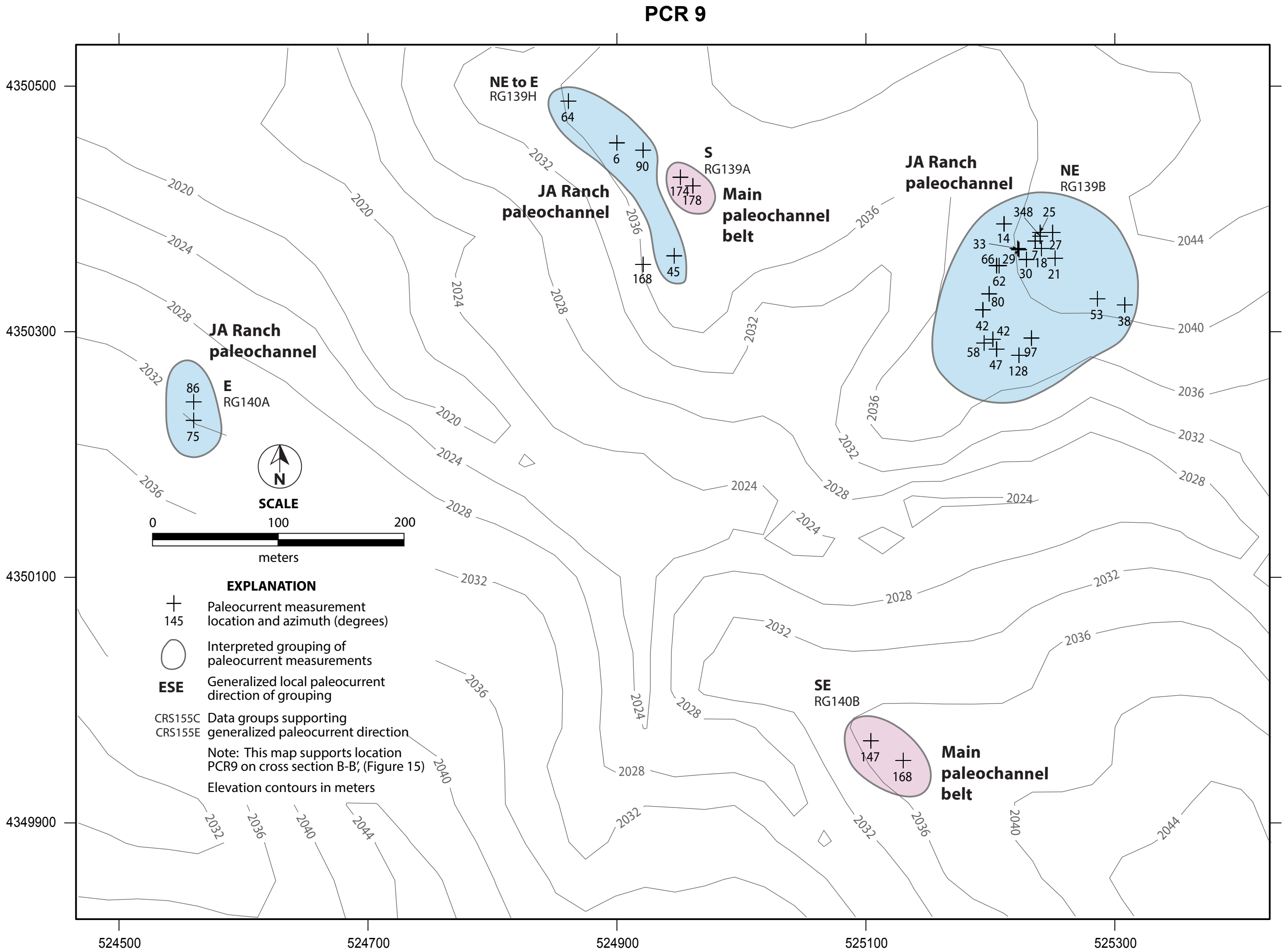


Figure 9. Large-scale paleocurrent map of location PCR9, showing exposures of Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel; supports cross section B-B' (Figure 15).

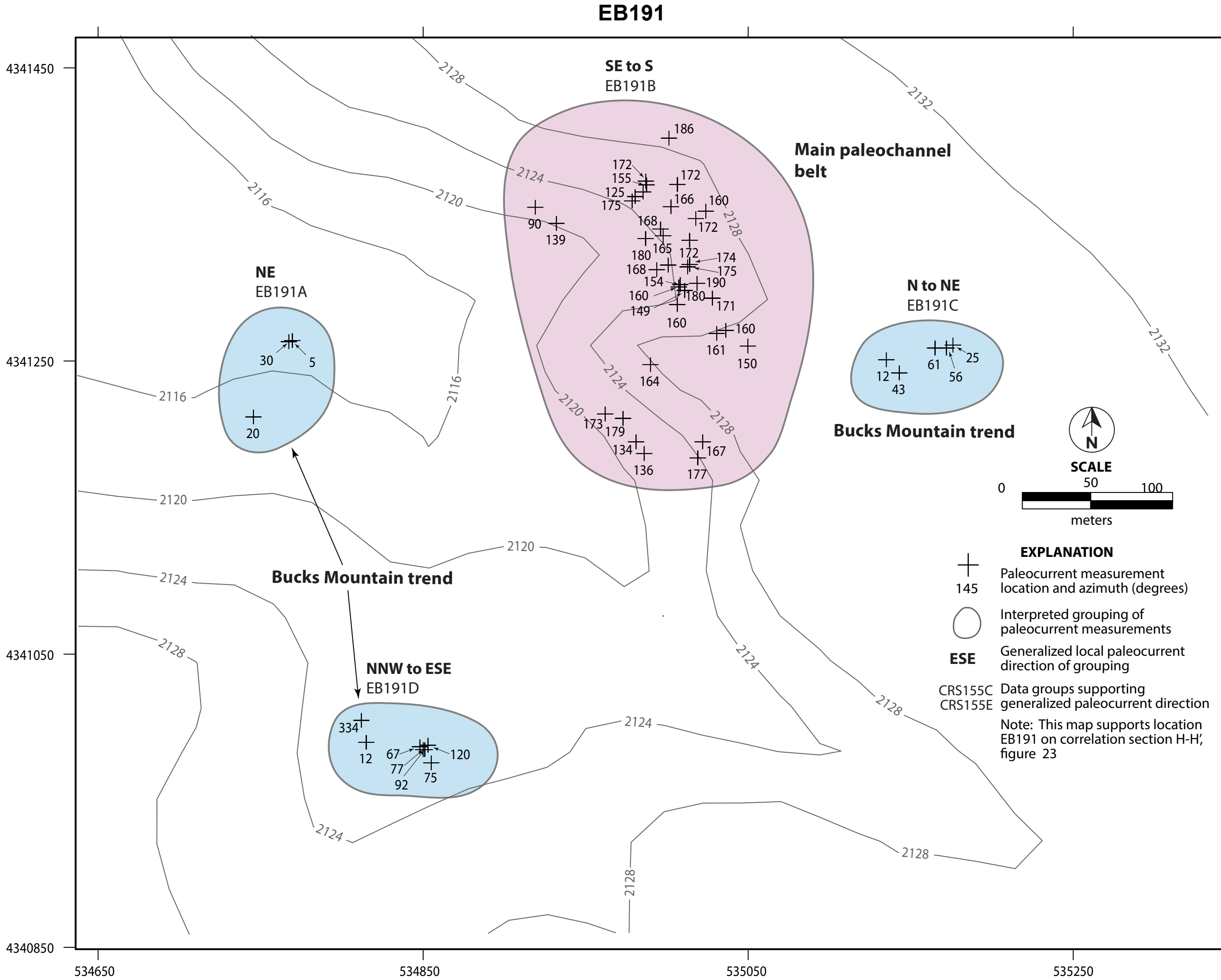


Figure 10. Large-scale paleocurrent map of location EB191, showing exposures of Elbert reach of main paleochannel and also Bucks Mountain trend; supports cross section H-H' (Figure 23).

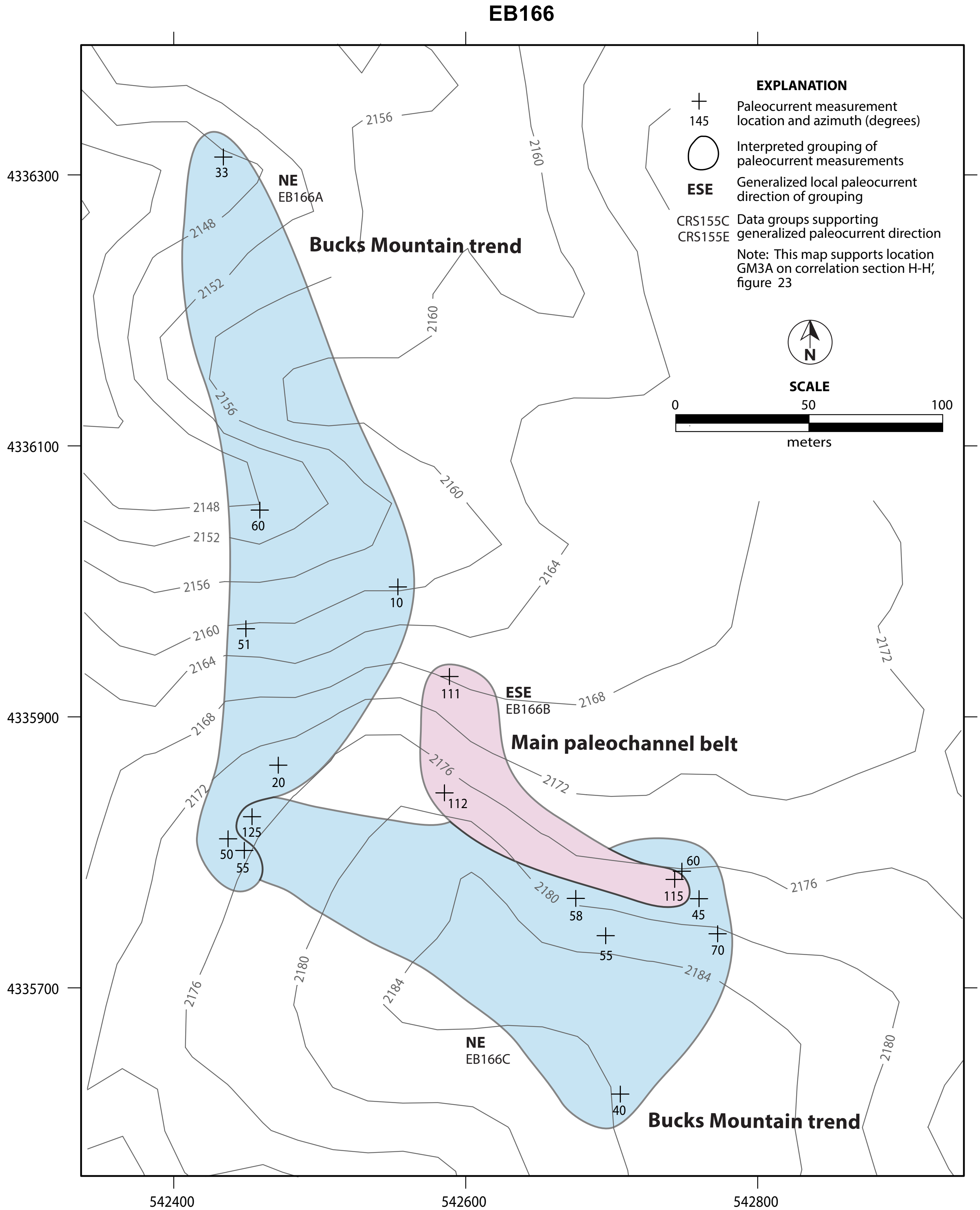


Figure 11. Large-scale paleocurrent map of location EB166, showing exposures of Elbert reach of main paleochannel and also Bucks Mountain trend; supports cross section H-H' (Figure 23).

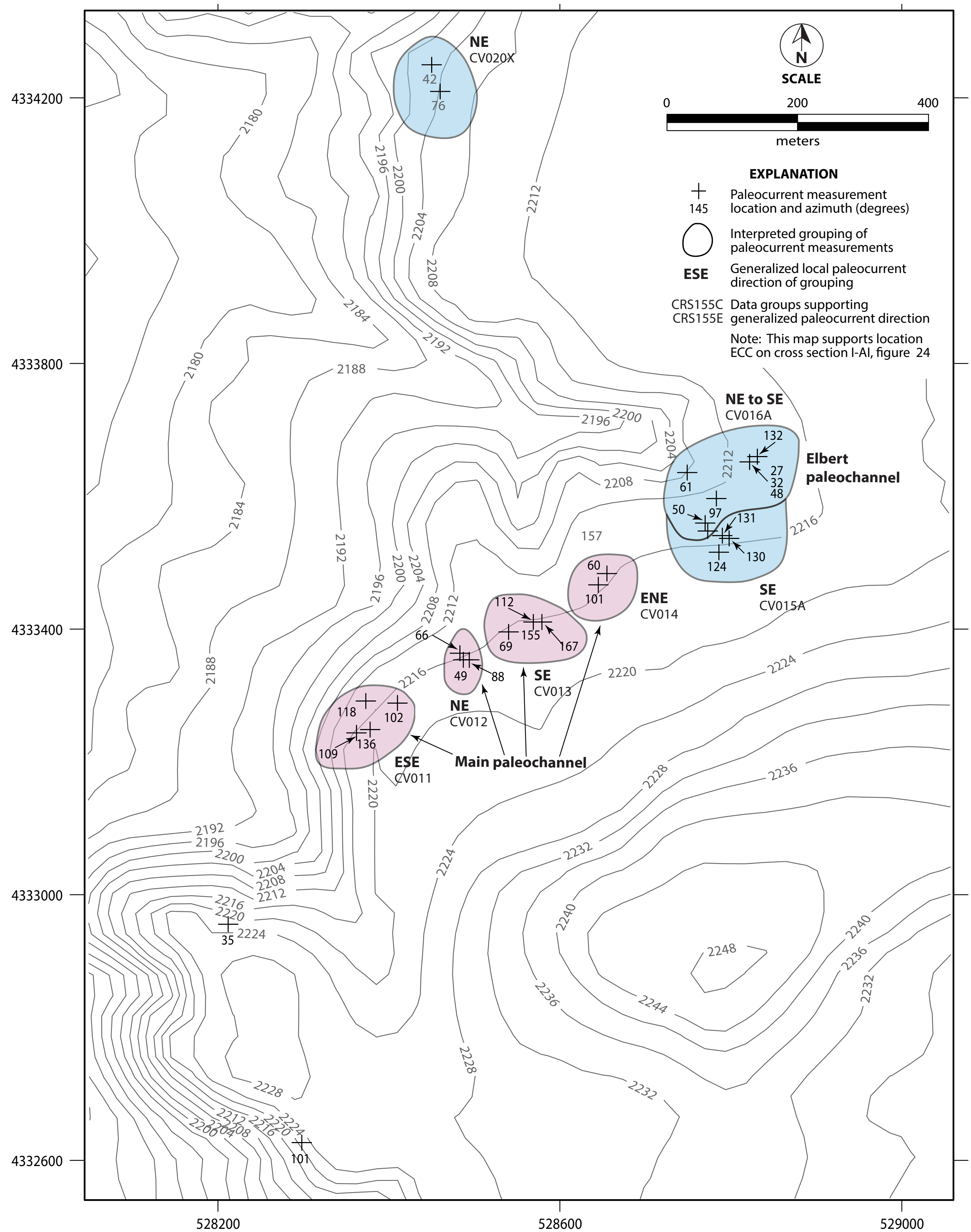


Figure 12. Large-scale paleocurrent map of location ECC, showing exposures of Bucks Mountain trend and also of Elbert Reach of main paleochannel; supports cross section I-I' (Figure 24).

Figure 13a. Paleocurrent rose diagram for location CRN100, resultant direction 205°, 5 measurements (supports Figure 5, map GM3A, Gateway Mesa Open Space).

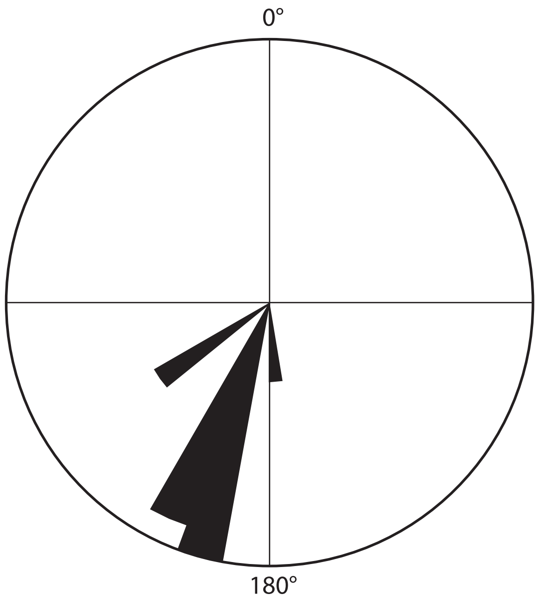


Figure 13b. Paleocurrent rose diagram for location CRN103A, resultant direction 44°, 4 measurements (supports Figure 5, map GM3A, Gateway Mesa Open Space).

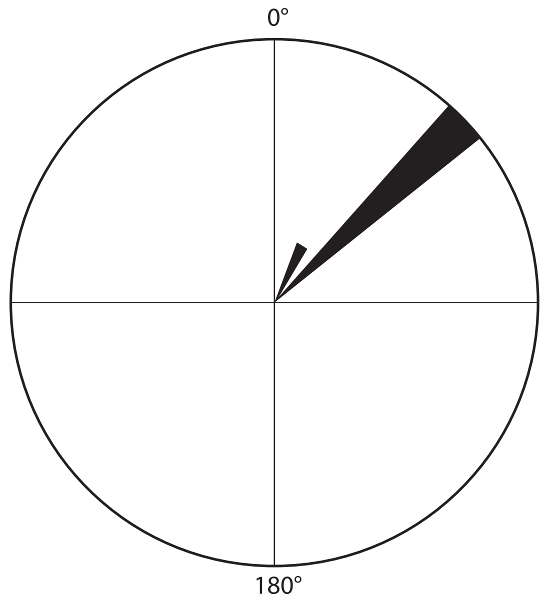


Figure 13c. Paleocurrent rose diagram for location CRS066, resultant direction 130°, 6 measurements (supports Figure 6, map LCRA, Lost Canyon Ranch area).

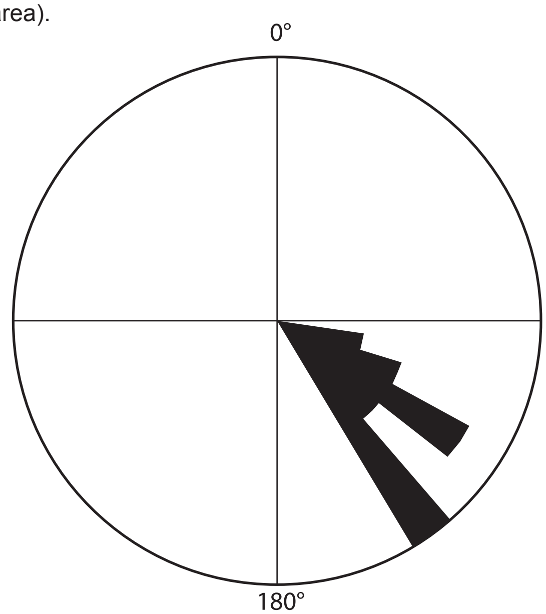


Figure 13d. Paleocurrent rose diagram for location CRS122B, resultant direction 23°, 8 measurements (supports Figure 6, map LCRA, Lost Canyon Ranch area).

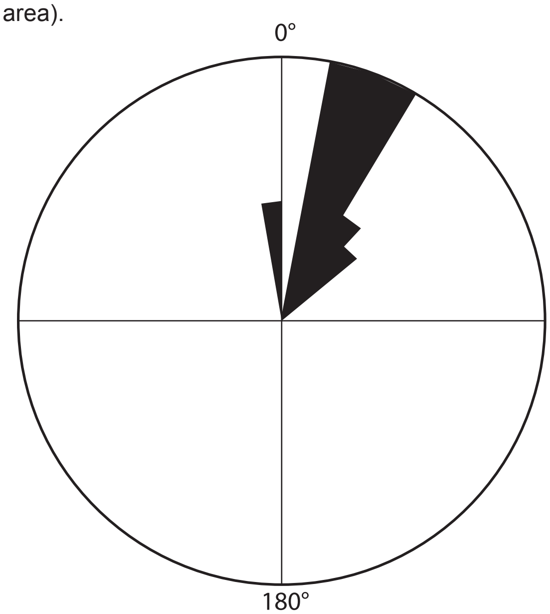


Figure 13a-d. Paleocurrent rose diagrams for given locations.

Figure 13e. Paleocurrent rose diagram for location RG157K, resultant direction 161°, 9 measurments (supports Figure 7, map CCSP5A, Castlewood Canyon State Park).

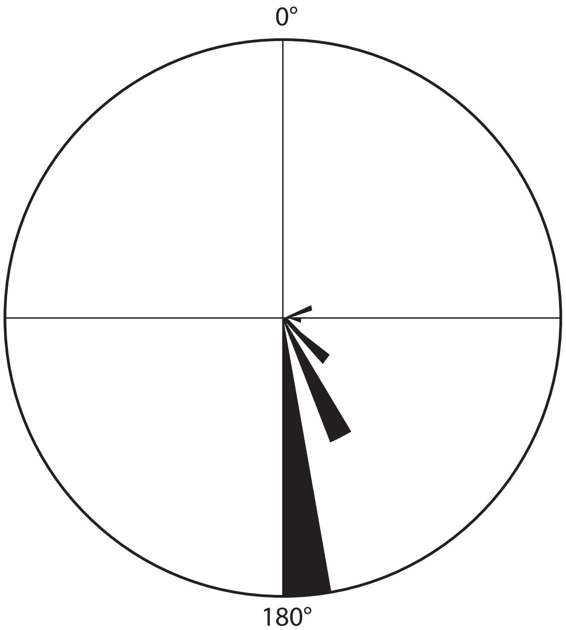


Figure 13f. Paleocurrent rose diagram for location RG157J, resultant direction 66°, 8 measurements (supports Figure 7, map CCSP5A, Castlewood Canyon State Park).

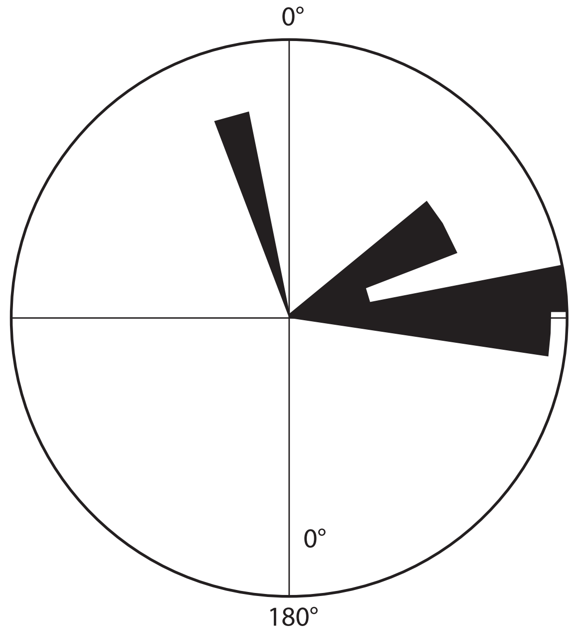


Figure 13g. Paleocurrent rose diagram for location EB191B, resultant direction 165°, 31 measurements (supports Figure 10, map EB191, 5 km west of Elbert).

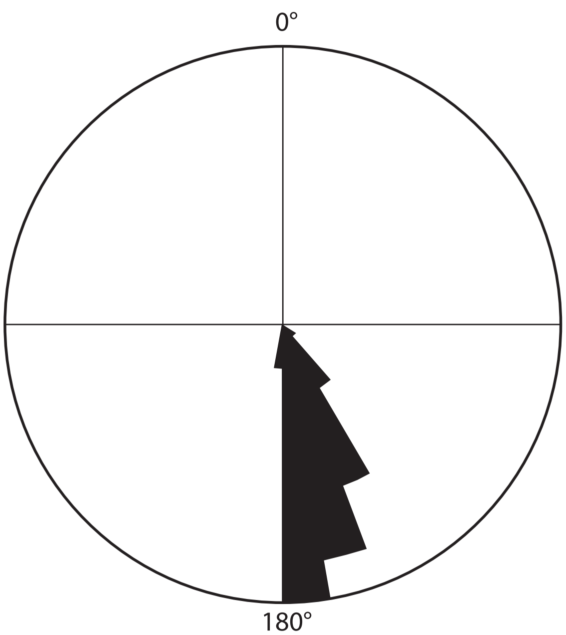


Figure 13h. Paleocurrent rose diagram for location EB191C, resultant direction 44°, 5 measurements (supports Figure 10, map EB191, 5 km west of Elbert).

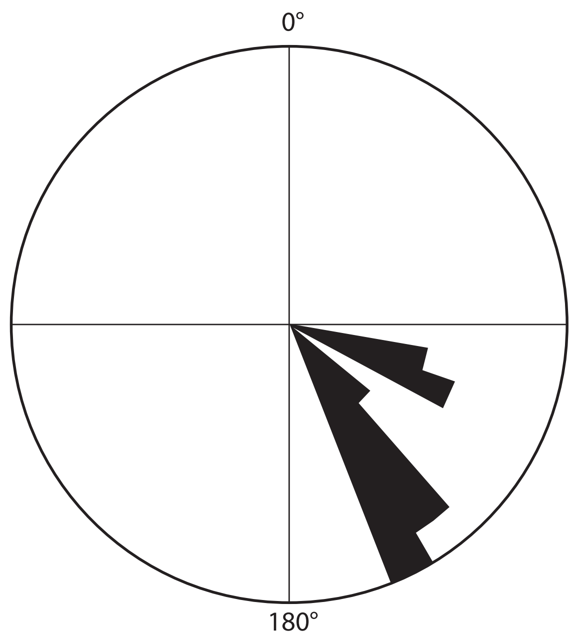


FIGURE 13E-H. PALEOCURRENT ROSE DIAGRAMS FOR GIVEN LOCATIONS.

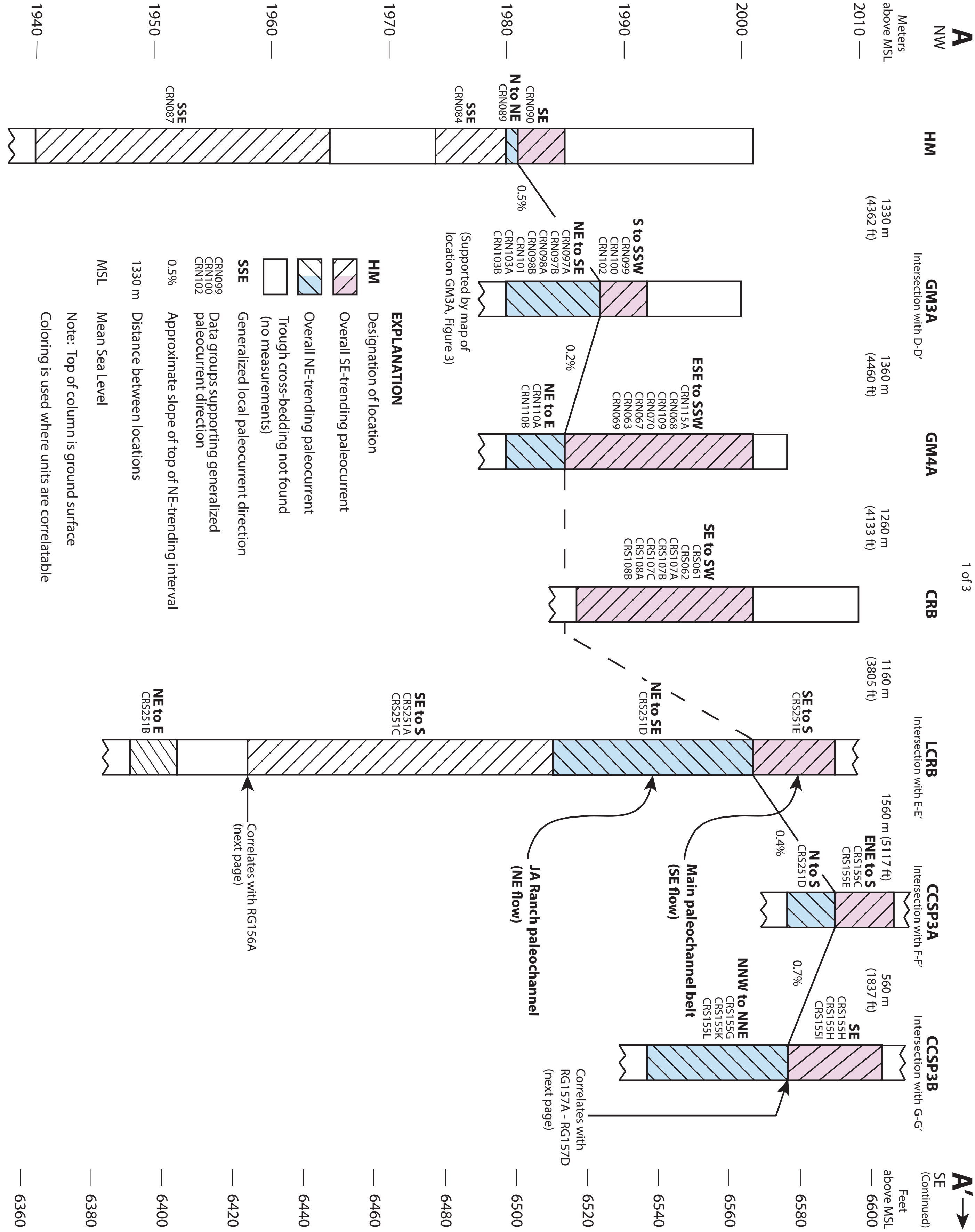


Figure 14. Cross section A-A', showing Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel.

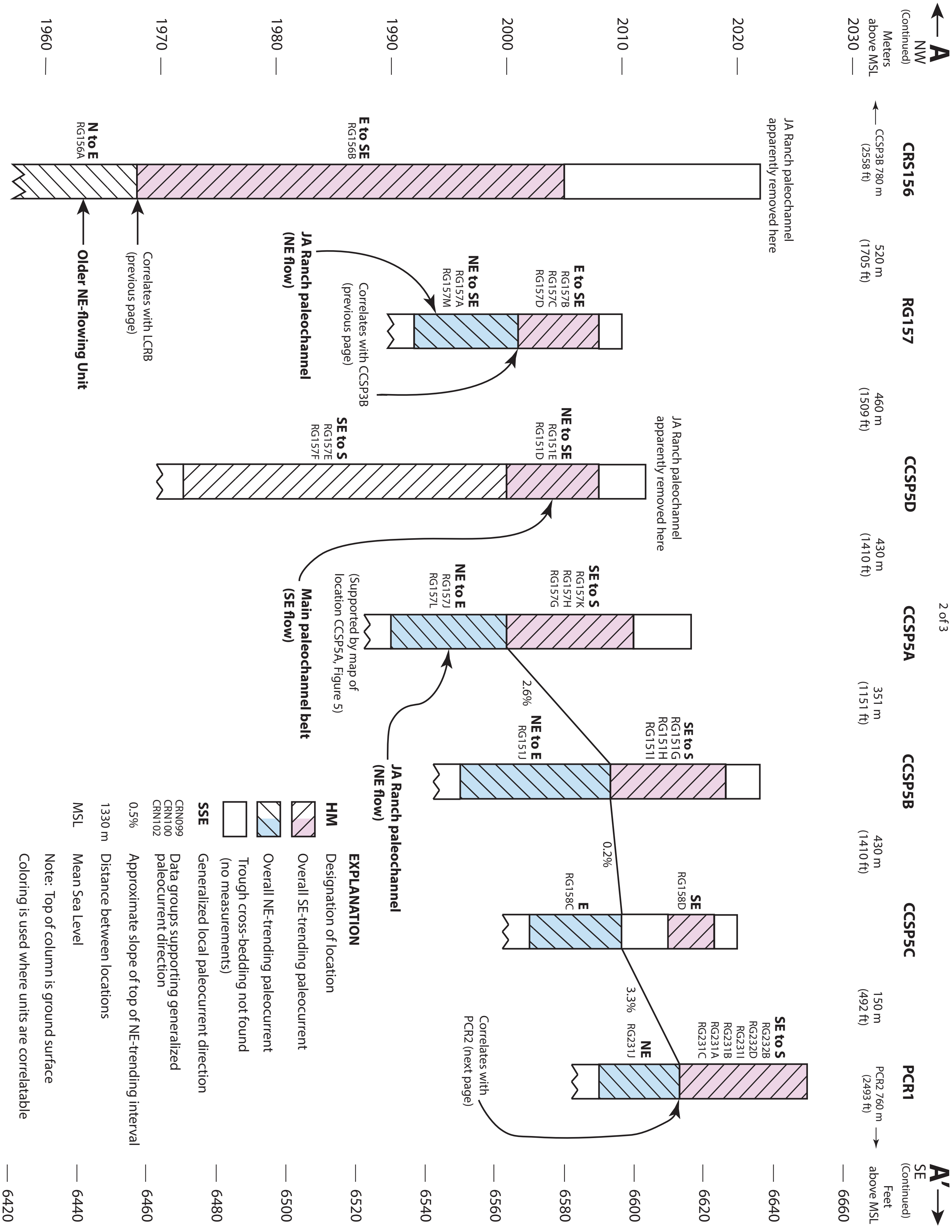


Figure 14. Continued.

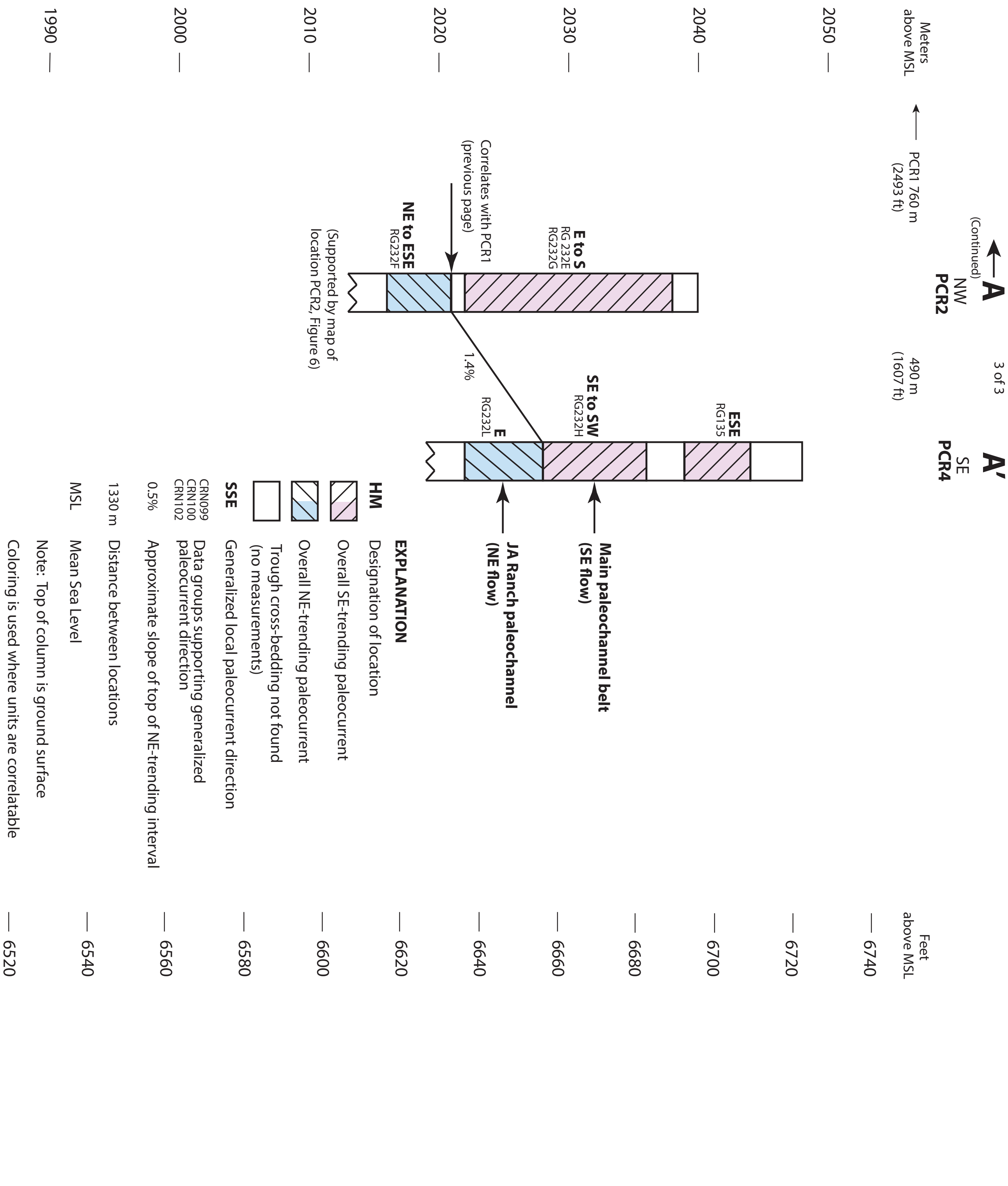


FIGURE 14. CONTINUED.

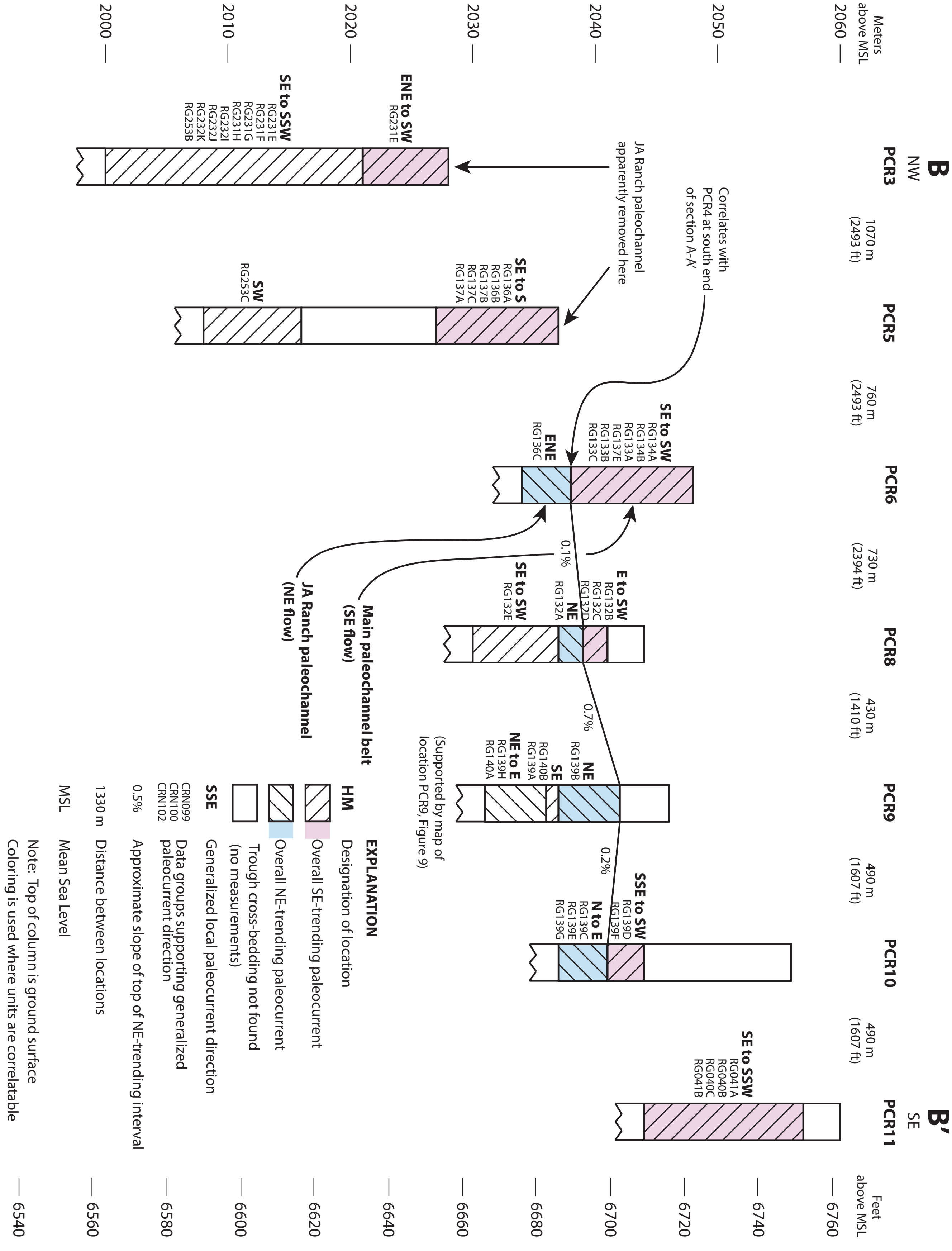


Figure 15. Cross section B-B′, showing Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel.

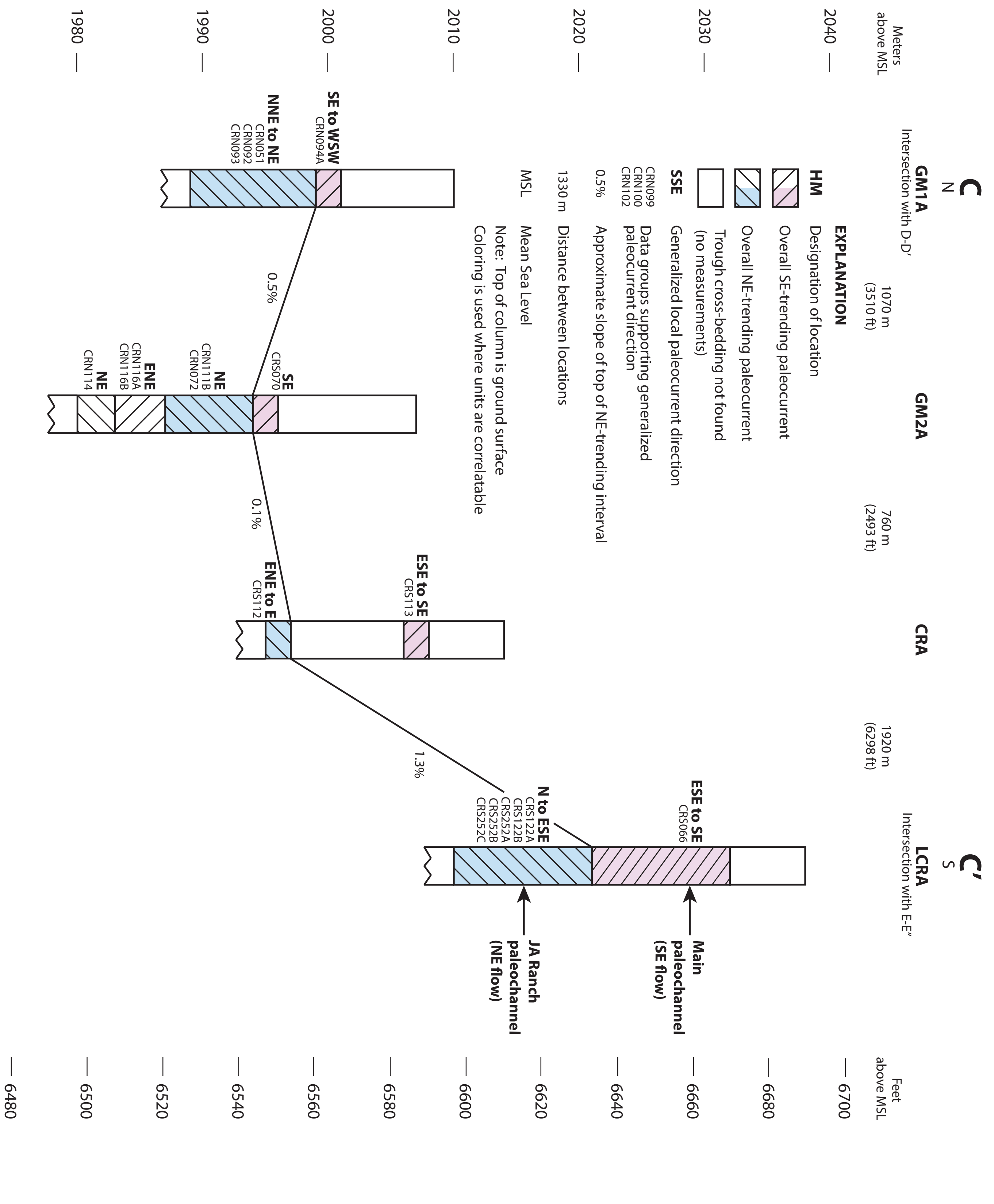
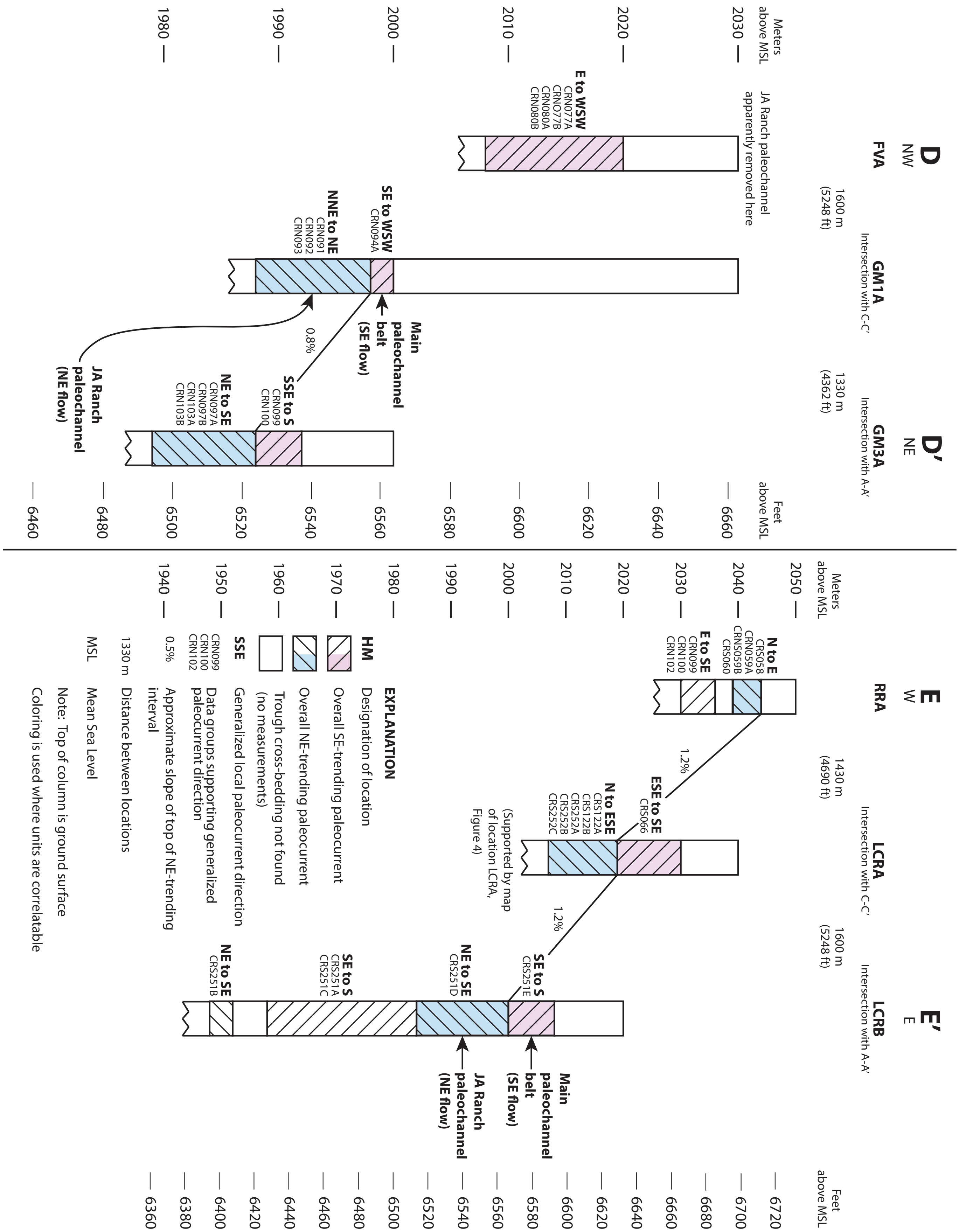


Figure 16. Cross section C-C', showing Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel.



Figures 17&18. Cross sections D-D' and E-E' showing Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel.

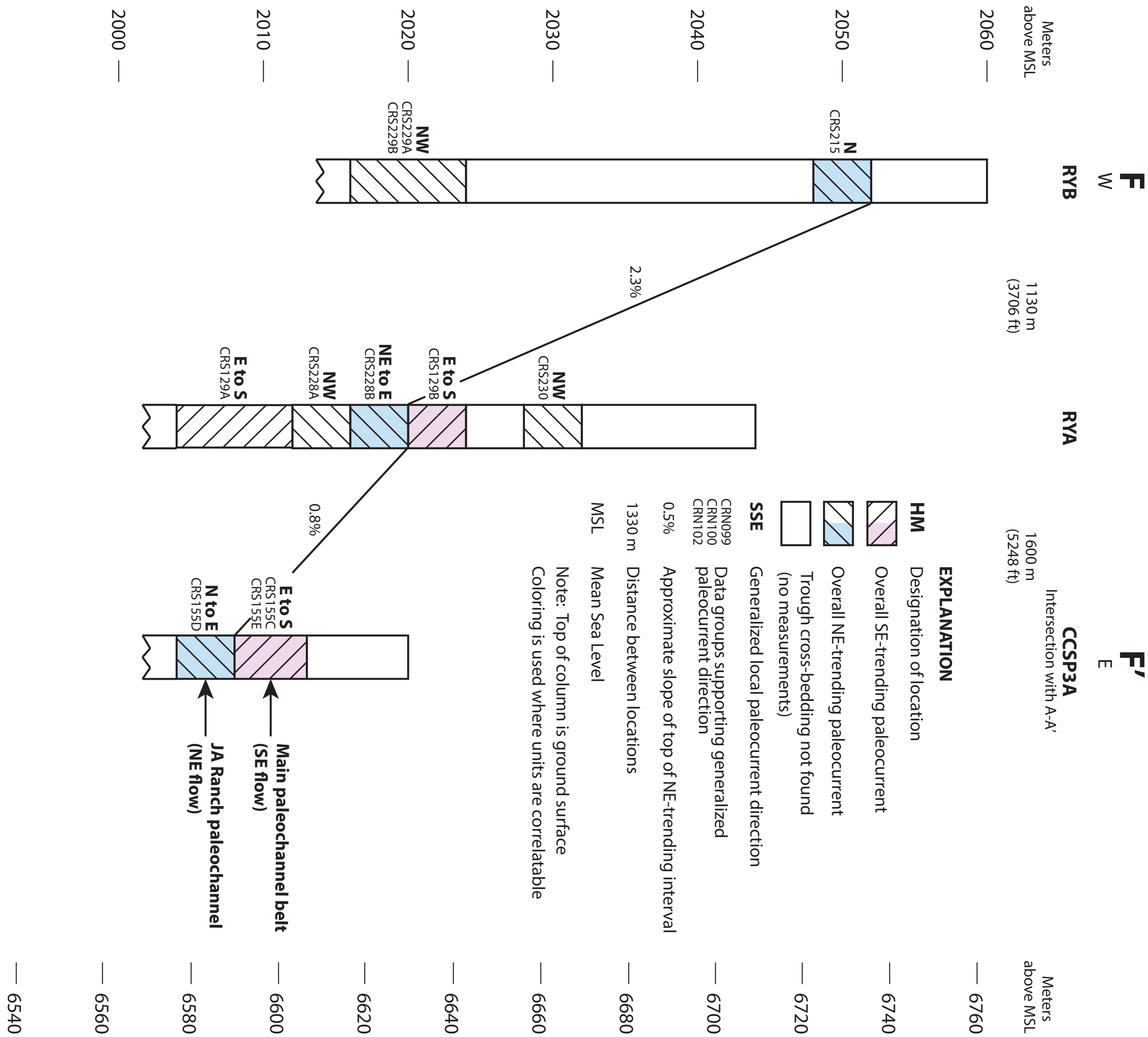


FIGURE 19. CROSS SECTION F-F', SHOWING CASTLEWOOD CANYON REACH OF MAIN PALEOCHANNEL AND ALSO JA RANCH PALEOCHANNEL.

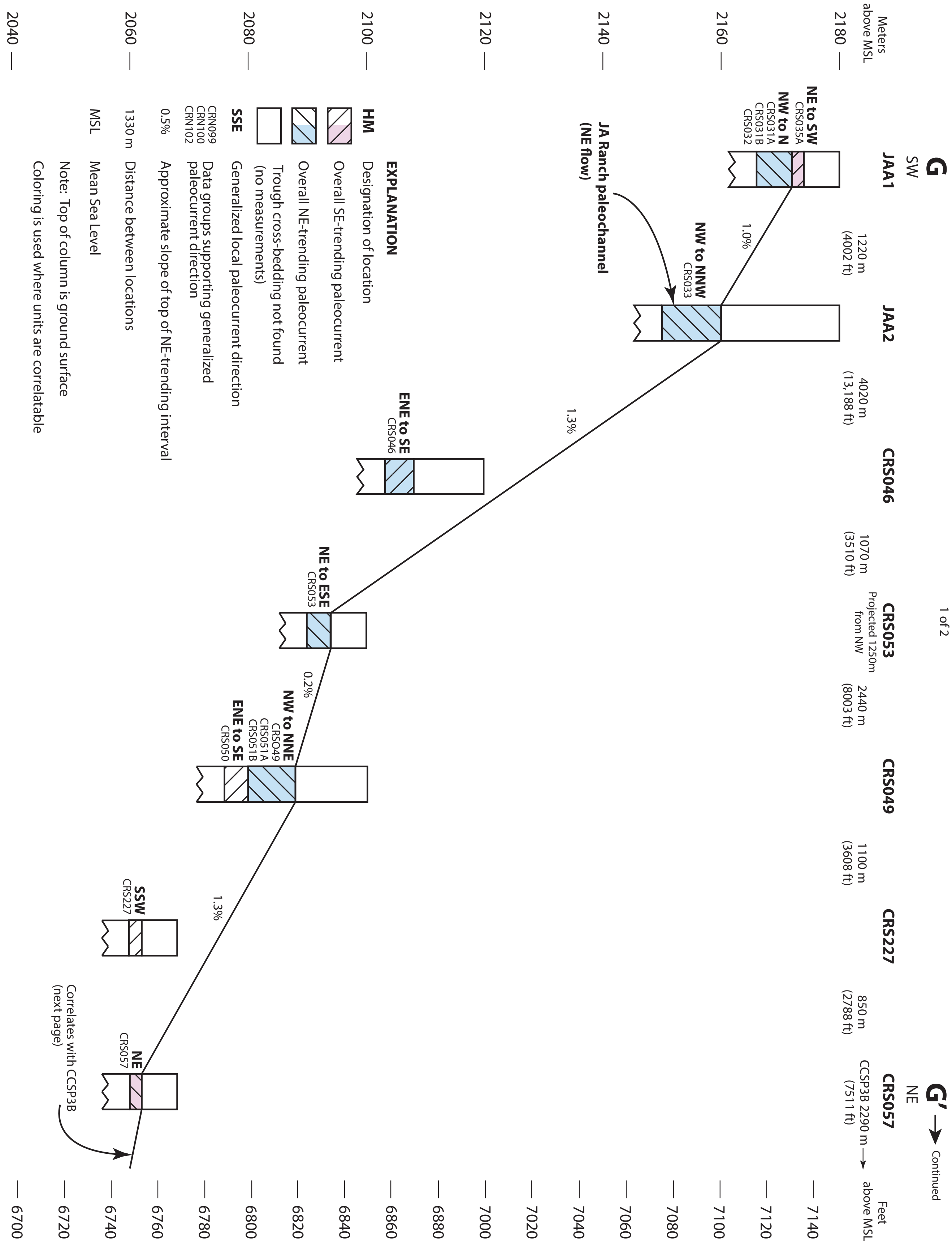


Figure 20. Cross section G-G', showing Castlewood Canyon reach of main paleochannel and also JA Ranch paleochannel.

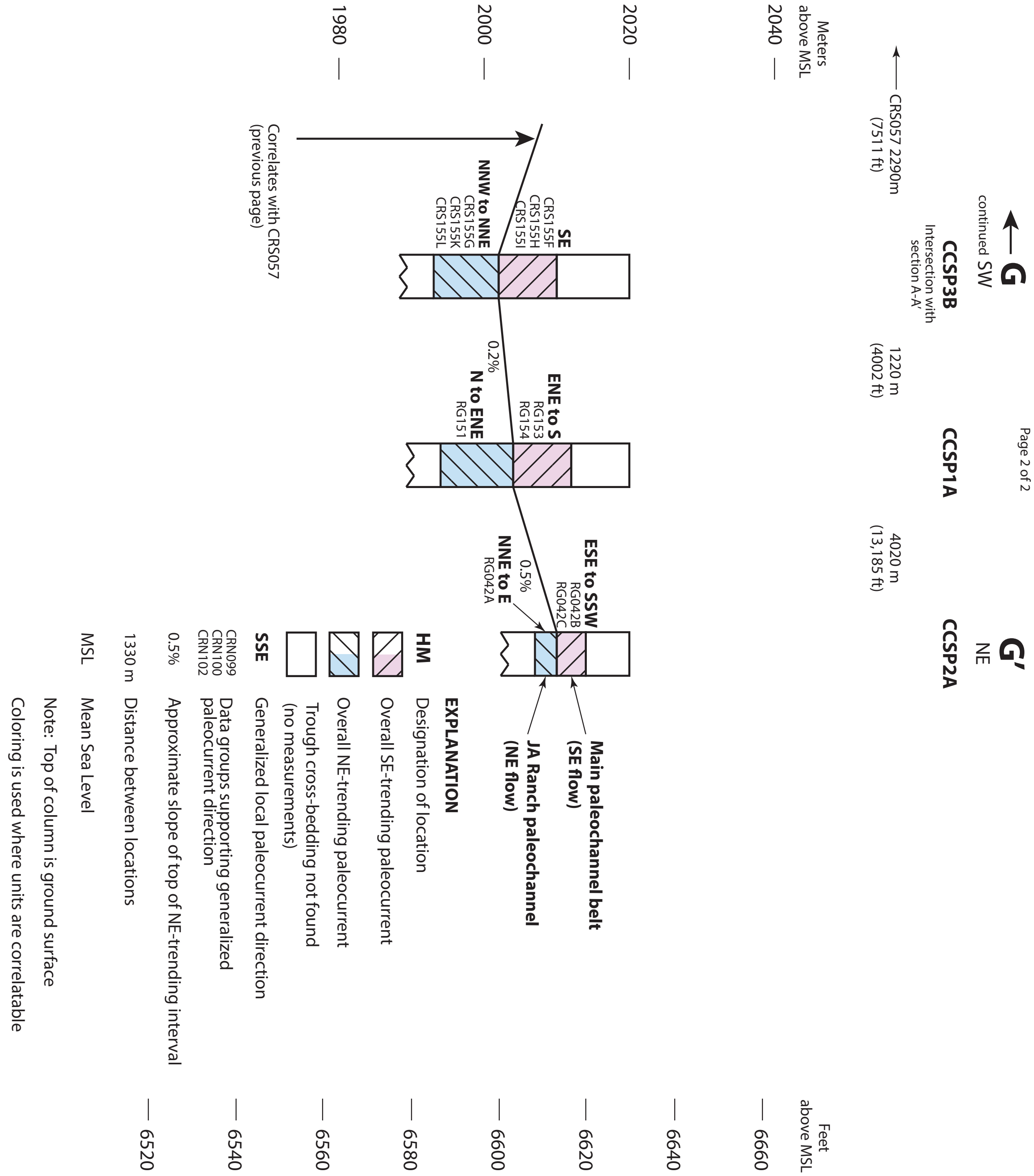


Figure 20. continued

PALEOCHANNELS

The main paleochannel belt constitutes most of the upper portion of the CRC, as the unit is depicted on the published geologic maps listed earlier. The belt begins at the mesa north of Newlin Gulch (Plate 3A) and extends about 63 km (39 mi) southeast to the buttes at Fremont Fort, just south of the Bijou Basin rim (Plate 3D). It is hypothesized that the main paleochannel belt followed a pre-existing paleovalley cut into the underlying Dawson Arkose. The paleocurrent measurements of the main paleochannel belt have an overall south-southeast to southeast trend, coincident with the northwest-southeast orientation of the conglomerate occurrence. Paleocurrent measurements at smaller but prominent outliers of CRC, southwest of the main paleochannel belt, support the existence of two principal tributary paleochannels. In these channels measurements indicate flow mainly to the northeast. The JA Ranch paleochannel is expressed topographically and both the JA Ranch paleochannel and Bucks Mountain trend are supported by many paleocurrent measurements. A possible third tributary system is suggested by isolated occurrences of east and northeast-trending measurements at Castle Rock Butte, Cherokee Mountain, and the mesa north of Newlin Gulch (Plate 3A). All three tributary paleochannels are labeled on Plates 3A through 3C.

Main Paleochannel Belt

The CRC main paleochannel belt begins at the mesa just north of Newlin Gulch and extends southeast for about 63 km (39 mi) to Fremont Fort and associated buttes, which straddle the boundary between Elbert and El Paso Counties. The main paleochannel belt has been informally divided herein into four reaches. From northwest to southeast they are the Newlin Gulch, Castlewood Canyon, Elbert, and Bijou Basin reaches. These are displayed on Plates 3A through 3D respectively, which will be useful in understanding the following discussion.

In the Newlin Gulch reach (Plate 3A), the CRC is only poorly exposed. In measurements at the north end of the mesa north of Newlin Gulch, five of the six paleocurrent azimuths indicate a south-southeast flow direction. At the east end of the mesa north of McMurdo Gulch, at the southeastern end of the reach, a single measurement indicates a southward flow direction. Along this reach the main paleochannel belt width increases from 3 km (2 mi) at the northwest to 6 km (4 mi) at the southeast.

Along the Castlewood Canyon reach (Plate 3B), the main paleochannel width increases from 6 km (4 mi) at the northwest to 8 km (5 mi) at the southeast. Several areas along the reach have abundant and well-exposed trough cross-beds: Hidden Mesa and Gateway Mesa Open Spaces, residential developments at Founders Village and Castlewood Ranch, private property at Lost Canyon Ranch, Castlewood Canyon State Park, and Prairie Canyon Ranch. On the eastern side of the main paleochannel belt, from Hidden Mesa southeast to Castlewood Canyon, the general flow direction is south-southeast (Plate 3B). On the western side of the main paleochannel belt, from Castle Rock butte southeast to Castlewood Canyon, the overall flow direction is southeast. This latter area may represent a small, southeast-flowing tributary joining the main paleochannel belt at a location near Castlewood Canyon. From Castlewood Canyon southeast to Heidemann Road, the main paleochannel belt shifts in overall direction, from generally south-southeast to southeast. Southeast of Colorado Highway 83 the overall width of the main paleochannel belt increases moderately to the southeast, and the areas of CRC become narrower, smaller, and more linear. Also, there also is an increase in paleocurrent variability, possibly caused by channel braiding.

Along the Elbert reach (Plate 3C) the main paleochannel belt width increases from 8 km (5 mi) at the northwest to 10 km (6 mi) at the southeast. In this reach the pattern of mapped conglomerate areas is notably different than along the Castlewood Canyon reach (Plate 3B). In the Castlewood Canyon reach there are fewer but more extensive areas of conglomerate within a smaller paleochannel width; in the Elbert reach there are many, smaller, and less continuous areas within a greater width. The Elbert reach has a smaller number of exposed trough cross-beds than the Castlewood Canyon reach. Within it the areas of CRC coverage can be large and fairly equant as well as thin and linear, with trough cross-beds being much more abundant in the latter. In the thin and linear areas the overall trend of paleocurrent directions is south-southeast to southeast and parallel to the trends of the areas themselves, possibly the result of a braided stream system. The trend of the main paleochannel belt along the Elbert reach is southeast, continuing the trend begun in the lowest portion of the Castlewood Canyon reach. This is evidenced by both the orientation of the swath of CRC occurrences and by

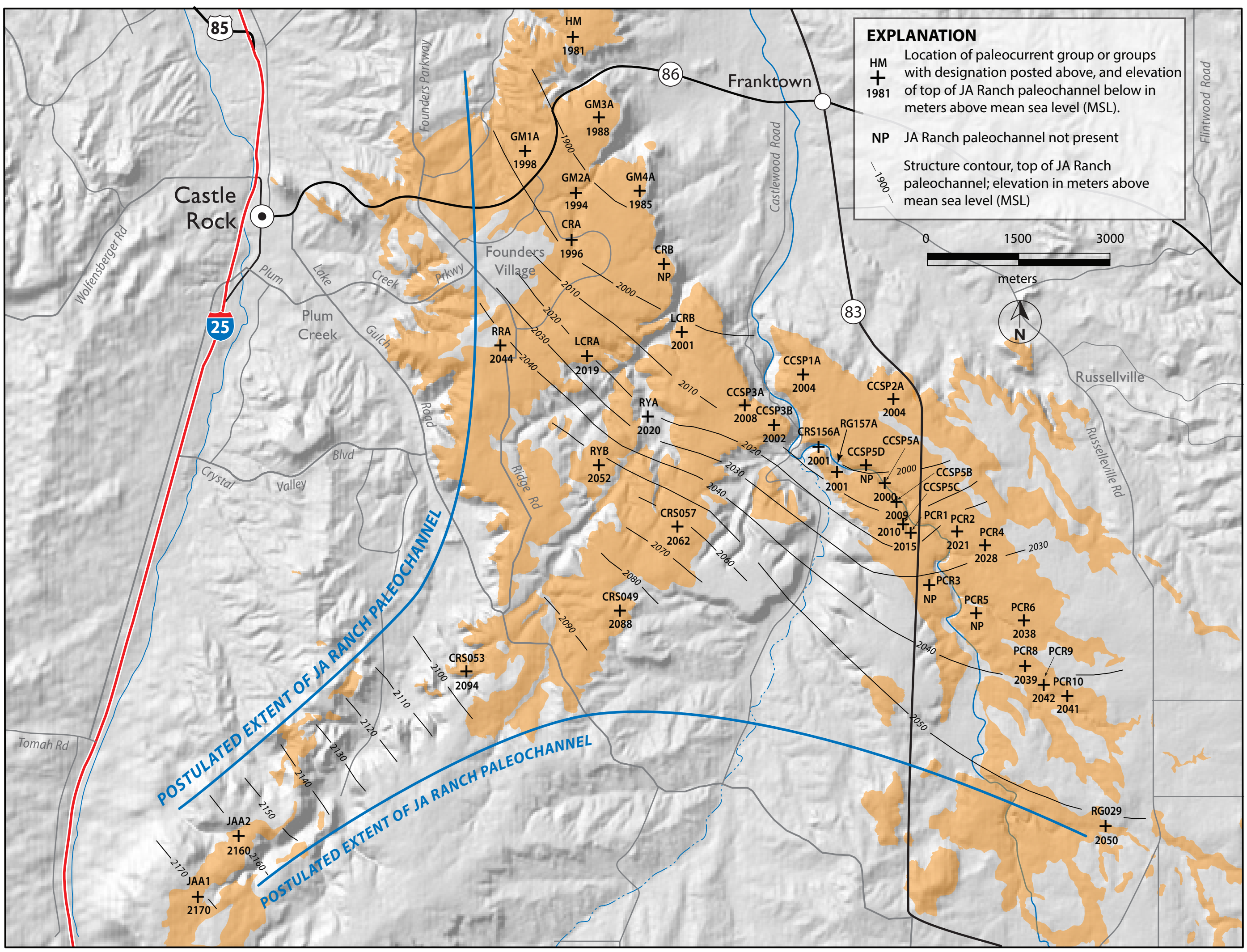


FIGURE 21. STRUCTURE CONTOUR MAP OF TOP OF JA RANCH PALEOCHANNEL AND ALLUVIAL FAN.

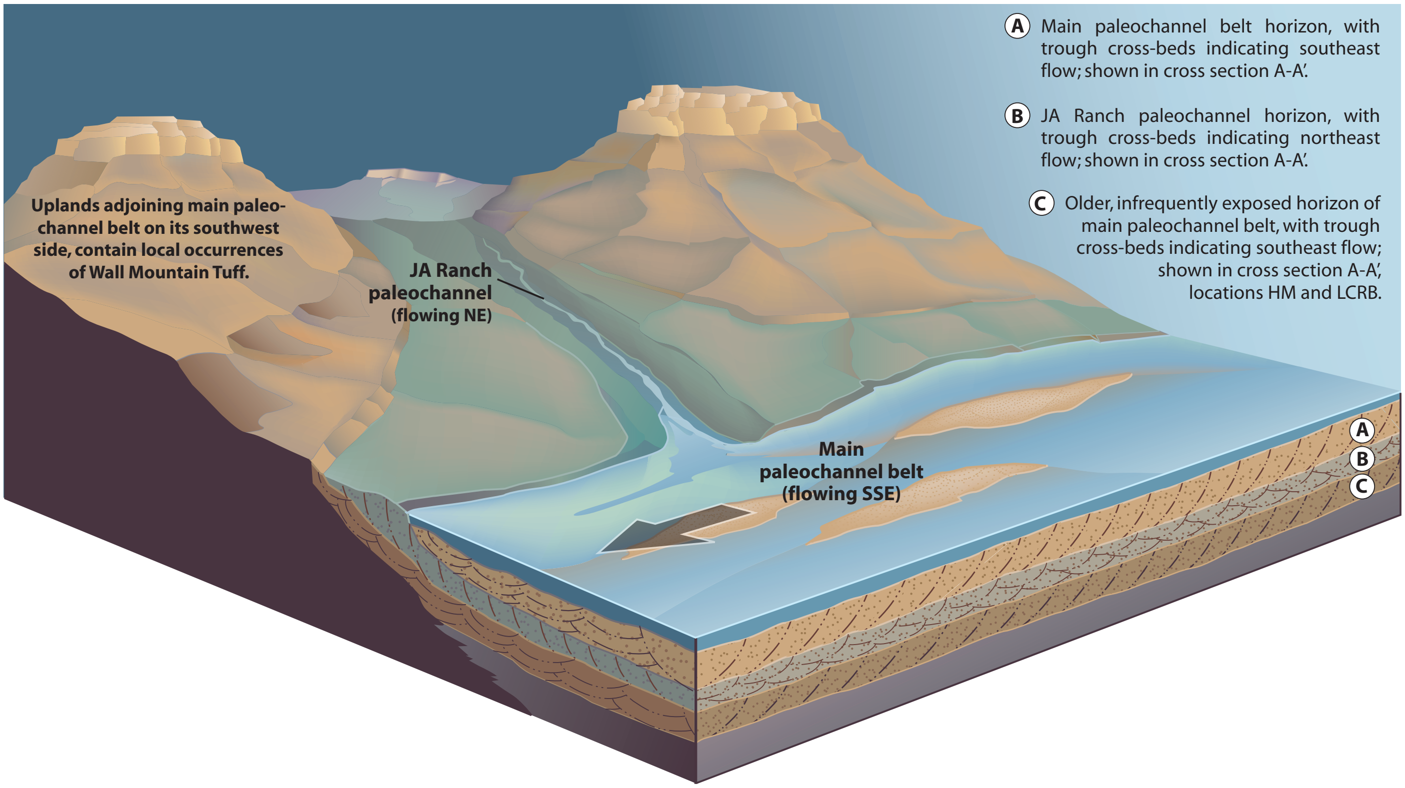


Figure 22. Block diagram showing relation of northeast-flowing JA Ranch paleochannel to southeast-flowing main paleochannel belt.

the overall trend of measured paleocurrent directions. The trend of widening paleochannel width and increasing paleocurrent variability continues from the Castlewood Canyon reach through the Elbert reach.

Along the Bijou Basin reach (Plate 3D) CRC outcrops are sparse, flat exposures are rare, and trough cross-bed paleocurrent measurements much fewer than in the Castlewood Canyon and Elbert reaches. The trend of the main paleochannel belt is generally southeast in this reach, and the probable width of the paleochannel is between 8 and 10 km (5 and 6 mi). At the southern part of the Bijou Basin west rim there is a small anomalous area (less than 200 m^2) (2,100 ft^2) where the consolidated current azimuth is nearly west (at 260°); 13 of the 14 measurements making up this resultant direction range from south-southwest to west-northwest (the fourteenth is east-northeast). Northwest of the Bijou Basin reach the main paleochannel belt contains some south-southwest and southwest paleocurrent directions.

JA Ranch Paleochannel

The JA Ranch paleochannel extends from Hunt Mountain northeast, to State Highway 83 in CCSP, a total distance of 16 km (10 mi) (Plate 3B). The upper reach of this northeast-flowing tributary is a band of resistant CRC exposures beginning at the JA Ranch (on Hunt Mountain) and ending near the junction of Lake Gulch Road and Ridge Road. This band may be an example of inverted topography, where the tributary followed a preexisting, northeast-trending paleovalley in the Dawson Arkose. From the width of the CRC outcrop band, this paleovalley was 0.5 to 1.0 km (0.3 to 0.6 mi) wide. The lower reach of the tributary appears to be an alluvial fan with its apex located near the aforementioned road junction. From the apical area the fan widens to the northeast, and the fan's approximate base extends from Hidden Mesa Open Space (location HM on Plate 3B) about 14 km (9 mi) southeast to Prairie Canyon Ranch (location PCR10 on Plate 3B). The approximate centerline of the fan trends southwest-northeast and passes through CCSP (locations CCSP3A and CCSP3B on Plate 3B). The upstream part (tributary paleovalley) of the JA Ranch paleochannel is evidenced both by northeast-trending paleocurrent measurements and by inverted topography. The downstream part (alluvial fan) is not expressed topographically but is evidenced by a correlatable horizon of northeast-trending paleocurrent measurements, extending through CCSP and environs. The JA Ranch horizon is overlain and underlain by horizons of the main paleochannel belt, with the latter horizons displaying southeast-trending paleocurrent measurements.

CRC occurrences are relatively sparse northeast of Cherry Creek, in the area beyond the known extent of the JA Ranch alluvial fan. The few CRC areas either were not

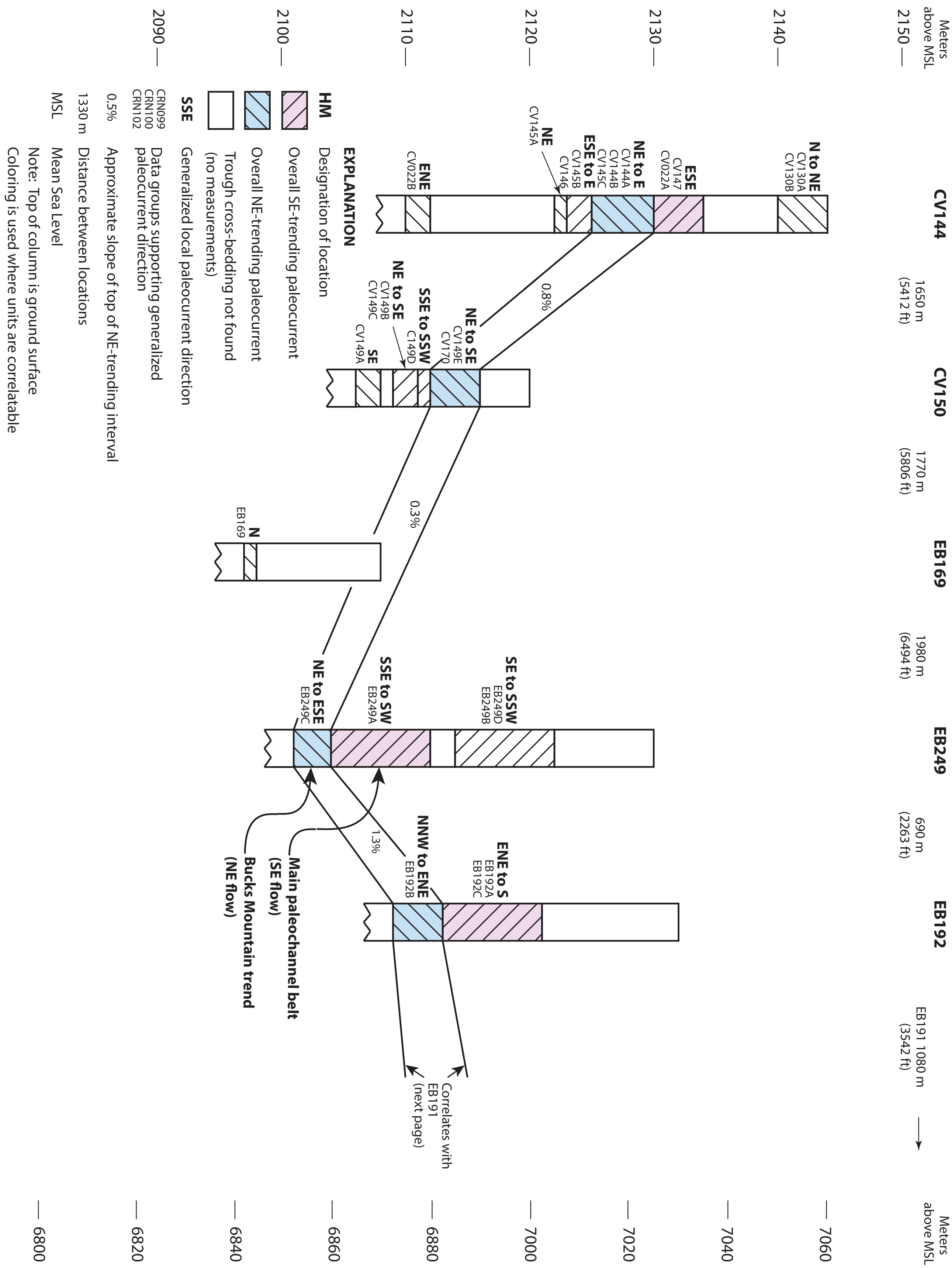


Figure 23. Cross section H-H', showing Bucks Mountain trend of main paleochannel and also JA Ranch paleochannel.

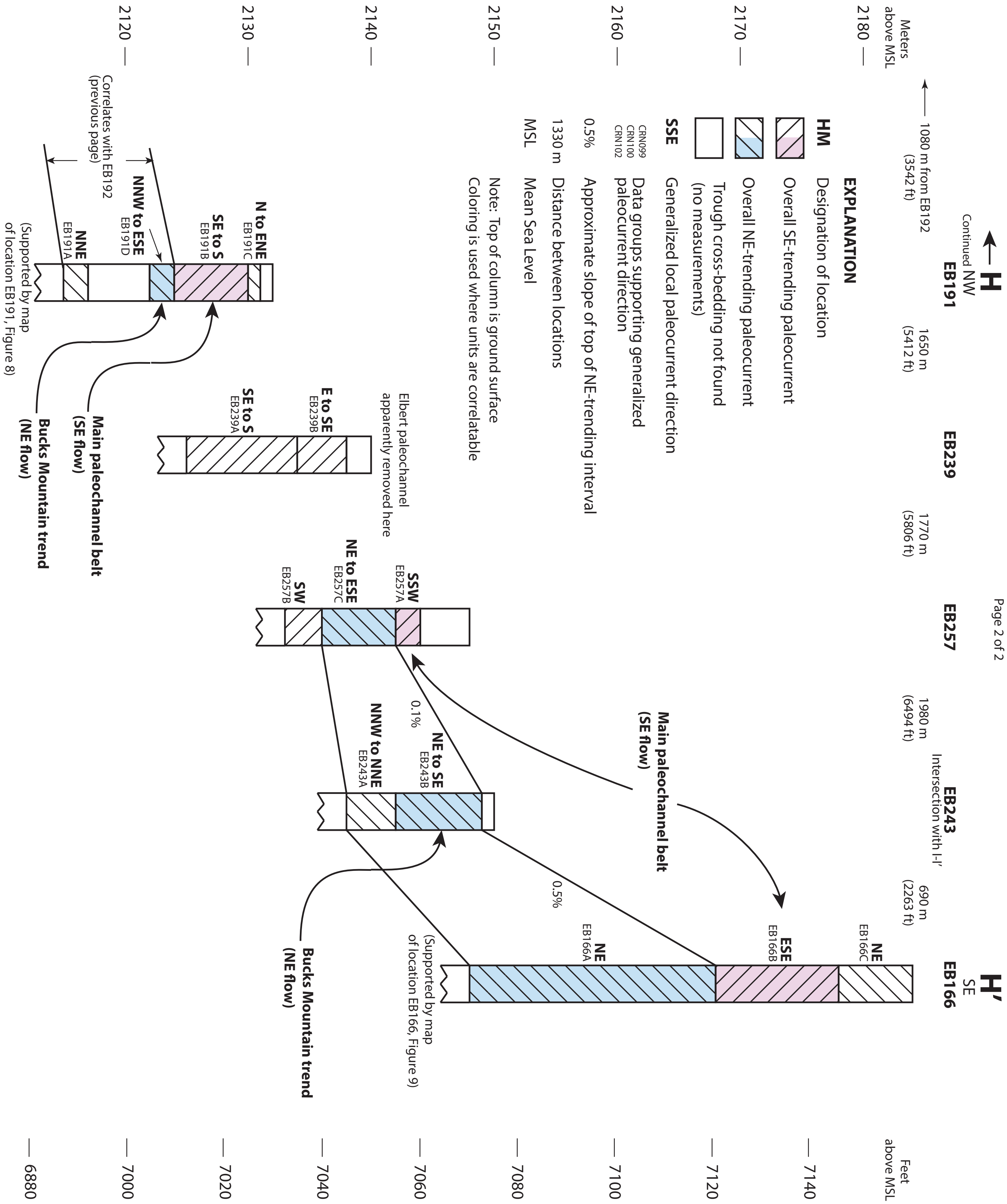


FIGURE 23. CONTINUED.

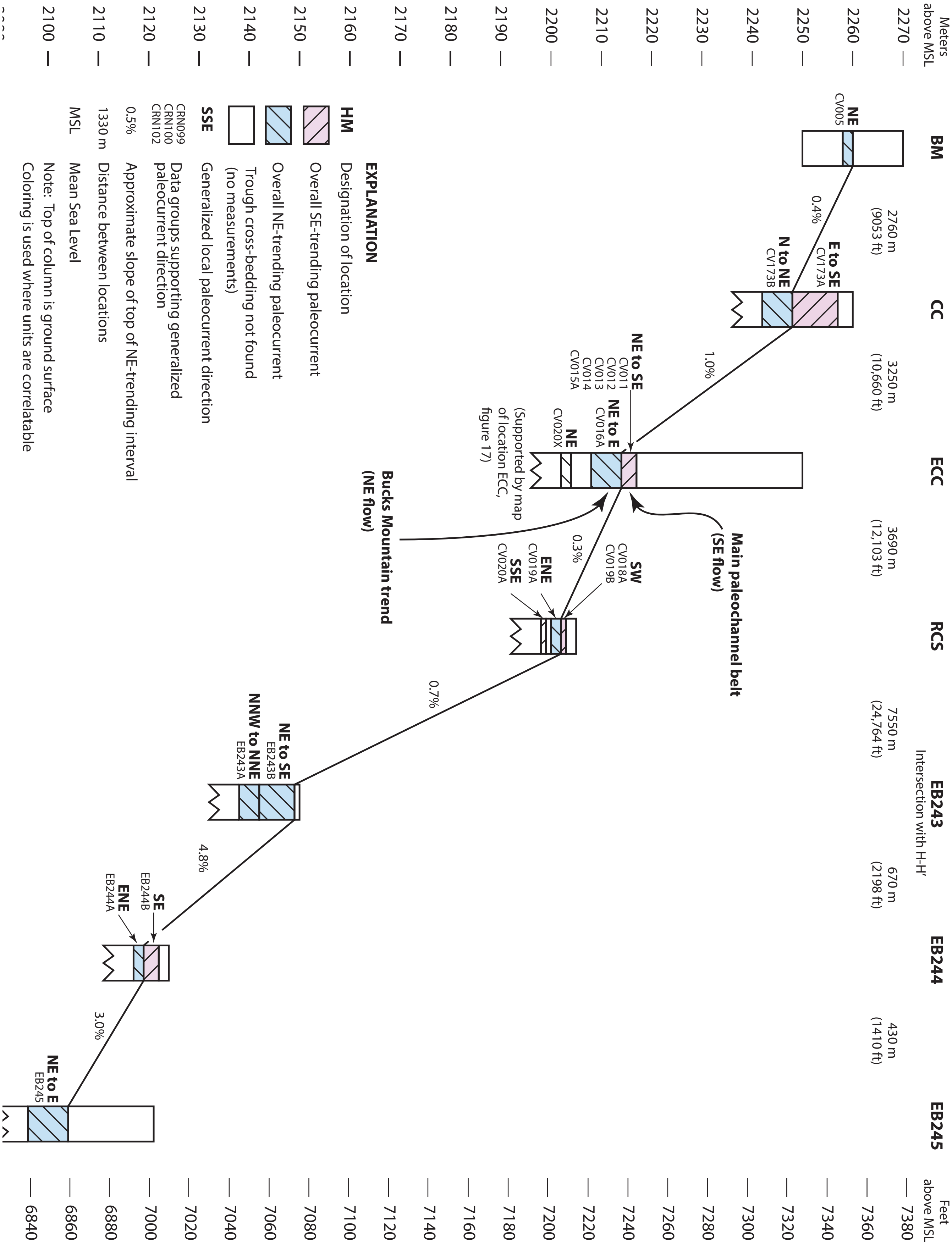


Figure 24. Cross section I-I', showing Bucks Mountain trend of main paleochannel and also JA Ranch paleochannel.

accessible to the CGS or too poorly exposed to yield measurements of trough cross-beds. At CCSP and environs there are many locations of paleocurrent measurements where groups of dominantly northeast and dominantly southeast populations are apparently intermingled in plan view. Among these locations are GM3A, LCRA, CCSP5A, PCR2, and PCR9 (Plate 3B). The large-scale paleocurrent maps of these five locations already were introduced in Figures 5 through 9, and these maps discretize different CRC horizons displaying different paleocurrent directions. As indicated by these maps, the southeast and northeast populations at CCSP belong mainly to two different correlatable horizons of the CRC: the main paleochannel belt and the JA Ranch paleochannel. A horizon of the main paleochannel overlies the JA Ranch horizon at many locations, and the JA Ranch horizon is underlain by an older horizon of the main paleochannel belt.

From Hidden Mesa Open Space southeast to Prairie Canyon Ranch there is a continuous horizon of north to east-northeast paleocurrent measurements indicating the JA Ranch paleochannel. This horizon underlies the main paleochannel belt horizon and occupies much of the same area, in CCSP and environs. The two horizons are presented in cross sections A-A' through G-G', which constitute Figures 14 through 20; the lines of section are shown on Plate 3B. The cross sections are supported by 35 consolidated paleocurrent areas (corresponding to the column labels shown on the sections), all of which are shown on Plate 3B. The large-scale paleocurrent maps of five of the 35 locations are the examples given in Figures 5 through 9, and the examples are cross-referenced to the cross sections they support.

Sections A-A' through C-C' (Figures 14 through 16) follow the southeastward trend of the main paleochannel belt, and sections D-D' through G-G' (Figures 17 through 20) follow the northeastward trend of the JA Ranch paleochannel and its alluvial fan. Cross section A-A' is centered on CCSP and runs along the base of the JA Ranch paleochannel alluvial fan. The JA Ranch paleochannel horizon is continuous throughout the section, except for two locations where JA Ranch deposits apparently have been eroded by the overlying main paleochannel belt; the main paleochannel horizon is present throughout the section. Cross section B-B' shows that the JA Ranch horizon extends southeast into Prairie Canyon Ranch, although the horizon apparently has been eroded at the northwest end of the section. Cross section C-C', between Gateway Mesa Open Space and CCSP, displays the continuity of the JA Ranch horizon in this area. Cross sections D-D' through F-F', in the area between Gateway Mesa Open Space and CCSP, show the continuity of the JA Ranch horizon from southwest to northeast. Cross section G-G', from Hunt Mountain to CCSP, traces the JA Ranch horizon from its southwesternmost known extent northeast to the base of the alluvial fan.

Figure 21 is a structure contour map of the top of the JA Ranch horizon. The map is based upon correlating the horizon across 35 consolidated paleocurrent areas, most of which appear in the cross sections presented earlier. Four of the consolidated areas shown on Figure 21 are in the JA Ranch paleovalley, extending from JAA1 northeast to CRS049, and the remainder are in the alluvial fan. At nearly all of the 35 locations in the fan, the JA Ranch horizon is overlain by the main paleochannel belt horizon. The overall shape of the JA Ranch paleochannel in **Figure 21** supports, as has been presented earlier, a northeast-trending paleovalley culminating in an alluvial fan. A portion of the fan once may have covered the area between locations CRS049 and PCR3 but this portion appears to have been removed by erosion. The JA Ranch horizon gradient appears to slightly decrease in the downgradient reach of the fan. In Figure 21 location CCSP2A is the only exception to the fairly regular, northeastward decline of the JA Ranch horizon, and is not contoured as part of the mapped surface. The higher elevation of CCSP2A may be due to variable scouring of the JA Ranch horizon by subsequent flow in the main paleochannel belt.

In summary, the upper portion of the CRC along the Castlewood Canyon reach (Figure 14; section A-A') consists of, from oldest to youngest: a lowermost local horizon with northeast flow, approximately 4m (13 ft) thick, possibly an early episode of the JA Ranch paleochannel; a horizon with southeast flow, approximately 25 m (82 ft) thick, possibly an early episode of the main paleochannel belt; the widespread JA Ranch horizon, with northeast to east flow; and last the dominant main paleochannel belt horizon, with southeast to south-southeast flow. **Figure 22** is a block diagram illustrating the above sequence.

Bucks Mountain Trend

The Bucks Mountain trend is a large area of northeast-oriented paleocurrent measurements, separated from the JA Ranch alluvial fan by 5 km (3 mi) (Plate 3C). The northwest extent of the trend is at Bucks Mountain proper and at the boundary between Douglas and Elbert Counties; the southeast extent is near the west rim of Bijou Basin. Most of the measurements indicating the trend occur in the large swath of CRC exposure extending from the boundary to the rim, and a small number occur in a linear band of hills beginning at Bucks

Clast survey number	Area of survey (square meters)	Total clasts in survey	Percent Wall Mtn tuff	Percent granitics	Mean clast size (cm)	Mean round-ness
Surveys in southeast paleocurrent troughs						
CS-01	111	458	18.8	59.0	4.7	2.3
CS-02	61	138	29.0	42.0	3.7	2.6
CS-03	124	556	22.3	51.4	4.2	2.6
CS-07	60	366	13.4	56.3	4.2	3.1
CS-08	75	605	15.4	62.5	4.2	3.0
CS-09	124	545	13.8	70.5	3.6	2.6
CS-12	133	1439	28.4	62.8	4.0	3.0
CS-14	70	201	20.4	74.6	3.6	3.1
CS-16	154	597	5.9	84.6	4.1	3.2
CS-17	20	265	16.6	36.6	5.6	3.5
CS-18	92	299	12.7	82.9	3.3	3.4
CS-20	52	176	6.3	93.2	3.2	3.4
CS-21	93	445	13.3	49.7	4.2	3.5
CS-22	88	909	47.7	38.2	4.8	3.3
CS-23	77	504	3.2	89.5	3.7	3.4
Weighted mean value			20.7	62.2	4.1	3.1
Surveys in northeast paleocurrent troughs						
CS-04	92	769	7.8	65.7	4.9	2.8
CS-05	65	158	25.3	50.0	3.7	3.3
CS-06	128	524	28.6	49.0	5.2	3.1
CS-10	72	470	73.6	23.2	5.6	2.8
CS-11	46	455	74.3	20.7	5.2	2.5
CS-13	31	161	17.4	74.5	3.9	3.0
CS-15	64	333	11.4	83.2	3.6	2.8
CS-19	47	201	8.0	86.1	3.9	3.3
CS-24	46	230	7.0	91.7	3.1	3.2
Weighted mean value			31.3	55.3	4.7	2.9
All surveys						
Weighted mean value			23.9	60.1	4.3	3.0

Table 3. Summary of clast survey results for clasts >2 cm (0.8 in) (maximum dimension), upper portion of Castle Rock Conglomerate.

Mountain and extending 10 km (6 mi) east from there. The Bucks Mountain trend contrasts in character with the JA Ranch paleochannel. The latter is a single paleovalley leading to an alluvial fan, while the former may be a system of subparallel northeast-flowing channels, as suggested by the trend's overall width (transverse to paleoflow direction) of 20 km (12 mi). The overall length of the trend is 14 km (8 mi). As at the JA Ranch paleochannel, there are two populations of paleocurrent directions: one southeast and the other northeast. Similar to the interpretation for the JA Ranch paleochannel, analysis using large-scale topographic maps and resultant cross sections indicates the two populations occur in discrete groups belonging to different CRC horizons. The two populations are the main paleochannel belt with southeast flow and the Bucks Mountain trend with northeast flow. The different horizons are shown on large-scale paleocurrent maps of locations EB191, EB166, and ECC (Figures 10, 11, and 12, respectively) and on cross sections H-H' and I-I' (**Figures 23 and 24**). At location EB166 on cross section H-H' there also is evidence for a younger, northeast-trending horizon overlying the main paleochannel belt horizon .

In the Elbert reach of the main paleochannel belt (Plate 3C), as in the upstream Castlewood Canyon reach, the overall southeast paleocurrent direction coincides with the general southeast orientation of the main swath of CRC outcrop and also with the general northwest-southeast elongation of many discrete occurrences .

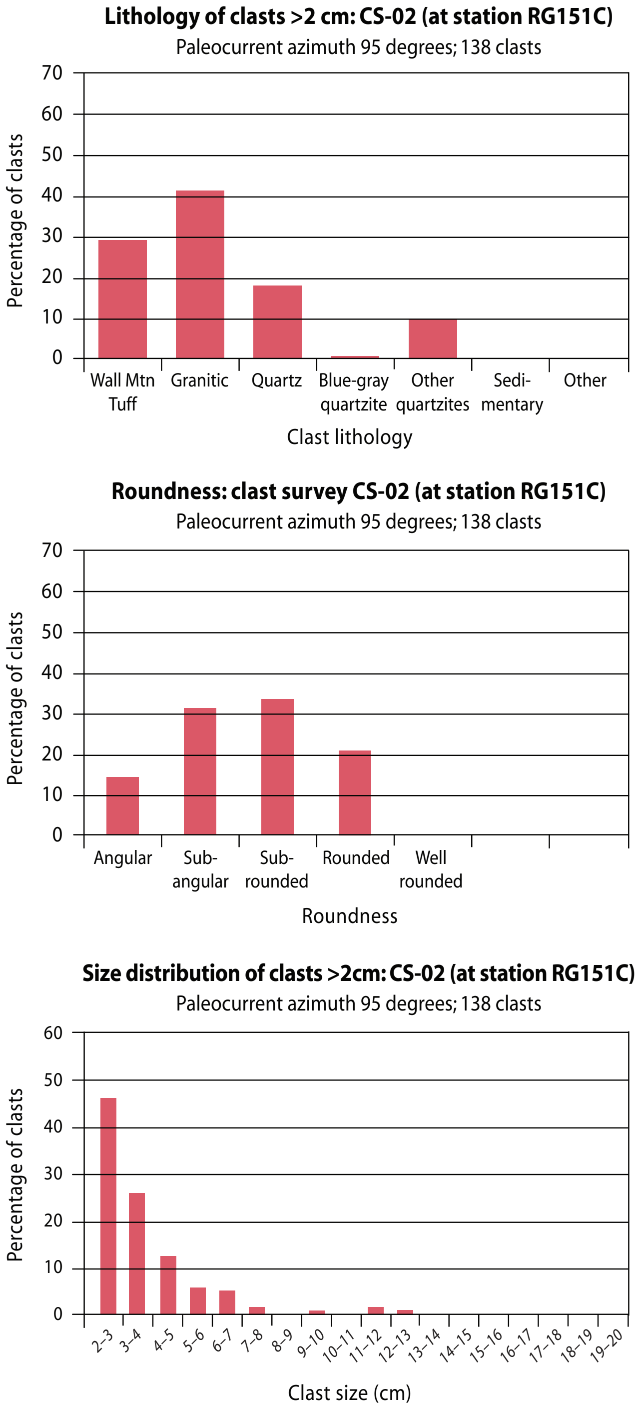


Figure 25. Summary of clast survey CS-02, southest-flowing main paleochannel, Castlewood Canyon State Park.

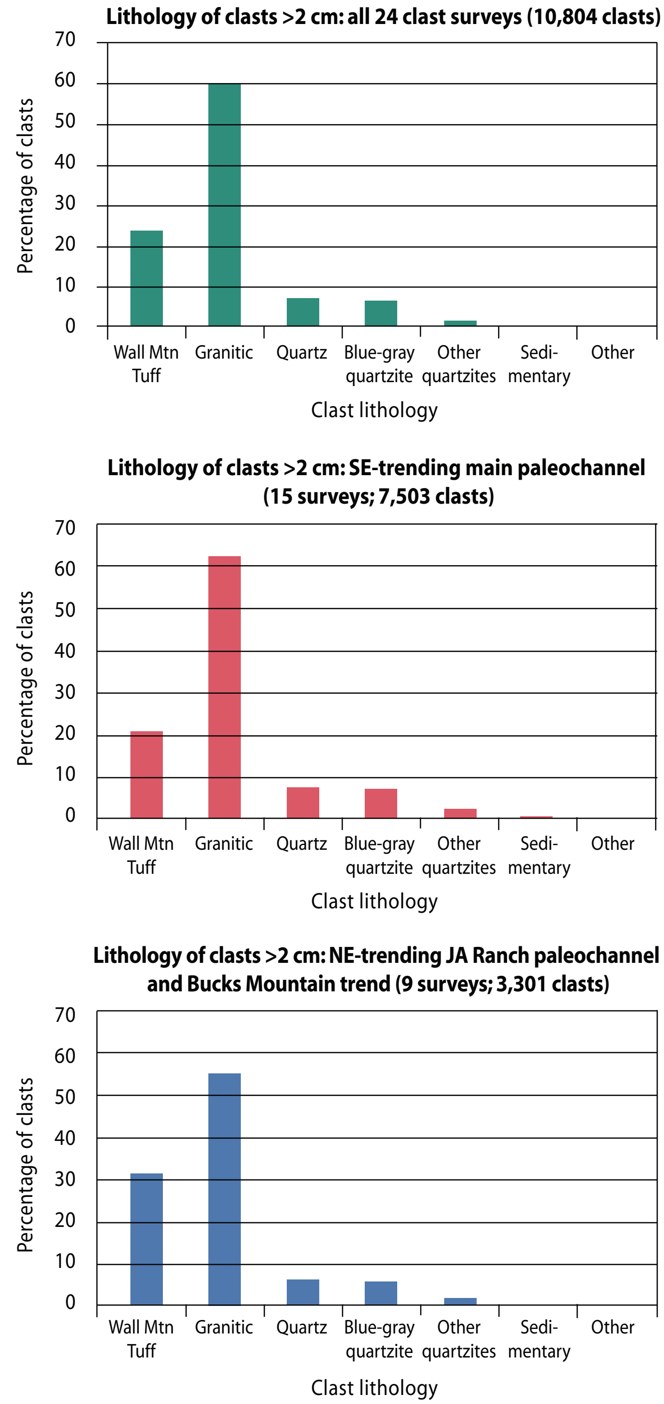


Figure 26. Lithology of clasts >2 cm (0.8 in), all clast surveys combined, then seprated according to northeast and southeast paleocurrent trends.

As discussed previously, the northeast-flowing JA Ranch paleovalley is evidenced by inverted topography as well as by paleocurrent measurements. For the northeast-flowing Bucks Mountain trend, as seen in the area of the Elbert reach, the evidence is from paleocurrent measurements only.

Additional evidence for the Bucks Mountain trend is found in the linear band of hills east of Bucks Mountain, which lie to the southwest of and isolated from the Elbert reach. The horizon of northeast paleocurrents found in these exposures appears to be the upstream portion of the trend. The linearity of the band suggests an east-trending

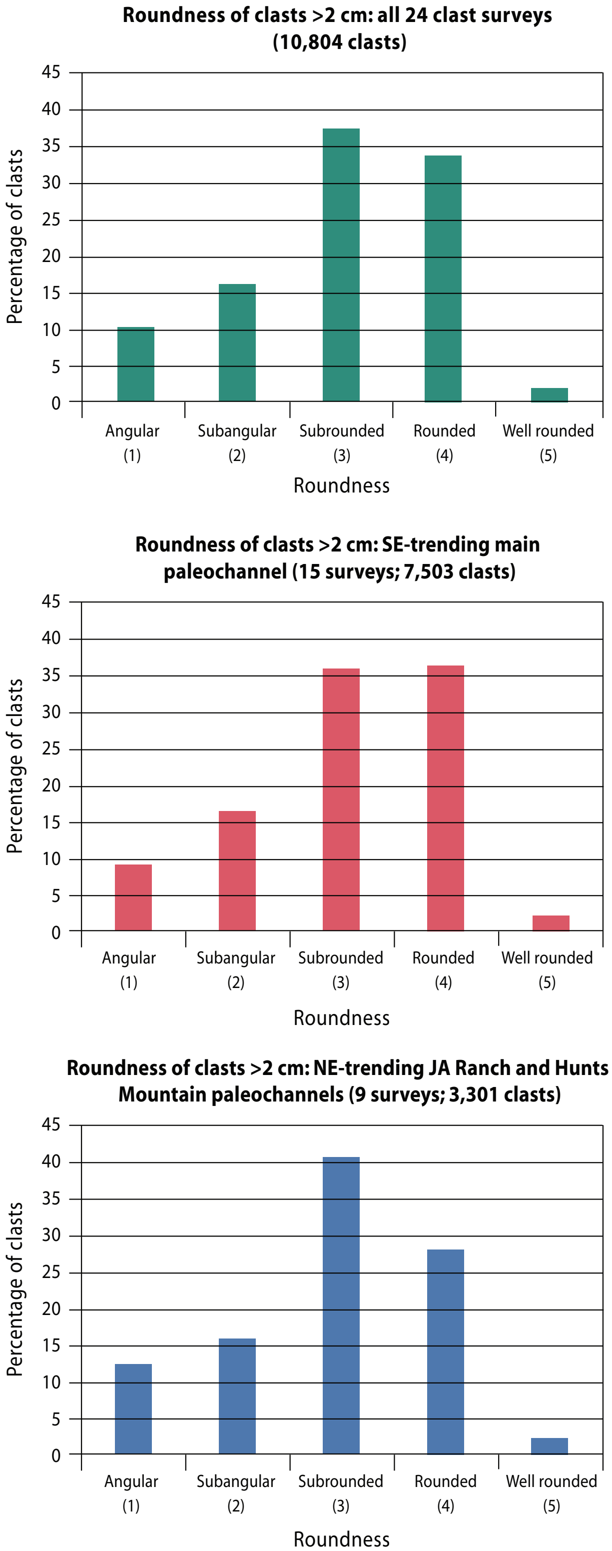


Figure 27. Roundness of clasts >2 cm (0.8 in) all clasts surveys combined, then separated according to northeast and southeast paleocurrent trends.

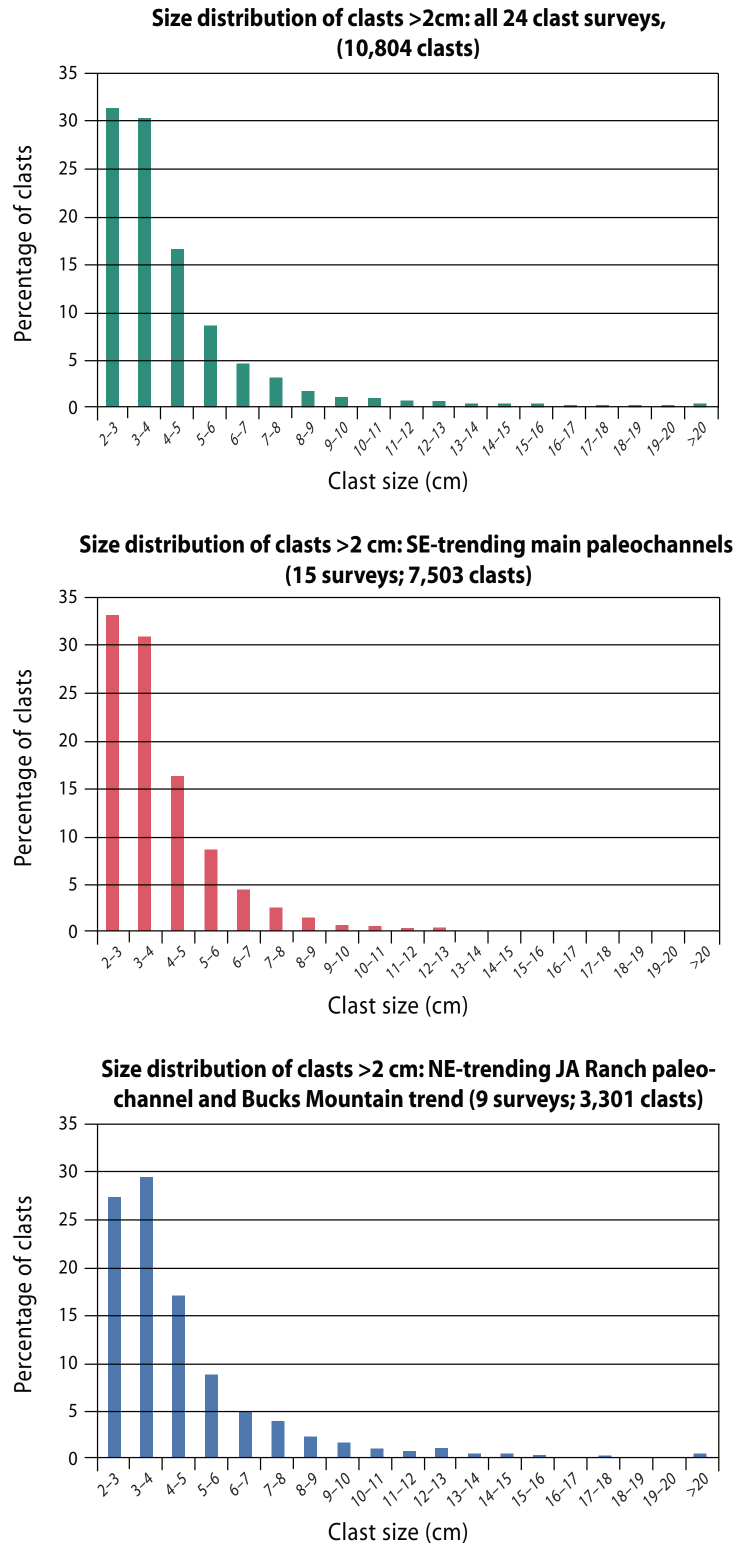


Figure 28. Size distribution of clasts >2 cm (0.8 in) all clast surveys combined,then separated according to northeast and southeast paleocurrent trends.

paleovalley, but many of the consolidated paleocurrent locations in the band trend north to northeast rather than east, indicating continuity with the Bucks Mountain trend near Elbert (Plate 3C). The Bucks Mountain trend, both west of Elbert and east of Bucks Mountain, is postulated to have at one time spanned the 10-km (6-mi) distance

Clast Surveys	Lithology	Clast Size	Rounding	Summary
All 24 clast surveys				
	Tuff markedly greater in NE than in SE Granitics moderately less in NE than in SE	Average clast size 0.6 cm greater in NE than in SE Clasts 6 cm to 18 cm moderately greater in NE than in SE Clasts 2 cm to 3 cm are less in NE than in SE	Angular clasts moderately greater in NE than in SE Rounded clasts markedly less in NE than in SE	NE has more tuff and less granitics than SE NE has larger clasts than SE NE clasts less rounded than SE (Results support difference between NE and SE)
Ryberg property and Castlewood Canyon State Park				
CS-10 (NE), CS-11 (NE) vs. CS-07 (SE), CS-08 (SE)	NE has markedly more tuff and less granitics, quartz, and other quartzites (than blue-gray) than SE Blue-gray quartzite absent in NE, present in SE	Average clast size 1.2 cm greater in NE than SE Clasts 6 cm to 20 cm markedly greater in NE than in SE	Roundness index markedly less in NE than in SE Angular clasts markedly greater in NE than in SE Rounded clasts markedly less in NE than in SE	NE has more tuff and less granitics than SE NE has larger clasts than SE NE clasts less rounded than SE Blue-gray quartzite absent in NE, present in SE (Results support difference between NE and SE)
Lost Canyon Ranch area				
CS-10 (NE), CS-11 (NE), vs. CS-16 (SE), CS-22 (SE)	Tuff markedly greater in NE than in SE Granitics markedly less in NE than in SE Blue-gray quartzite absent in NE, present in SE	Average clast size 0.9 cm greater in NE than in SE Clasts 6 cm to 18 cm moderately greater in NE than in SE Clasts 2 cm to 5 cm moderately less in NE than in SE	Roundness index markedly less in NE than in SE Angular clasts markedly greater in NE than in SE Rounded clasts markedly less in NE than in SE	NE has more tuff and less granitics than SE NE has larger clasts than SE NE clasts less rounded than SE Blue-gray quartzite absent in NE, present in SE (Results support difference between NE and SE)
Castlewood Canyon State Park (near dam ruin)				
CS-05 (NE), CS-06 (NE) vs. CS-07 (SE), CS-08 (SE)	NE has markedly more tuff and less granitics than SE Blue-gray quartzite occurs in both NE and SE	Average clast size 0.6 cm greater in NE than in SE Clasts 6 cm to 20 cm moderately greater in NE than in SE	Roundness indices and histograms similar in NE and SE	NE has more tuff and less granitics than SE NE has larger clasts than SE NE and SE have similar roundness Blue-gray quartzite occurs in both NE and SE (Results support difference between NE and SE)
Founders Village area				
CS-15 (NE) vs. CS-16 (SE)	Tuff somewhat greater in NE than in SE Blue-gray quartzite absent in NE, present in SE	Average clast size 0.5 cm less in NE than in SE	Roundness index somewhat less in NE than in SE	NE has more tuff than SE NE has smaller clasts than SE NE clasts less rounded than SE Blue-gray quartzite absent in NE, present in SE (Results support difference between NE and SE)
CS-19 (NE) vs. CS-21 (SE)	Markedly more granitics in NE than in SE Blue-gray quartzite absent in NE, present in SE Other quartzites (other than blue-gray) sparse in NE, abundant in SE	Average clast size 0.3 cm less in NE than in SE Histograms similar, except that clasts 2 cm to 3 cm markedly greater in NE than in SE	Roundness index slightly less in NE than in SE Subangular and subrounded clasts markedly greater in NE than in SE Rounded clasts markedly less in NE than in SE	NE has more granitics than SE NE has smaller clasts than SE NE clasts less rounded than SE Blue-gray quartzite absent in NE, present in SE
Castlewood Canyon State Park (near Highway 83)				
CS-05 (NE), CS-06 (NE) vs.CS-01 (SE), CS-02 (SE)	Histograms are similar Blue-gray quartzite occurs in both NE and SE	Average clast size 0.3 cm greater in NE than in SE Histograms are similar	Roundness index markedly greater in NE than in SE Angular and subangular clasts markedly less in NE than in SE Rounded clasts markedly greater in NE than in SE	NE and SE lithologies are similar NE has larger clasts than SE NE clasts more rounded than SE Blue-gray quartzite occurs in both NE and SE
Prairie Canyon Ranch				
CS-13 (NE) vs. CS-12 (SE), CS-14 (SE)	Histograms very similar in NE and SE Blue-gray quartzite occurs in both NE and SE	Average clast sizes and histograms very similar in NE and SE	Roundness indices and histograms very similar in NE and SE	No notable contrast between SE and NE
Private Road 104				
CS-24 (NE) vs. CS-18 (SE), CS-23 (SE)	Quartz somewhat less in NE than in SE Blue-gray quartzite absent in NE, present in SE Histograms are otherwise similar	Average clast size 0.6 cm less in NE than in SE Clasts 2 cm to 3 cm markedly greater in NE than in SE Clasts 4 cm to 8 cm markedly less in NE than in SE	Roundness index slightly less in NE than in SE Subrounded clasts markedly greater in NE than in SE Rounded clasts markedly less in NE than in SE	NE has less quartz than SE NE has smaller clasts than SE NE clasts less rounded than SE Blue-gray quartzite absent in NE, present in SE

Table 4. Comparison of clast surveys: northeast-trending tributary paleochannels vs. southeast-trending main paleochannel.

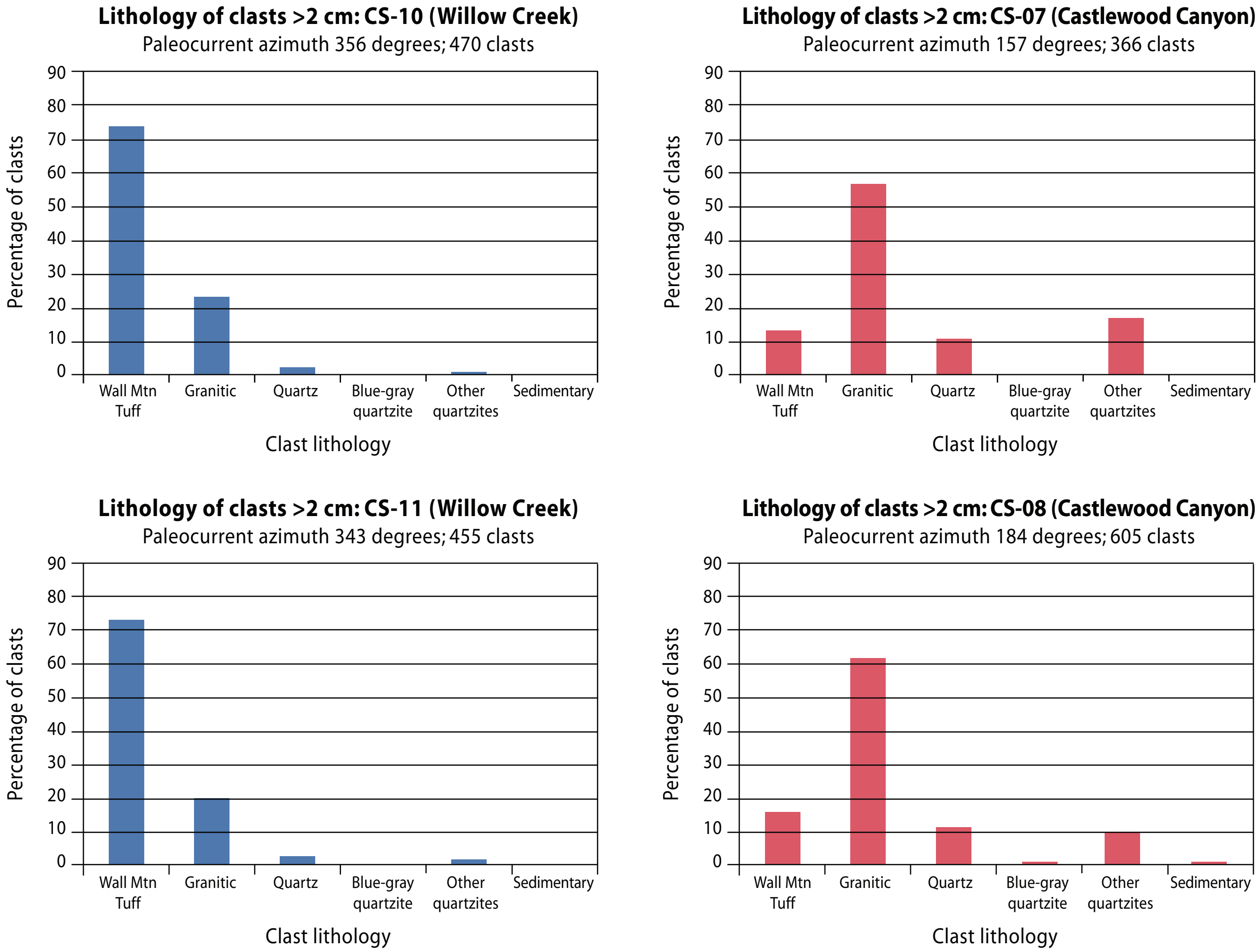


Figure 29. Distribution of clast lithology: comparison of northeast-flowing JA Ranch paleochannel at Willow Creek area with southeast-flowing main paleochannel at Castlewood Canyon area.

between the Elbert reach and the hills east of Bucks Mountain. Correlating the two areas is somewhat tenuous considering that there are no CRC outcrops between them, but the abundance and consistency of northeast paleocurrents both west of the town of Elbert and east of Bucks Mountain appear to support extending the trend across this distance. The gap in CRC exposure also could be the result of erosion or of nondeposition due to variations in topographic control.

There is another isolated population of paleocurrent directions, this one ranging from southeast to southwest as in the Elbert reach of the main paleochannel belt. This population occurs at locations CC, ECC, and RCS and is separated from the Elbert reach by a gap of 4 to 10 km (2.5 to 6 mi) (Plate 3C). Speculatively, large flood events or infilling of the main paleovalley could have caused some of the southeast flow of the main paleochannel belt to overtop the paleovalley and spread out to the southwest nearly as far as Bucks Mountain.

The locations of cross sections H-H' and I-I' (Figures 23 and 24) are shown on Plate 3C. From oldest to youngest the horizons shown on cross section H-H' are as follows. At locations CV144, CV150, and EB257 there is a horizon indicating an older, southeast-flowing unit of the main paleochannel belt beneath the Bucks Mountain trend. The overlying Bucks Mountain trend is correlated across most of the section, except for location EB169, where the trend was not found, and location EB239, where the trend may have been eroded and filled in by the main paleochannel belt. The Bucks Mountain trend is directly overlain by the main paleochannel belt, and the latter can be correlated across most of the section. At locations CV144 and EB166 there is some evidence for a younger episode of northeast flow overlying the main paleochannel belt.

As presented in cross section I-I' (Figure 24), the Bucks

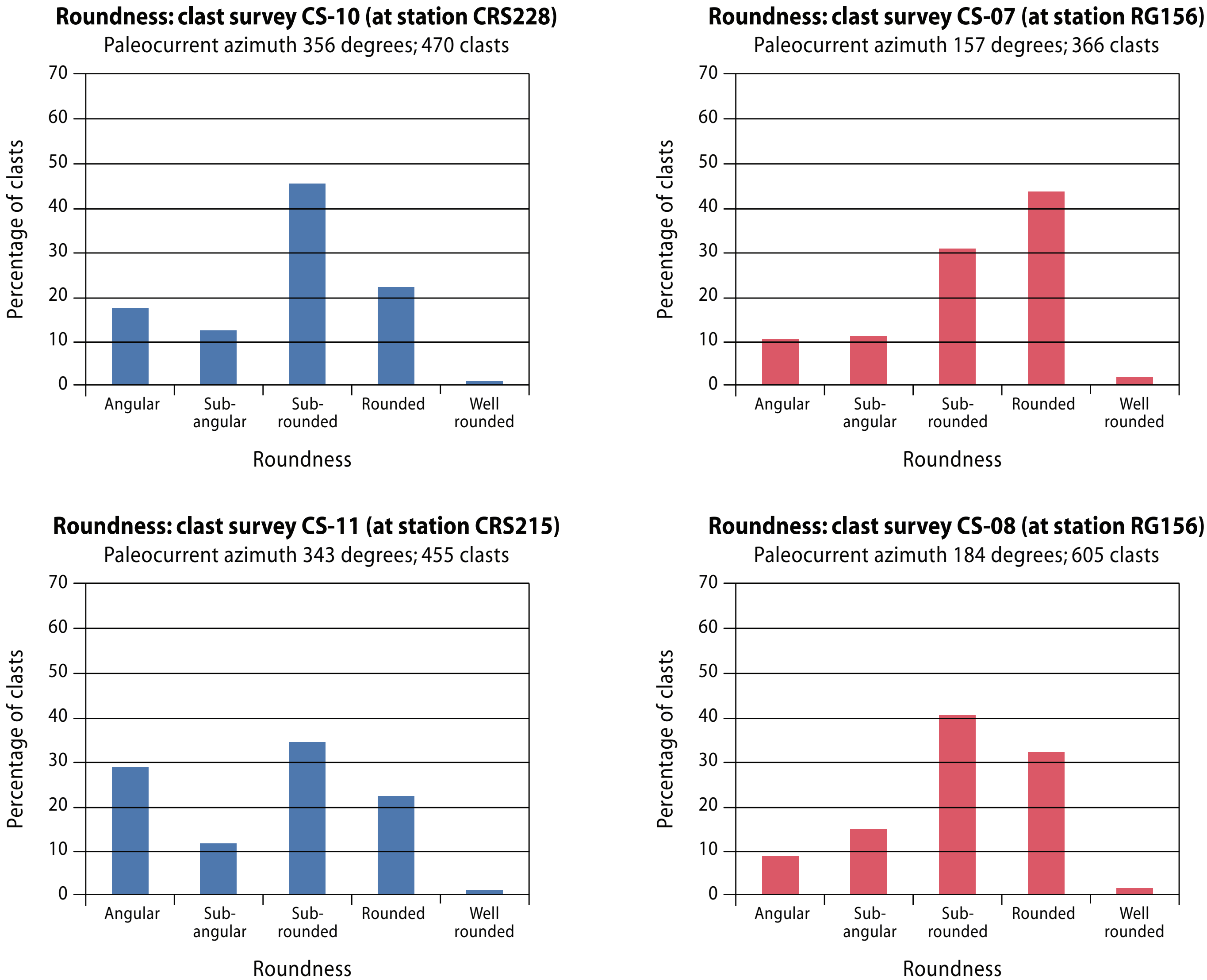


Figure 30. Roundness: comparison of northeast-flowing JA Ranch paleochannel at Willow Creek area with southeast-flowing main paleochannel at Castlewood Canyon area.

Mountain trend apparently correlates from location BM to location RCS, and the correlation is extended for another 8 km (5 mi) from location RCS to locations EB243 through EB245. This extension is tentative because of the lack of CRC exposures between locations RCS and EB243. Such a correlation would be reasonable if one of the Bucks Mountain trend paleochannels flowed east from location ECC to location RCS, then turned northeast to impinge upon the main paleochannel belt in the area just south of Elbert (Plate 3C). At locations CC through RCS on cross section I-I', the Bucks Mountain trend is overlain by a unit of southeast to southwest paleocurrent directions. This unit may have resulted from some of the flow in the main paleochannel belt spreading southwest nearly as far as Bucks Mountain.

In summary, the upper portion of the CRC along the Elbert reach consists of, from oldest to youngest: a lowermost local unit resulting from older, southeastward flow in the main paleochannel belt; a thick and widespread Bucks Mountain trend unit of northeast flow possibly originating from a topographic high east of Bucks Mountain; a widespread main paleochannel belt unit; and last a local unit from a younger episode of northeast flow (Figure 23; section H-H').

Possible Tributary System North of Castle Rock

North and northeast of Castle Rock there are three relatively small and isolated outcrop areas where groups of paleocurrent azimuths yield consolidated directions trending from northeast to east; all three are shown on

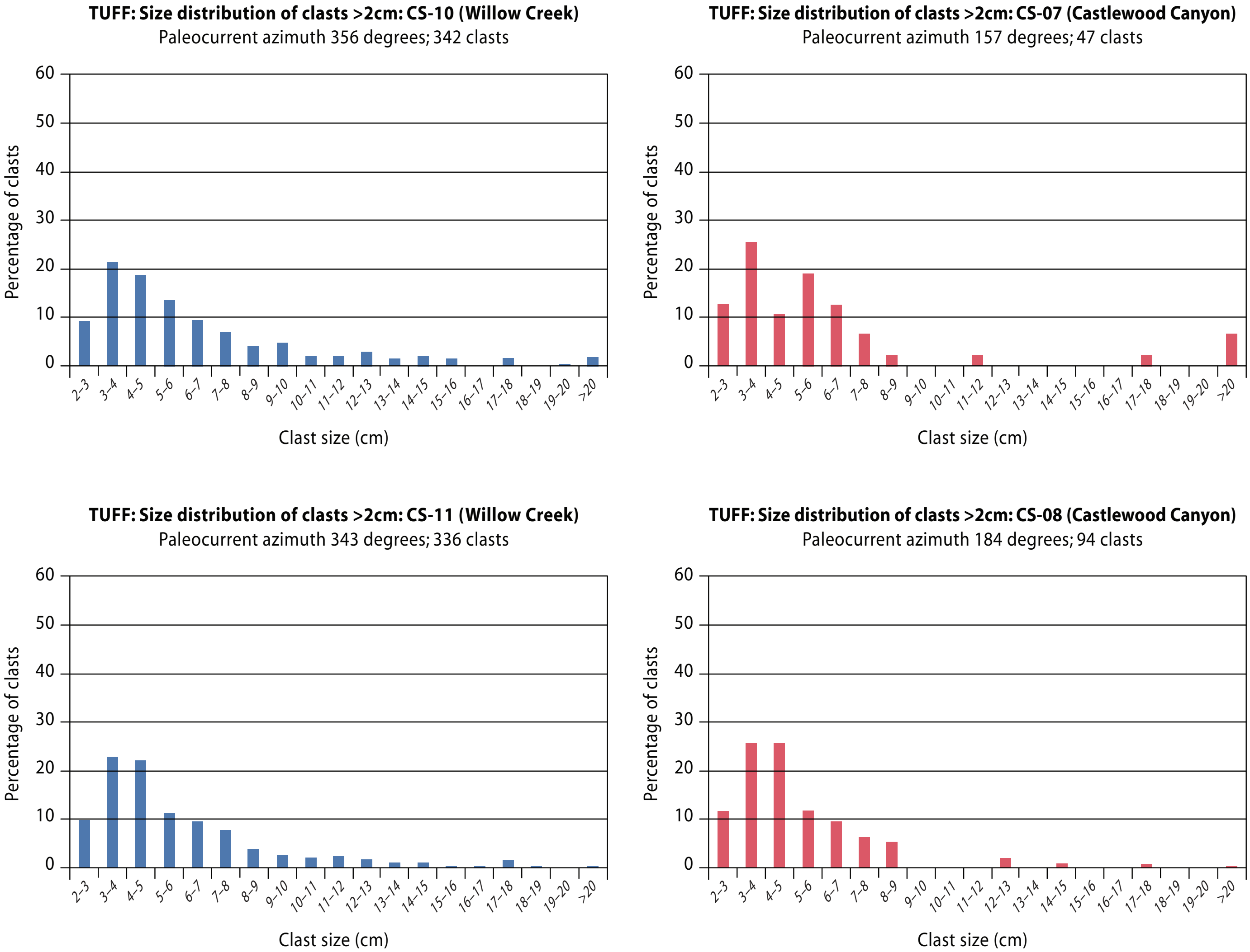


Figure 31. Size distribution of tuff clasts: comparison of northeast-flowing JA Ranch paleochannel at Willow Creek area with southeast-flowing main paleochannel at Castlewood Canyon area.

Plate 3A. The first area is the top of Castle Rock Butte, located within the town of Castle Rock. On the butte there is a group of 11 measurements having a resultant northeast direction, and also a separate pair of south-southeast-trending measurements that are apparently part of the main paleochannel belt. The second area is at Cherokee Mountain, located about 11 km (7 mi) northwest of Castle Rock. At this location there is a group of 12 measurements having a dominantly eastward direction (no southeast-trending measurements were found). Cherokee Mountain lies about 7 km (4.4 mi) southwest of the Newlin Gulch reach of the main paleochannel belt. The third area is at the northeast end of the mesa lying north of Newlin Gulch, and contains one north-northeast azimuth that is sharply juxtaposed with five nearby south-southeast-trending measurements. The above three occurrences may be the erosional remnants of a third tributary system that flowed northeast to join the main paleochannel belt. The number of measurements is small and the area large, and therefore different interpretations are possible here.

Interpretation of Clast Surveys

Plates 3A trough 3D show all 24 clast survey locations. **Table 3** summarizes the clast survey results grouped according to occurrence in southeast- and northeast-trending troughs, and also for the complete set of surveys. **Figure 25** is an example of how the data for lithology, maximum dimension, and roundness were organized for each clast survey location. It presents the histogram set for survey CS-02, located within the southeast-trending main paleochannel belt horizon at CCSP. **Figures 26, 27,** and **28** present histograms for lithology, roundness, and

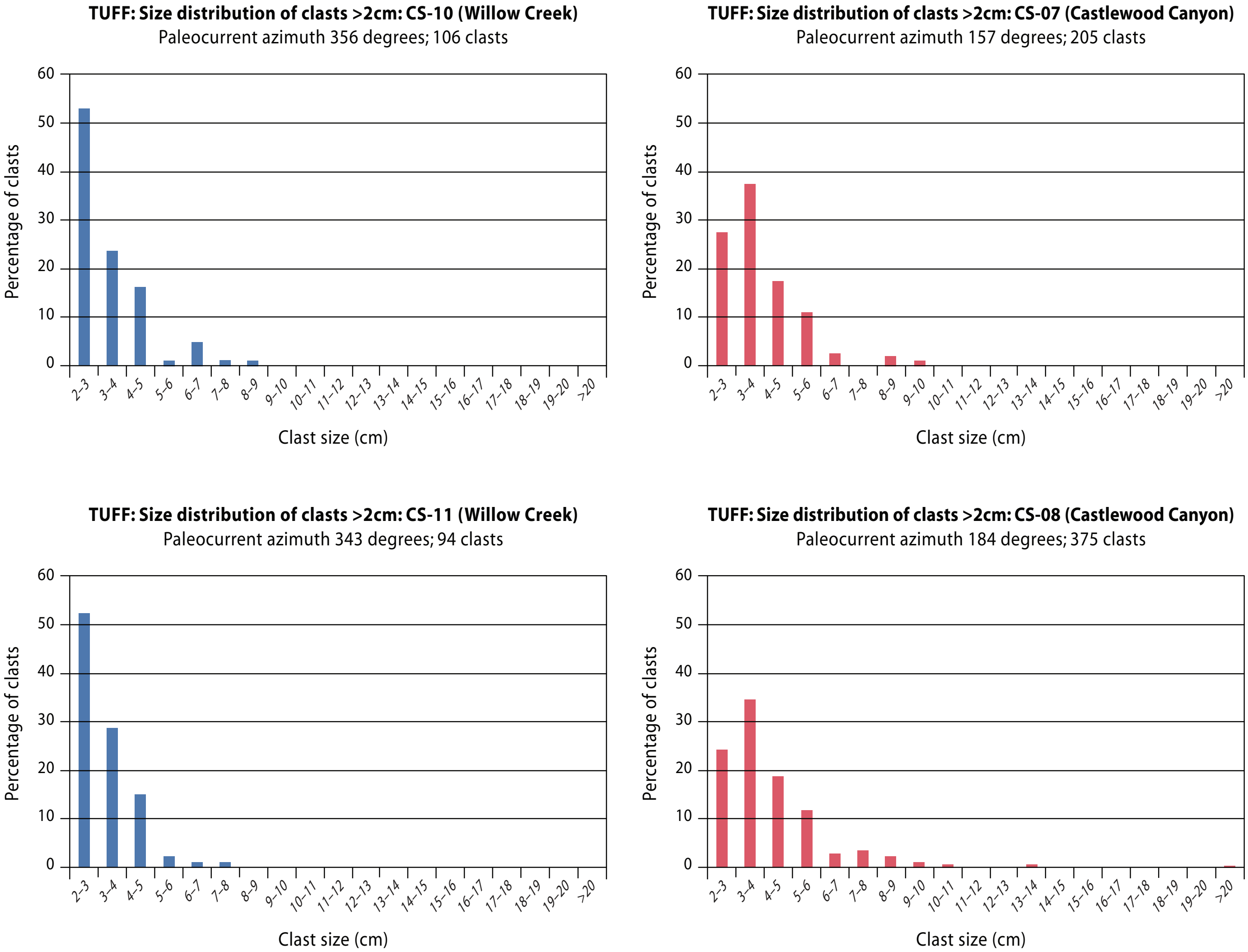


Figure 32. Size distribution of granitic clasts: comparison of northeast-flowing JA Ranch paleochannel at Willow Creek area with southeast-flowing main paleochannel at Castlewood Canyon area.

size distribution for all 24 clast surveys combined, for the 15 surveys performed in southeast-trending troughs, and for the nine in northeast-trending troughs. **Appendix 4** contains the complete set of lithology, maximum dimension, and roundness histograms for all 24 surveys.

General Observations

For the combined 24 clast surveys, granitics and Wall Mountain Tuff are the dominant lithologies; quartz and blue-gray quartzite follow with considerably lower percentages, and the remaining categories are small (Figure 26). Sedimentary rocks were uncommon in the surveys. Many of the sedimentary clasts were of red sandstone, similar in appearance to outcrops of Pennsylvanian Fountain Formation exposed prominently along the eastern flank of the Front Range. Boulders of this sandstone also occur at the base of the CRC as exposed in CCSP. No volcanic rocks other than Wall Mountain Tuff were found in the clast surveys, all of which were performed in the upper portion of the CRC (other volcanics do occur lower in the unit). The tuff content for the northeast-trending troughs is greater than for the southeast, granitics are somewhat less for the northeast, and quartz, blue-gray quartzite, and other quartzites are slightly less for the northeast (Figure 24).

Figure 27 indicates that the population is dominated by subrounded and rounded clasts. In comparing northeast to southeast troughs, the percentage of angular clasts is somewhat greater and the percentage of rounded clasts is notably less for the northeast than for the southeast. This may be due to shorter transport distances from the source areas for the northeast-trending flows than for the southeast main paleochannel belt.

Figure 28 indicates that for all 24 surveys approximately 60% of the clasts range from 2 to 4 cm (0.8 to 1.6 in), approximately 30% of the clasts range from 4 to 7 cm

(1.6 to 2.8 in), and approximately 10% range from 7 cm to >20 cm (2.8 to >8 in). In comparing size distributions of northeast and southeast troughs, the 2 to 3 cm (0.8 to 1.2 in) category is approximately 10% less in the northeast than in the southeast, and in all categories from 6 to 18 cm (2.4 to 7 in) the percentages are slightly greater for the northeast than for the southeast.

All but one (CS-24) of the northeast surveys are from troughs in the postulated JA Ranch paleochannel horizon, and many of the southeast surveys are from the area where the JA Ranch paleochannel is believed to join the main paleochannel belt. Comparison of the lithology, roundness, and size data for the northeast versus the southeast surveys indicates that the gravel characteristics of the JA Ranch paleochannel differ from those of the main paleochannel belt. In summary, the JA Ranch paleochannel gravel has a greater content of tuff, has a lesser content of granitics, is less rounded, has a smaller content of clasts 2 to 3 cm (0.8 to 1.2 in), and has a greater content of clasts larger than 6 cm (2.4 in) than the main paleochannel belt gravel.

Comparison of Clast Surveys

Eight sets of clast surveys from northeast-trending versus southeast-trending troughs were examined for differences in lithology, roundness, and grain size of the fraction of the deposits. Seven of these locations are along the swath of CRC extending from Founders Village southeast to Prairie Canyon Ranch; it is in this area that the alluvial fan of the JA Ranch paleochannel is believed to meet the main paleochannel belt. The eighth location is just north of Private Road 104 and approximately 6 km (4 mi) east of Colorado Highway 83; this is within the area where the Bucks Mountain trend is believed to meet the main paleochannel belt. The comparisons for the eight locations are summarized in **Table 4**, and the results for one group (northeast-trending CS-10 and CS-11 versus southeast-trending CS-07 and CS-08) are summarized in **Figures 29 through 32**. The comparisons presented in Table 4 are discussed below; note that some clast surveys are used in more than one comparison.

Two pairs of clast surveys lie south of Lost Canyon Ranch and at CCSP (Table 4 and Plate 3B). Clast surveys CS-10 and CS-11, with azimuths of 356º and 343º respectively, lie south of Lost Canyon Ranch and are thought to be within the generally northeast-trending JA Ranch paleochannel. CS-07 and CS-08 are located at CCSP and lie within the southeast-trending main paleochannel belt; their azimuths are 157° and 184°, respectively. As shown in Table 4, there are important contrasts between the clast populations of the two pairs. The northeast-trending pair has markedly more Wall Mountain Tuff and less granitics, quartz, and quartzite than the southeast-trending pair (Figure 29). Angular clasts are more prominent in the northeast-trending pair and rounded clasts more prominent in the southeast-trending pair, probably due to the prevalence of tuff in the northeast-trending pair (Figure 30). The mean clast size in the northeast-trending pair is notably greater than for the southeast-trending pair, and this probably is due to the dominance of tuff, which occurs in larger clast sizes in the northeast-trending pair than in the southeast-trending pair (Figure 31). Granitic clasts are smaller in the northeast-trending pair than in the southeast-trending pair (Figure 32).

Near Lost Canyon Ranch (Table 4 and Plate 3B) the northeast-trending surveys CS-10 and CS-11 also were compared with CS-16 and CS-22, which have azimuths of 128º and 145º respectively and lie within the southeast-trending main paleochannel belt. As shown in Table 4, there are important contrasts between the clast populations of the two pairs. The northeast-trending pair has markedly more Wall Mountain Tuff and less granitics than the southeast-trending pair. The mean clast size in the northeast-trending pair is notably greater than for the southeast-trending pair, again probably due to the prevalence of tuff in the northeast-trending troughs. Angular clasts are more prominent in the northeast-trending troughs and rounded clasts more prominent in the southeast-trending troughs. As in the previous comparison, the pairs appear to belong to different paleochannels.

At CCSP, above the dam ruin, there is a prominent juxtaposition of the generally southeast paleocurrent directions in the main paleochannel belt with the generally northeast-to east-trending measurements of the JA Ranch paleochannel. As shown in Table 4 and Plate 3B, the northeast-trending pair consists of CS-05 and CS-06, whose trough azimuths are 18° and 60°, respectively; and the southeast-trending pair consists of CS-07 and CS-08, whose trough azimuths are 157° and 184°, respectively. There are important contrasts between the clast populations of the two groups. The northeast-trending pair has markedly more Wall Mountain Tuff and less granitics than the southeast-trending pair. The mean clast size and number of larger clasts in the northeast-trending pair are notably greater than for the southeast-trending pair, again probably due to the prevalence of tuff in the northeast-trending troughs. This prevalence may be due to close proximity (to the southwest) of a tuff source area.

In the Founders Village area, clast surveys CS-15 and CS-16 are located west and east, respectively, of Ridge Road (Table 4 and Plate 3B), and their trough axis azimuths are 47° and 128°, respectively. Local paleocurrent measurements indicate that CS-15 is part of the northeast-trending JA Ranch paleochannel, in a place where it is not

Clast survey number	Area of survey (square meters)	Total clasts in survey	Percent Wall Mtn tuff	Percent granitics	Mean clast size (cm)	Mean round-ness
Surveys in southeast paleocurrent troughs						
CS-01	111	458	18.8	59.0	4.7	2.3
CS-02	61	138	29.0	42.0	3.7	2.6
CS-03	124	556	22.3	51.4	4.2	2.6
CS-07	60	366	13.4	56.3	4.2	3.1
CS-08	75	605	15.4	62.5	4.2	3.0
CS-09	124	545	13.8	70.5	3.6	2.6
CS-12	133	1439	28.4	62.8	4.0	3.0
CS-14	70	201	20.4	74.6	3.6	3.1
CS-16	154	597	5.9	84.6	4.1	3.2
CS-17	20	265	16.6	36.6	5.6	3.5
CS-18	92	299	12.7	82.9	3.3	3.4
CS-20	52	176	6.3	93.2	3.2	3.4
CS-21	93	445	13.3	49.7	4.2	3.5
CS-22	88	909	47.7	38.2	4.8	3.3
CS-23	77	504	3.2	89.5	3.7	3.4
Weighted mean value			20.7	62.2	4.1	3.1
Surveys in northeast paleocurrent troughs						
CS-04	92	769	7.8	65.7	4.9	2.8
CS-05	65	158	25.3	50.0	3.7	3.3
CS-06	128	524	28.6	49.0	5.2	3.1
CS-10	72	470	73.6	23.2	5.6	2.8
CS-11	46	455	74.3	20.7	5.2	2.5
CS-13	31	161	17.4	74.5	3.9	3.0
CS-15	64	333	11.4	83.2	3.6	2.8
CS-19	47	201	8.0	86.1	3.9	3.3
CS-24	46	230	7.0	91.7	3.1	3.2
Weighted mean value			31.3	55.3	4.7	2.9
All surveys						
Weighted mean value			23.9	60.1	4.3	3.0

Table 5. Clast surveys in southeast-trending main paleo-channel belt, from Gateway Mesa to near Fremont Fort.

overlain by the main paleochannel belt. CS-16 lies within the southeast-trending main paleochannel belt. The differences between these two clast survey results are not as pronounced as in the three preceding comparisons. Northeast-trending CS-15 contains slightly more tuff than the southeast-trending CS-16. Granitics are predominant in CS-15, which is opposite from the three previous comparisons, in which tuff is predominant in northeast-trending troughs. Angular clasts are more abundant in CS-15, and CS-16 has a larger content of rounded and well rounded clasts. In northeast-trending CS-15 the mean clast size, and the number of clasts ranging from 5 to 11 cm (2 to 4.3 in), both are smaller than in CS-16; this is opposite from the previous three comparisons, where larger clasts occur in the northeast-trending troughs.

Also in the Founders Village area, clast surveys CS-19 and CS-21 are located on the south side of Mitchell Gulch (Table 4 and Plate 3B), and their trough azimuths are 50° and 150°, respectively. CS-19 is believed to lie at the northernmost extent of the JA Ranch paleochannel, and CS-21 lies in the southeast-trending main paleochannel belt. There is a marked difference in total granitic content and total quartzite content between the two surveys. Granitics are predominant in both, but in northeast-trending CS-19 granitics are markedly greater than in southeast-trending CS-21, and the content of quartzites in CS-19 is markedly less. In northeast-trending CS-19 the percentage of subangular and subrounded clasts is notably less than in southeast-trending CS-21, and in CS-21 the percentage of rounded clasts is markedly greater.

At CCSP near Colorado Highway 83 there are two pairs of surveys, one northeast-trending and the other southeast-trending (Table 4 and Plate 3B). They do not show the contrasts typical of the previous five comparisons of the JA Ranch paleochannel with the main paleochannel belt. The northeast pair, lying within the proposed JA Ranch paleochannel, consists of CS-05 and CS-06; their azimuths are 18° and 60°, respectively. The southeast-trending pair, lying within the main paleochannel belt, consists of CS-01 and CS-02 with azimuths of 160° and 95°, respectively. Unlike the previous five comparisons, the clast lithology histograms are similar for both pairs. The percentage of angular and subangular clasts is markedly less in the northeast-trending pair than in the southeast-trending pair, and the percentage of rounded clasts is correspondingly greater. This pattern for roundness, more rounded in the northeast-trending troughs and more angular in the southeast-trending troughs, also is unlike the previous five comparisons. The clast-size histograms for the two pairs are similar, which also is unlike the previous five comparisons. Both pairs of clast surveys lie close together, on the northeast side of the main paleochannel belt and at the northeasternmost extent of the proposed JA Ranch paleochannel. On the basis of their trough azimuths, it is believed that the CS-05 and CS-06 belong to the JA Ranch paleochannel, even though this does not appear to be supported by the clast survey data. Speculatively, at this location the JA Ranch paleochannel may be interfingered with the main paleochannel belt, and may have entrained coarse sediment from an underlying horizon of the main paleochannel belt, causing the coarse sediment characteristics of both pairs of surveys to be somewhat similar .

At Prairie Canyon Ranch there are three clast surveys located along Cherry Creek and approximately 2 km (1.2 mi) south of CCSP (Table 4 and Plate 3B). CS-13 has a trough azimuth of 64° and is believed to lie within the JA Ranch paleochannel. CS-12 and CS-14 have azimuths of 140° and 174°, respectively, and lie within the main paleochannel belt. The histograms for lithology, roundness, and size are similar for all three surveys. Granitics are the dominant clast type with tuff being subordinate; subrounded and rounded clasts predominate over angular and subangular; and the percentage of large clasts is very low. All three clast surveys lie fairly close together, on the northeast side of the main paleochannel belt and at the southeasternmost extent of the JA Ranch paleochannel. On the basis of its trough azimuth, it is believed that CS-13 is within the JA Ranch paleochannel, even though this does not appear to be supported by the clast survey data. As is the case for the previous comparison (CCSP near Colorado Highway 83), the JA Ranch paleochannel at this location may be interfingered with the main paleochannel belt, and may have entrained gravel from an underlying main paleochannel belt horizon, causing the three surveys to be somewhat similar.

Private Road 104 lies approximately 12 km (7.5 mi) east-southeast of Colorado Highway 83 and Russellville Road (Table 4 and Plate 3C), and in this area there are two clast surveys having different, juxtaposed paleocurrent directions. CS-24 has an azimuth of 80° and lies within a large group of northeast to east-northeast-trending troughs, believed to be part of the northeast-flowing Bucks Mountain trend. CS-23 has an azimuth of 124° and is part of the southeast-trending main paleochannel belt. Granitic clasts are approximately 90% in both surveys, tuff content is comparable, and the quartz content in southeast-trending CS-23 is noticeably greater than in northeast-trending CS-24. Southeast-trending CS-23 has greater rounding than CS-24. Northeast-trending trough CS-24 has a notably greater mean clast size, a much larger percentage of clasts from 2 to 3 cm (0.8 to 1.2 in), and a much smaller percentage of clasts 4 to 8 cm (1.6 to 3.2 in), than does southeast-trending CS-23. These contrasts in roundness and in clast size suggest that CS-24 and CS-23 represent two different gravel populations, being from the Bucks Mountain trend and main paleochannel belt, respectively.

Summary of Clast Survey Results

The first five of the above eight comparisons indicate that the main paleochannel belt and JA Ranch paleochannel horizons are distinct and probably originated in different source areas. In lithology, these five comparisons show markedly to moderately more tuff and less granitics for northeast-trending locations than southeast-trending ones. In clast size, they show average clast size to be markedly to moderately greater in the JA Ranch paleochannel than in the main paleochannel belt. In roundness, they show the average rounding index to be less in the northeast-trending locations than in the southeast-trending ones, with angular clasts having a greater proportion in the JA Ranch paleochannel and rounded clasts a greater proportion in the main paleochannel belt. The three comparisons located at and near CCSP (second through fourth rows in Table 4) show the strongest contrasts in gravel characteristics between the two horizons. The blue-gray quartzite is not consistently present or consistently absent in either of the JA Ranch paleochannel and main paleochannel belt horizons, as sampled in the 24 clast surveys. The blue-gray quartzite occurs in four of the nine northeast-trending locations and in 12 of the 15 southeast-trending locations.

There are distinct changes in gravel characteristics within the main paleochannel belt as the clast survey locations move in the downstream direction toward the southeast. **Table 5** presents the principal clast survey results for the 15 southeast-trending locations, beginning with Gateway Mesa Open Space and ending with the Fremont Fort area, a distance of 47 km (29 mi). Mean clast size declines overall downstream, with a notable exception being near Fremont Fort, the survey furthest to the southeast. This may be because the Fremont Fort area clast survey was performed in the lower and possibly basal portion of the CRC. Tuff and granitics values are irregular, except for the section downstream from Prairie Canyon Ranch where there is a marked decrease in tuff and a marked increase in granitics. There is a notable increase in roundness from CCSP all the way to Fremont Fort. Probably the decrease in mean clast size, decrease in tuff content, and increase in granitics content south of Prairie Canyon Ranch are due to the increasing distance downstream from the JA Ranch paleochannel, which could have locally supplied a large amount of tuff clasts to the main paleochannel. The increase in roundness along the same reach of the main paleochannel belt can be similarly attributed, because the JA Ranch paleochannel contains a large proportion of angular tuff clasts, and could have added them at CCSP to the main paleochannel belt. Angularity of tuff clasts would decrease downstream in the main paleochannel belt, and average roundness of the entire clast population would correspondingly increase. Part of the increase in roundness also may be due to increasing transport distance southeast along the main paleochannel belt.

Other investigators (e.g., Leonard and others, 2002; Evanoff, 2007; Koch, 2013) of the CRC have proposed that the blue-gray quartzite clasts originated solely from Coal Creek Canyon south of Boulder. This type of clast notably occurs in the JA Ranch paleochannel as well as in the main paleochannel belt. In the northeast-trending JA Ranch paleochannel the blue-gray quartzite is found only in the vicinity of Castlewood Canyon State Park, and is absent from the northeast-trending Bucks Mountain trend. It is therefore unlikely that the blue-gray quartzite in the JA Ranch paleochannel came from the southwest. More likely this quartzite was entrained from an older horizon of the main paleochannel belt. Along the Front Range, varicolored quartzite clasts exist in the Fountain Formation (Richardson, 1915), Dawson Arkose, and conglomerate of Larkspur Butte (Richardson, 1915; Thorson, 2003 a,b), all of which likely contributed sediment to the CRC. Additional studies of the compositions of the different quartzites in the CRC would provide better constraints on the possible source areas of the clasts.

Rounded dacitic volcanic clasts were collected from the base of the main paleochannel in CCSP and submitted to the U.S. Geological Survey for U-Pb SHRIMP-RG geochronology. Ages of zircons within these clasts range from 46 to 56 Ma (Morgan and others, 2013). These ages are similar in age to other dacitic volcanic rocks that lie along a northeast trend between Leadville and Boulder.

Absent from the clast surveys is the suite of Mesozoic sedimentary rocks now exposed in hogbacks along the east side of the Front Range.

CONCLUSIONS

Field observations indicate that a large southeast-trending paleovalley was eroded into the Dawson Arkose and Wall Mountain Tuff, and that a southeast-flowing fluvial system, possibly consisting of braided channels, filled the paleovalley with CRC deposits (Morse, 1985; Evanoff, 2007; Keller and Morgan, 2013; Koch, 2013a). The CRC fluvial system may have emerged from the Front Range near present-day Coal Creek Canyon, between the sites of present-day Boulder and Denver (Evanoff, 2007; Koch, 2013b). CRC between Coal Creek Canyon and Parker would have been removed later by the South Platte River and its tributaries. The large paleovalley of Morse (1985) and Evanoff (2007) corresponds to the main paleochannel belt of Keller and Morgan (2013; present report) and the northern facies of Koch (2013a). The tributaries of Keller and Morgan (2013; present report) appear to correspond to the western facies of Koch (2013a).

This paleocurrent investigation in the upper portion of the CRC has produced a detailed map of paleocurrent directions in the southeast-trending main paleochannel belt, documented and mapped two northeast-flowing tributaries to the main paleochannel belt (and indicated a possible third tributary), and characterized in detail the lithology, roundness, and size distribution of the gravel fraction of the CRC at 24 locations.

Plates 3A through 3D serve to guide the following summary. The main paleochannel belt has been informally divided into four reaches: the Newlin Gulch, Castlewood Canyon, Elbert, and Bijou Basin reaches. In the Newlin Gulch reach, all but one paleocurrent measurement indicates a south-southeast flow direction. In the northwest portion of the Castlewood Canyon reach, from Hidden Mesa Open Space to Castlewood Canyon, the general flow direction is south-southeast, with a possible small southeast-flowing tributary trending from Castle Rock Butte to Castlewood Canyon. In the lower part of the reach, from Castlewood Canyon to beyond Highway 83, there is a marked change in the general flow direction: from south-southeast to southeast. Southeast of the highway the overall width of the main paleochannel belt increases; the mapped conglomerate areas become narrower and more linear; and the paleocurrent directions appear to be more variable. These observations suggest that in the lower part of the Castlewood Canyon reach the main paleochannel belt may have begun spreading out into a network of distributary streams. In the Elbert reach, the width of the main paleochannel belt continues to increase southeastward. The conglomerate occurrences are numerous but become smaller in area and less continuous southeastward. Some mapped areas are linear in the northwest-southeast direction, can be as long as 5 km (3 mi), and have paleocurrents trending parallel to the long direction. Also in the Elbert reach, the overall paleocurrent direction remains southeast, but paleocurrents appear to increase in variability compared to the southeast part of the Castlewood Canyon reach (immediately upstream). In the Bijou Basin reach the flow direction of the main paleochannel belt is dominantly southeast, but the local paleocurrent directions are quite variable, as in the Elbert reach. For example, at one locality on the west rim of Bijou Basin the consolidated paleocurrent direction is west-southwest. This suggests that the main paleochannel belt may have terminated as a network of distributary streams.

From Bucks Mountain to Running Creek, about 10 km (6 mi) southwest of the main paleochannel belt and separated from it by an area having no mapped CRC, there is a band of conglomerate outcrops containing a horizon of south- to southeast-flowing paleocurrents (as well as a horizon of northeast paleocurrents). The southeast-flowing horizon appears to correlate with the main paleochannel belt. It is possible that in this area the main paleochannel belt extended considerably further to the southwest than in its upper reaches, perhaps by overtopping the main paleochannel belt paleovalley.

On the basis of detailed mapping and interpretation of trough cross-bed paleocurrents throughout the occurrence of the uppermost part of the CRC, two large northeast-flowing tributaries to the southeast-flowing main paleochannel belt have been recognized; a third tributary is possible, as evidenced by three isolated outcrop areas. The two large tributaries are identified as the JA Ranch paleochannel and the Bucks Mountain trend, and the possible third system lies north and northeast of Castle Rock. Three lines of evidence support distinguishing the two large tributaries:

1) the existence of distinct conglomerate horizons having different and juxtaposed dominant paleocurrent directions (generally southeast versus generally northeast);

2) differences in gravel fraction characteristics (lithology, maximum dimension, and roundness) between the underlying, older northeast-trending tributary horizons

and the overlying, younger horizon of the southeast-trending main paleochannel belt; and

3) inverted topography (for the JA Ranch paleochannel only).

The upper reach of the JA Ranch paleochannel is located approximately 12 km (7.5 mi) southwest of CCSP. A JA Ranch paleochannel horizon, having a dominantly northeast paleocurrent direction, is correlated over a distance of 12 km (7.5 mi) from the intersection of Lake Gulch Road and Ridge Road northeast to CCSP, and over a distance of 12 km (7.5 mi) from Gateway Mesa Open Space south-southeast to Prairie Canyon Ranch. This horizon directly underlies the main paleochannel belt horizon, which has a dominantly east-southeast flow direction in that area. A structure contour map on the top of the JA Ranch paleochannel horizon indicates that the feature is a paleovalley culminating in a northeast-sloping alluvial fan. The fan axis runs from JA Ranch northeast to the park, and the fan spreads out to the north and east. The upper reach of the JA Ranch paleochannel is topographically inverted as a series of outcrops trending from JA Ranch to Lake Gulch Road. This suggests that the tributary paleochannel occupied a relatively narrow, northeast-trending paleovalley before fanning out in its lower reach. Comparing the gravel fractions of the northeast-flowing JA Ranch paleochannel horizon to the south-southeast main paleochannel belt horizon resulted in the following observations: 1) the main paleochannel belt has a larger proportion of granitics, quartz, and various quartzites, and a smaller proportion of Wall Mountain Tuff, than the JA Ranch paleochannel; 2) the main paleochannel belt contains markedly less clasts greater than 6 cm (2.4 in) in maximum dimension, and more clasts ranging from 2 to 3 cm (0.8 to 1.2 in); and 3) the main paleochannel belt has a notably greater proportion of rounded clasts. The contrast in gravel lithologies indicates different source areas for the two horizons, with the source area for the JA Ranch paleochannel gravel being richer in Wall Mountain Tuff and poorer in granitics, quartz, and quartzites. The differences in clast-size distribution and roundness suggest a shorter transport distance for the JA Ranch horizon gravel, possibly corresponding to the apparently smaller length of the JA Ranch paleochannel compared to the length of the main paleochannel belt (i.e., the northwest portion of the belt, upstream from CCSP).

The northeast-flowing Bucks Mountain trend is indicated by a swath of paleocurrent measurements situated about 15 km (9 mi) south of CCSP and about 10 km (6 mi) west of the town of Elbert. The southwest end of this feature is just east of Colorado Highway 83 at Bucks Mountain; the northeast end is coincident with the main paleochannel belt, in an area reaching from the Douglas County/Elbert County boundary northeast to Elbert. The overall length of the trend (southwest-northeast, parallel to paleoflow) is approximately 13 km (8 miles) and the width is approximately 20 km (12 mi). In the southwest portion of the trend, there is an area approximately 10 km (6 mi) long (in the paleoflow direction, northeast) where CRC is absent and was likely eroded. The width of the trend suggests that, unlike the JA Ranch paleochannel which in its upper reach occupied a relatively narrow paleovalley, the Bucks Mountain trend could have contained several subparallel and generally northeast-flowing streams. The Bucks Mountain horizon is oriented northeast and slopes northeast. It immediately underlies the younger, southeast-trending main paleochannel belt horizon and can be correlated from Bucks Mountain northeast to the Elbert area. This assumes that the CRC once occupied the area lying in between Bucks Mountain and the area west of Elbert.

North and northeast of Castle Rock there are three relatively small and isolated outcrops where groups of paleocurrent azimuths yield consolidated directions trending from northeast to east: Castle Rock Butte, Cherokee Mountain, and the mesa north of Newlin Gulch (one measurement only). These may be the erosional remnants of a third tributary system that flowed northeast to the main paleochannel belt. The number of measurements is small and the area large, and so different interpretations are possible here.

At CCSP the scenario of two juxtaposed and correlatable horizons – the older, northeast-trending JA Ranch paleochannel overlain by a younger, southeast-flowing main paleochannel belt – represents a partial fluvial history for the stratigraphically upper portion of the CRC. There is some evidence for other events in the history, events older and younger than the above scenario. At one location in CCSP, the JA Ranch horizon is underlain by an older southeast-trending main paleochannel belt horizon, which is in turn underlain by an older northeast-trending horizon. At two locations immediately southwest of the park, the main paleochannel belt horizon is overlain by a younger horizon of the JA Ranch paleochannel. The above observations indicate that at CCSP the CRC was deposited by at least two periods of flow in the main paleochannel belt and as many as three periods of JA Ranch tributary flow. At a location south of Peaceful Valley Ranch in Elbert County, the main paleochannel belt horizon is underlain and overlain by northeast-trending horizons, suggesting that there was more than one flow period for the Bucks Mountain trend tributaries.

In the gravel fraction of the stratigraphically upper part of the CRC, as sampled in 24 clast surveys (10,804 clasts >2 cm (>0.8 in) maximum dimension), granitics and Wall Mountain Tuff are the dominant lithologies, quartz and blue-gray quartzite (the latter possibly originating from Coal Creek Canyon) follow with considerably lower percentages, and the categories of other quartzites, sedimentary rocks, and other lithologies are small to negligible. It is notable that sedimentary rocks were rarely found in the surveys, but many of the sedimentary clasts were of red sandstone resembling the Pennsylvanian Fountain Formation, which crops out prominently along the eastern flank of the Front Range. No volcanic rocks except Wall Mountain Tuff were found in the clast surveys. The differences in lithology, clast size, and roundness between the gravel fractions of the northeast-trending JA Ranch paleochannel and the southeast-trending main paleochannel belt indicate different source areas. Along the main paleochannel belt in the stratigraphically upper portion of the CRC, the gravel characteristics change with increasing distance in the downstream, southeast direction. On the basis of 15 clast surveys in the main paleochannel belt, the mean clast size declines overall downstream, and this decrease probably is partially related to transport distance. Southeast of Prairie Canyon Ranch there is a marked decrease in tuff content and a marked increase in granitics, and southeast of CCSP there is a notable increase in clast roundness. The above results could be due to increasing distance downstream from the intersection of the JA Ranch paleochannel with the main paleochannel belt and also to increasing distances from tuff source areas; the JA Ranch paleochannel contains a large proportion of angular tuff clasts.

Blue-gray quartzite, suggested by previous workers to originate solely from Coal Creek Canyon south of Boulder, is common in the main paleochannel belt and present at several locations in the JA Ranch paleochannel; this suggests additional source areas for the blue-gray quartzite. During summer 2015, many CRC outcrops in the JA Ranch paleochannel at CCSP were re-examined for blue-gray quartzite clasts, and 54 samples were collected among 17 locations. No blue-gray quartzite, however, was found at Hunt Mountain in the well-exposed upper reach of the JA Ranch paleochannel. Also, no blue-gray quartzite was found in the northeast-flowing Bucks Mountain trend. Despite the presence of blue-gray quartzite in the lower portion of JA Ranch paleochannel, there is no evidence as yet for an additional, primary (outcrop) southwest source of this quartzite in the Front Range. The blue-gray quartzite clasts in the JA Ranch paleochannel may have been originally part of an underlying main paleochannel belt horizon, and may have been entrained by subsequent flow in the tributary stream.

Two well-rounded volcanic clasts of probable dacitic composition were collected from the base of the main paleochannel belt in Castlewood Canyon State Park. Sensitive High Resolution Ion Microprobe (SHRIMP)-RG U-Pb zircon age dates of these clasts range from 46 to 55 million years ago (Ma). Potential source areas for these volcanic clasts lie along a northeast trend between Leadville and Boulder. All of the clast lithologies found in the conglomerate are derived from the southern Rocky Mountains. As stated earlier, sedimentary clasts are rare in the upper CRC. The majority of these are red-brown sandstone, resembling the Pennsylvanian-Permian Fountain Formation exposed in the Front Range hogback (Evanoff, 2007). Absent from the upper CRC clast surveys is the suite of Mesozoic sedimentary rocks now exposed along the mountain front, suggesting that the hogbacks of these rocks visible today were either not exposed during the late Eocene, or were not present in the CRC source area. Gravel-fraction lithologies in the CRC indicate that large quantities of granitic and volcanic material existed along the Front Range during the time of CRC deposition. This arkosic and volcanic material may have buried the Paleozoic and Mesozoic sections along the range front. Later downcutting by the CRC stream system may have exposed the Paleozoic section, prior to exhumation of the Mesozoic rocks sometime after the deposition of the CRC (Morgan and others, 2013).

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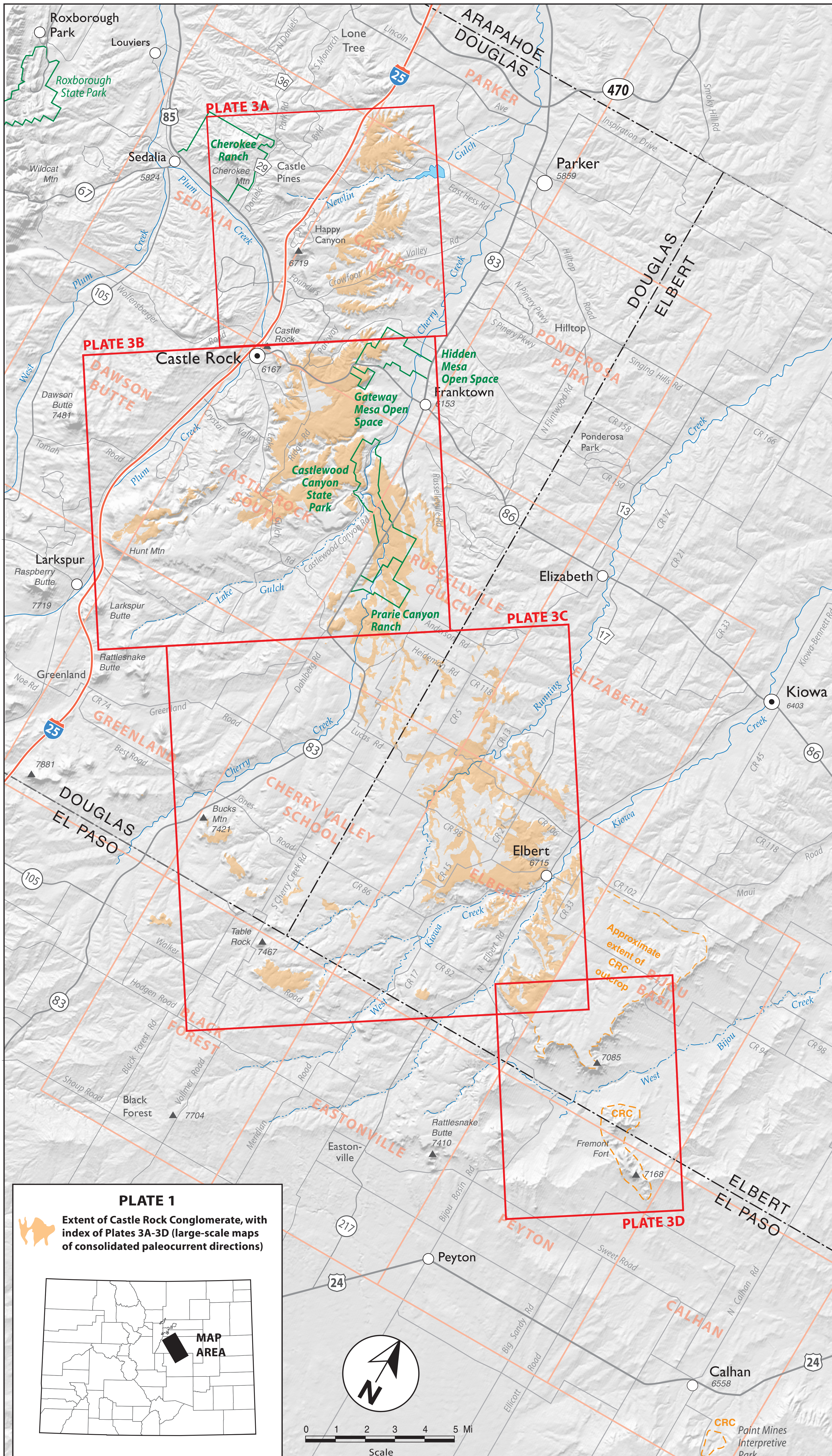

PLATE 1

Extent of Castle Rock Conglomerate, with index of Plates 3A-3D (large-scale maps of consolidated paleocurrent directions)

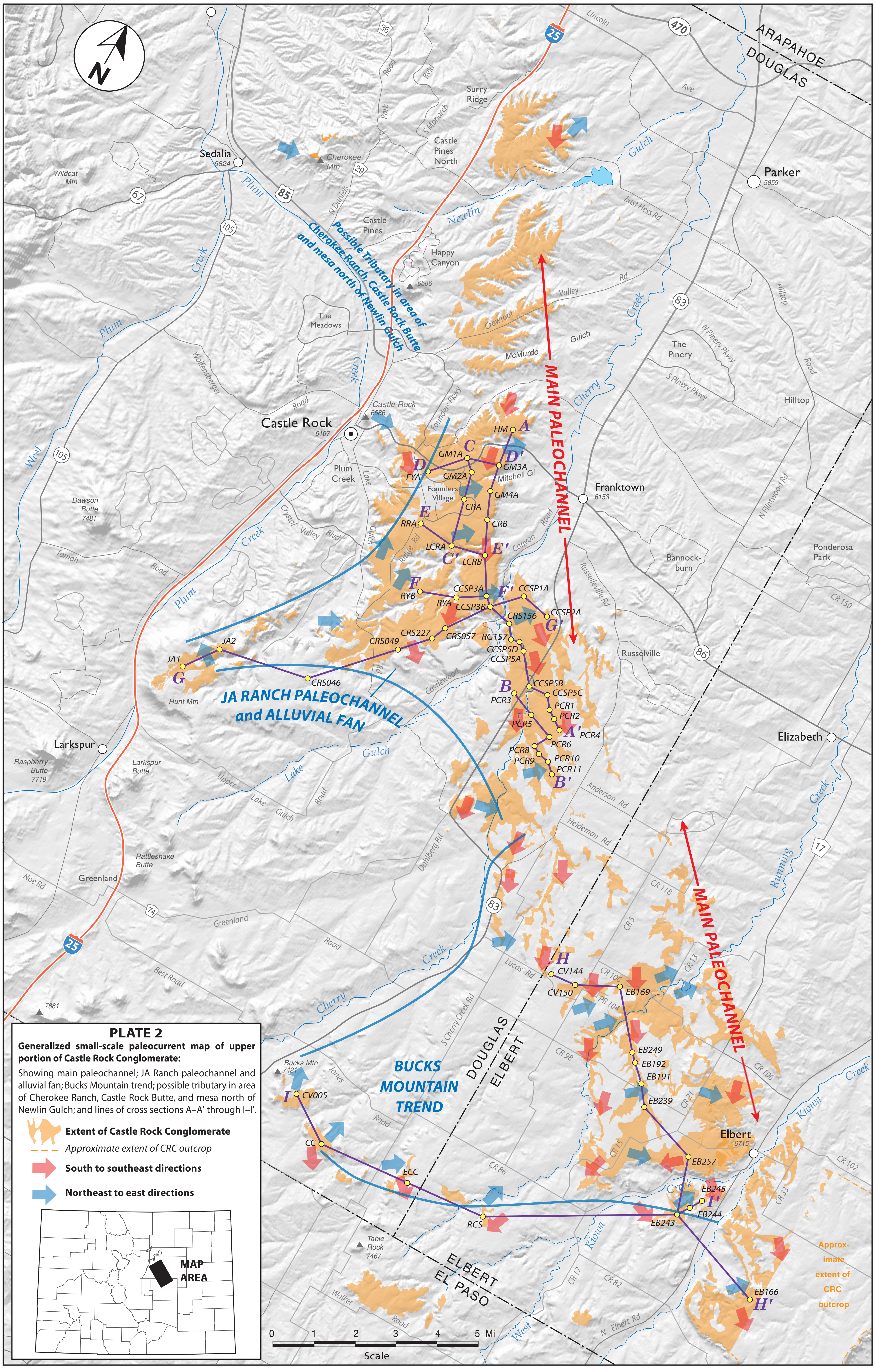

PLATE 2

Generalized small-scale paleocurrent map of upper portion of Castle Rock Conglomerate:

Showing main paleochannel; JA Ranch paleochannel and alluvial fan; Bucks Mountain trend; possible tributary in area of Cherokee Ranch, Castle Rock Butte, and mesa north of Newlin Gulch; and lines of cross sections A–A' through I–I'.

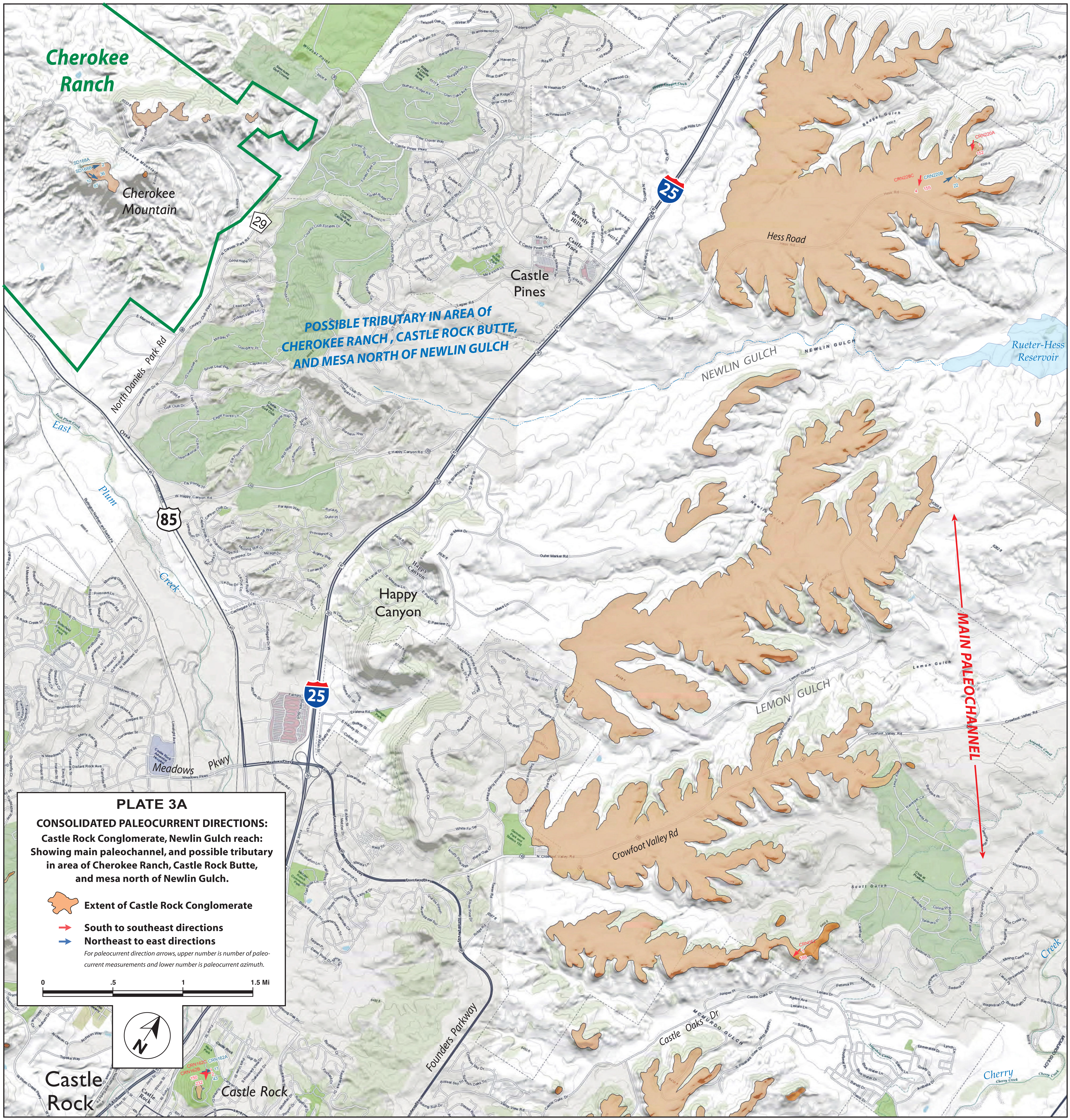
PLATE 3A
CONSOLIDATED PALEOCURRENT DIRECTIONS:
Castle Rock Conglomerate, Newlin Gulch reach:
Showing main paleochannel, and possible tributary
in area of Cherokee Ranch, Castle Rock Butte,
and mesa north of Newlin Gulch.
Extent of Castle Rock Conglomerate
South to southeast directions
Northeast to east directions
For paleocurrent direction arrows, upper number is number of paleo-current measurements and lower number is paleocurrent azimuth.
0
.5
1
1.5 Mi
N
Cherokee Ranch
Cherokee Mountain
POSSIBLE TRIBUTARY IN AREA OF CHEROKEE RANCH, CASTLE ROCK BUTTE, AND MESA NORTH OF NEWLIN GULCH
MAIN PALEOCHANNEL
Castle Pines
Hess Road
NEWLIN GULCH
Rueter-Hess Reservoir
LEMON GULCH
Crowfoot Valley Rd
Happy Canyon
North Daniels Park Rd
East Plum Creek
Meadows Pkwy
Founders Parkway
Castle Oaks Dr
Castle Rock
Cherry Creek
25
85
29
CRN220A
CRN220B
CRN220C
SD168A
SD168B
CRN162A
CRN162B

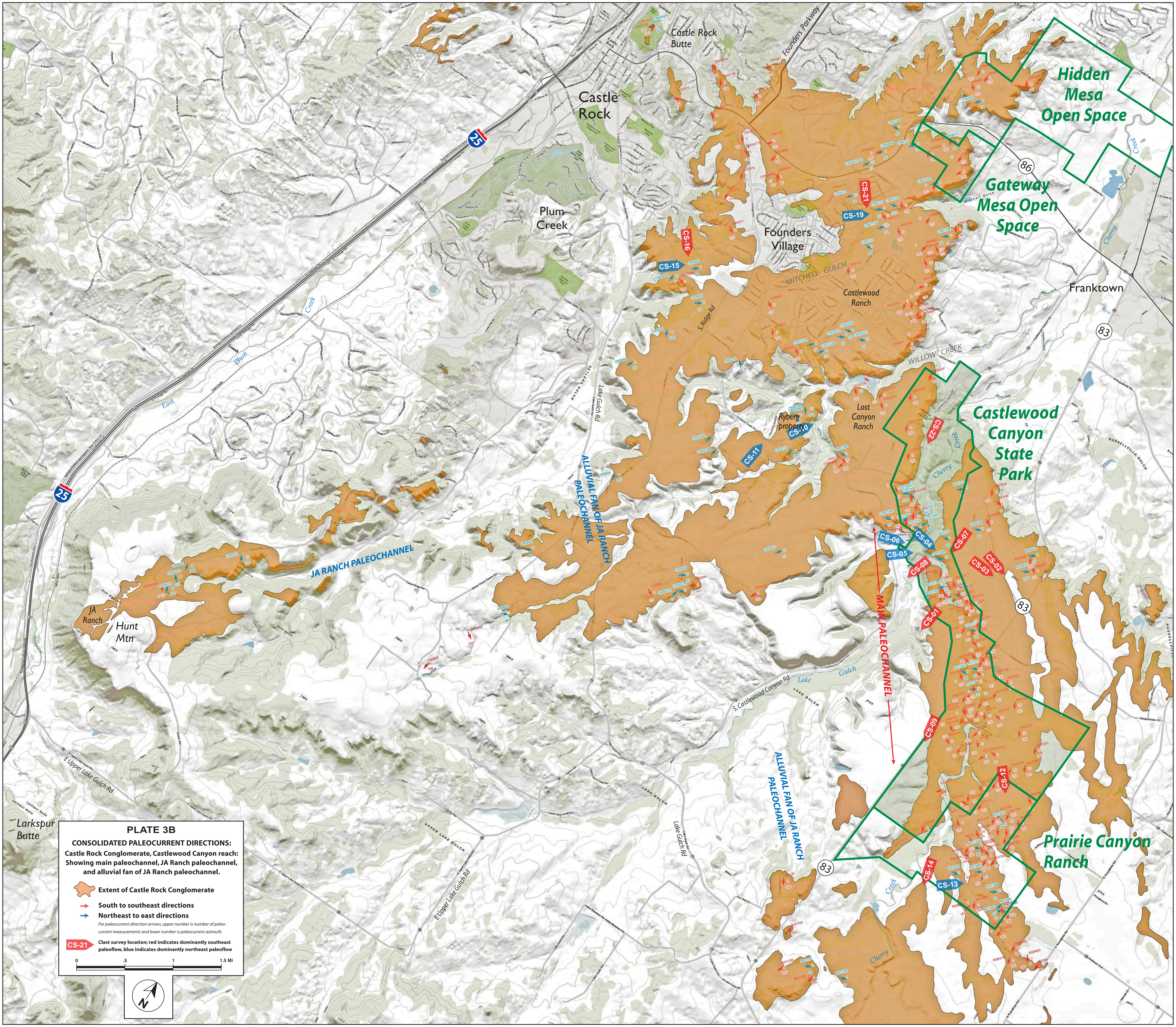

PLATE 3B
CONSOLIDATED PALEOCURRENT DIRECTIONS:
Castle Rock Conglomerate, Castlewood Canyon reach: Showing main paleochannel, JA Ranch paleochannel, and alluvial fan of JA Ranch paleochannel.
Extent of Castle Rock Conglomerate
South to southeast directions
Northeast to east directions
For paleocurrent direction arrows, upper number is number of paleocurrent measurements and lower number is paleocurrent azimuth.
CS-21
Clast survey location; red indicates dominantly southeast paleoflow, blue indicates dominantly northeast paleoflow
0
.5
1
1.5 Mi
N
Castle Rock Butte
Castle Rock
Founders Parkway
Hidden Mesa Open Space
Gateway Mesa Open Space
Plum Creek
Founders Village
Mitchell Gulch
Castlewood Ranch
Franktown
Willow Creek
Lost Canyon Ranch
Ryberg property
Castlewood Canyon State Park
Cherry Creek
Alluvial fan of JA Ranch paleochannel
JA Ranch paleochannel
JA Ranch
Hunt Mtn
Main paleochannel
Lake Gulch
S. Castlewood Canyon Rd
Lake Gulch Rd
S. Ridge Rd
E Upper Lake Gulch Rd
Upper Lake Gulch
Larkspur Butte
Prairie Canyon Ranch
East Plum Creek
25
83
86
CS-01
CS-02
CS-03
CS-04
CS-05
CS-06
CS-07
CS-08
CS-09
CS-10
CS-11
CS-12
CS-13
CS-14
CS-15
CS-16
CS-19
CS-21
CS-22

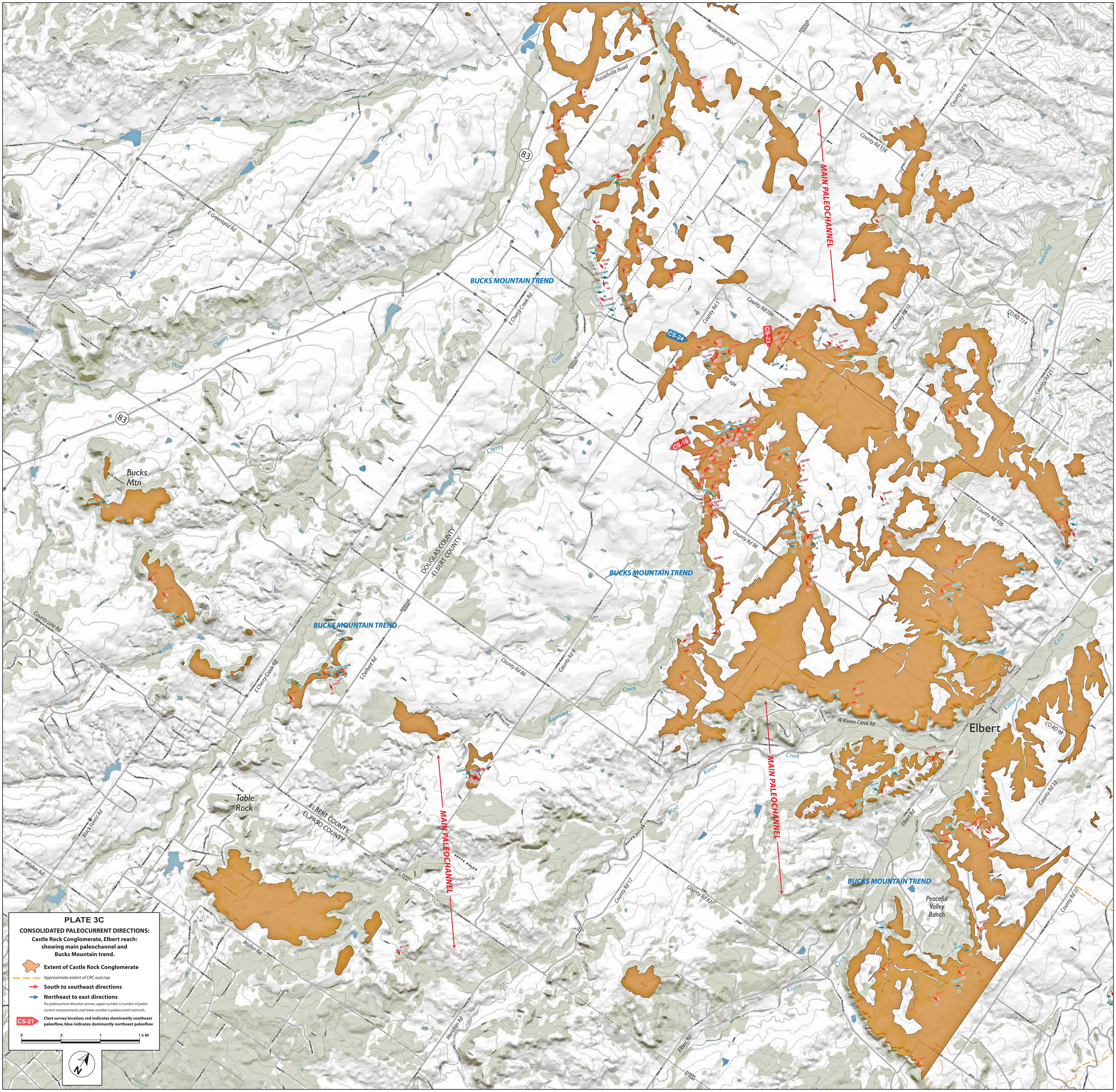
PLATE 3C
CONSOLIDATED PALEOCURRENT DIRECTIONS:
Castle Rock Conglomerate, Elbert reach:
showing main paleochannel and
Bucks Mountain trend.
Extent of Castle Rock Conglomerate
Approximate extent of CRC outcrop
South to southeast directions
Northeast to east directions
For paleocurrent direction arrows, upper number is number of paleocurrent measurements and lower number is paleocurrent azimuth.
CS-21
Clast survey location; red indicates dominantly southeast paleoflow, blue indicates dominantly northeast paleoflow
0
.5
1
1.5 Mi
N
MAIN PALEOCHANNEL
BUCKS MOUNTAIN TREND
CS-24
CS-23
CS-18
Bucks Mtn
Table Rock
Elbert
Peaceful Valley Ranch
DOUGLAS COUNTY
ELBERT COUNTY
ELBERT COUNTY
EL PASO COUNTY
83
Russellville Road
Heideman Road
County Rd 118
E Greenland Rd
E Cherry Creek Rd
County Rd 5
County Rd 106
County Rd 13
CO RD 114
County Rd 21
PR 104
County Line Rd
County Rd 98
County Rd 86
County Rd 9
S Delbert Rd
W Kiowa Creek Rd
CO RD 98
County Rd 33
Elbert Rd
County Rd 17
County Rd 82
County Rd 37
Black Forest Rd
Walker Rd
Meridian Rd
West Cherry Creek
East Cherry Creek
Running Creek
West Kiowa Creek
Kiowa Creek

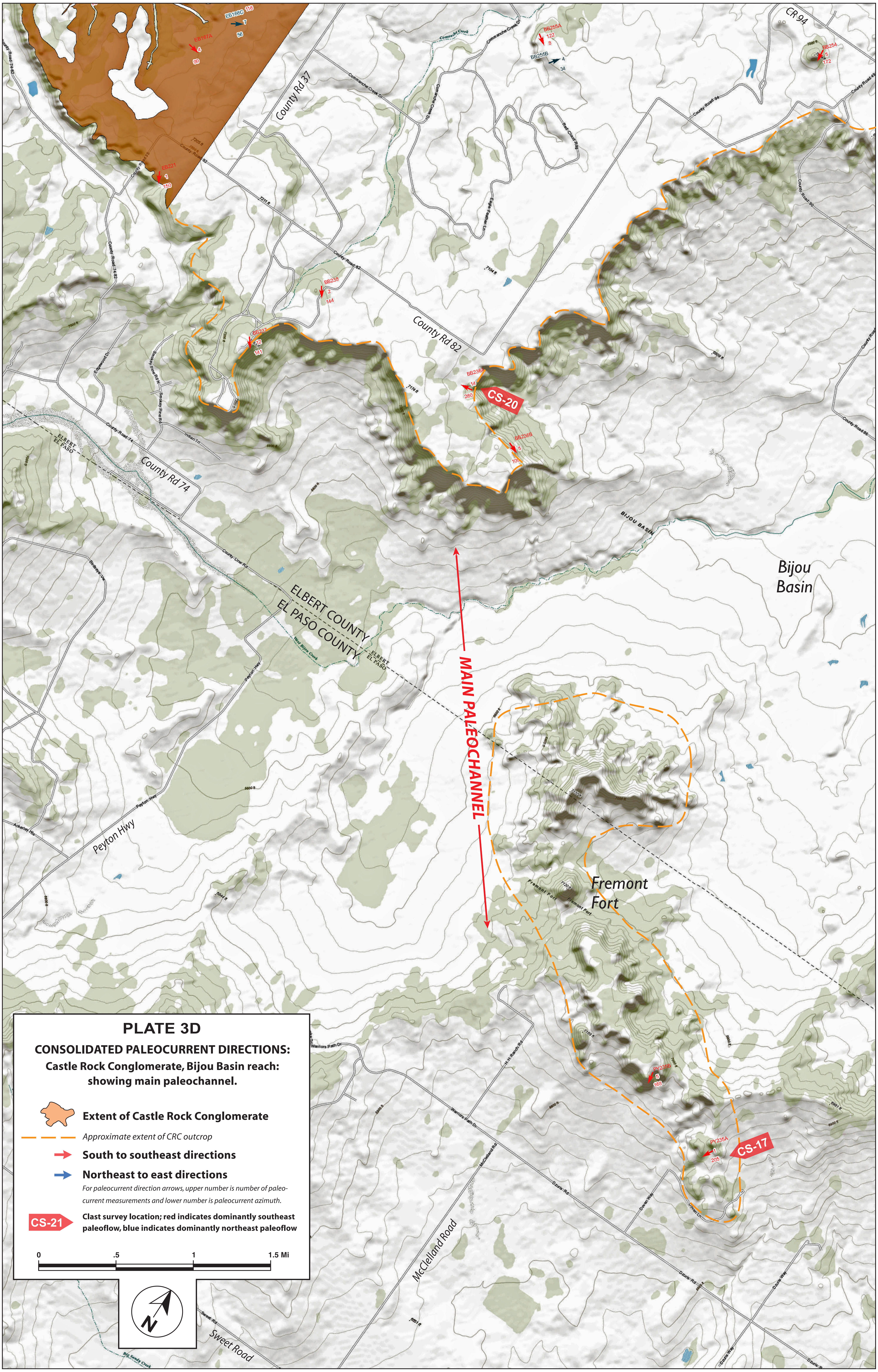

PLATE 3D

CONSOLIDATED PALEOCURRENT DIRECTIONS: Castle Rock Conglomerate, Bijou Basin reach: showing main paleochannel.

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

APPENDIX 1 - COMPLETE PALEOCURRENT DIRECTIONS DATABASE

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CV005, Cherry Valley School quad, 522917E/4333703N, T10S, R66W, Sec. 25, NW, 29Jun08								
522917	4333703	49	NM	NM	NM	poor	NM	NM
522902	4333710	40	NM	NM	NM	poor	NM	NM
522875	4333714	30	NM	NM	NM	poor	NM	NM
CV006, Cherry Valley School quad, 523490E/4333643N, T10S, R66W, Sec. 25, NW, 29Jun08								
523490	4333643	322	NM	NM	NM	fair	NM	NM
CV007, Cherry Valley School quad, 522070E/4333479N, T10S, R66W, Sec. 25, NW, 29Jun08								
522070	4333479	20	NM	NM	NM	poor	NM	NM
CV008, Cherry Valley School quad, 522830E/4333623N, T10S, R66W, Sec. 25, NW, 29Jun08								
522830	4333623	4	NM	NM	NM	fair	NM	NM
CV009X, Cherry Valley School quad, 528212E/4332956N, T10S, R65W, Sec. 28, SW, 10Jul08								
528212	4332956	35	14	2	1	fair	NM	NM
CV011, Cherry Valley School quad, 528378E/4333249N, T10S, R65W, Sec. 28, SW, 10Jul08								
528378	4333249	136	18	2	3	NM	NM	NM
528362	4333244	109	12	3	2	NM	NM	NM
528373	4333292	118	NA	1	2	NM	NM	NM
528410	4333289	102	12	1	2	NM	NM	NM
CV012, Cherry Valley School quad, 528494E/4333354N, T10S, R65W, Sec. 28, SE, 10Jul08								
528494	4333354	88	NA	2	5	fair	NM	NM
528487	4333354	49	14	6	4	good	NM	NM
528483	4333364	66	13	5	5	good	NM	NM
CV013, Cherry Valley School quad, 528540E/4333396N, T10S, R65W, Sec. 28, SE, 10Jul08								
528540	4333396	69	NA	6	2	good	NM	NM
528569	4333411	112	13	5	2	NM	NM	NM
528569	4333411	155	14	5	3	NM	NM	NM
528579	4333411	167	11	2	2	fair	NM	NM

Abbreviations: NA = not available, NM = not measured, ms = medium-grained sand, cs = coarse sand, vcs = very coarse sand, fg = fine-grained, Twm = Wall Mountain Tuff, qtz = quartz, qtzt = quartzite

COMPILATION OF ALL TROUGH CROSS-BED MEASUREMENTS

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CV014, Cherry Valley School quad, 528645E/4333467N, T10S, R65W, Sec. 28, NE, 10Jul08								
528645	4333467	101	30	2	6	fair	NM	NM
528655	4333484	60	18	3	6	good	NM	NM
CV015, Cherry Valley School quad, 528786E/4333516N, T10S, R65W, Sec. 28, NE, 10Jul08								
upper unit								
528786	4333516	124	26	5	10	good	NM	NM
528798	4333537	130	29	6	2	very good	NM	NM
528790	4333541	131	14	4	4	fair	NM	NM
528773	4333548	157	15	5	5	good	NM	NM
lower unit								
528770	4333560	50	NA	5	3	fair	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CV016, Cherry Valley School quad, 528783E/4333597N, T10S, R65W, Sec. 28, NE, 10Jul08								
upper unit								
528783	4333597	97	7	11	10	very good	NM	NM
528749	4333636	61	18	5	8	good	NM	NM
528831	4333660	132	20	4	5	fair	NM	NM
lower unit								
528822	4333652	48	NA	5	3	NM	NM	NM
528822	4333652	27	NA	6	5	NM	NM	NM
528822	4333652	32	NA	5	3	NM	NM	NM
CV017, Cherry Valley School quad, 528298E/4332627N, T10S, R65W, Sec. 28, SW, 11Jul08								
528298	4332627	101	18	2	2	poor	NM	NM
CV018, Cherry Valley School quad, 532231E/4333466N, T10S, R65W, Sec. 26, NE, 11Jul08								
532231	4333466	230	15	5	6	very good	NM	NM
532234	4333468	209	NA	3	2	fair	NM	NM
532315	4333473	101	10	3	2	poor	NM	NM
532311	4333477	91	9	5	2	good	NM	NM
532305	4333481	120	NA	3	2	poor	NM	NM
532295	4333482	104	10	3	3	poor	NM	NM
532292	4333486	84	NA	4	2	poor	NM	NM
532287	4333483	79	28	3	4	fair	NM	NM
532277	4333483	44	17	5	4	good	NM	NM
532270	4333486	53	11	2	3	fair	NM	NM
CV019, Cherry Valley School quad, 532266E/4333479N, T10S, R65W, Sec. 26, NE, 11Jul08								
upper unit								
532236	4333467	86	22	9	2	good	NM	NM
532231	4333472	49	15	5	3	good	NM	NM
532220	4333480	62	13	3	2	good	NM	NM
532191	4333488	52	26	5	4	good	NM	NM
lower unit								
532271	4333458	223	21	6	4	very good	NM	NM
532263	4333460	243	21	2	1	good	NM	NM
532262	4333460	263	34	1	2	poor	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CV020, Cherry Valley School quad, 532151E/4333430N, T10S, R65W, Sec. 26, NE, 11Jul08								
upper unit								
532151	4333430	164	13	6	6	very good	NM	NM
532126	4333448	158	16	3	5	fair	NM	NM
lower unit								
532103	4333467	15	NA	2	5	poor	NM	NM
CV020X, Cherry Valley School quad, 528460E/4334210N, T10S, R65W, Sec. 28, NE, 18Jul08								
528460	4334210	76	7	2	1	poor	NM	NM
528450	4334250	42	NA	4	2	poor	NM	NM
CV021, Cherry Valley School quad, 527839E/4344176N, T9S, R65W, Sec. 21, SW, 18Jul08								
527839	4344176	72	12	2	2	poor	NM	NM
527839	4344163	78	24	5	5	fair	NM	NM
527791	4344105	73	22	2	3	fair	NM	NM
527805	4343981	116	15	5	5	fair	NM	NM
527830	4343971	104	26	3	2	poor	NM	NM
527818	4343962	90	12	5	4	fair	NM	NM
527824	4343953	86	23	2	4	fair	NM	NM
527824	4343924	103	25	5	5	fair	NM	NM
527818	4343928	98	22	5	3	fair	NM	NM
527866	4343923	106	18	2	5	fair	NM	NM
CV022, Cherry Valley School quad, 528298E/4343567N, T9S, R65W, Sec. 28, NW, 19Jul08								
528214	4343417	90	17	4	4	fair	NM	NM
528144	4343536	66	12	5	5	poor	NM	NM
528122	4343567	91	20	5	5	poor	NM	NM
528127	4343578	72	10	6	4	poor	NM	NM
528171	4343696	50	15	3	3	poor	NM	NM
528174	4343686	111	20	3	4	poor	NM	NM
528210	4343675	115	23	3	2	very good	NM	NM
528160	4343832	134	NA	4	3	poor	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CV023, Cherry Valley School quad, 529688E/4344055N, T9S, R65W, Sec. 22, SW, 19Jul08								
529688	4344055	124	25	6	5	fair	NM	NM
CV024, Cherry Valley School quad, 530761E/4342438N, T9S, R65W, Sec. 26, SW, 19Jul08								
530761	4342438	153	11	2	2	poor	NM	NM
530762	4342433	120	11	2	3	poor	NM	NM
530894	4342668	97	19	3	5	poor	NM	NM
RG025, Russellville Gulch quad, 526218E/4344749N, T9S, R65W, Sec. 20, NW, 26Jul08								
526218	4344749	104	24	5	3	good	NM	NM
526222	4344751	114	23	6	5	good	NM	NM
526272	4344770	85	17	5	2	fair	NM	NM
526286	4344763	114	13	5	3	good	NM	NM
526303	4344750	127	23	12	6	very good	NM	NM
526307	4344775	85	16	5	3	fair	NM	NM
526392	4344723	156	27	8	6	poor	NM	NM
526435	4344653	187	28	6	4	very good	NM	NM
526557	4344436	134	25	7	4	poor	NM	NM
526425	4344385	102	22	4	6	fair	NM	NM
526563	4344131	60	21	3	4	poor	NM	NM
526812	4344189	126	16	18	18	very good	NM	NM
526692	4344657	105	26	5	5	good	NM	NM
526656	4344643	154	14	5	3	good	NM	NM
526653	4344636	211	20	6	5	very good	NM	NM
526529	4344707	72	13	5	5	fair	NM	NM
526318	4345157	61	18	2	5	poor	NM	NM
526148	4345147	182	22	6	4	fair	NM	NM
526106	4345185	108	26	4	6	fair	NM	NM
526048	4345263	214	27	7	6	good	NM	NM
525965	4345384	202	19	5	7	good	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
RG026, Russellville Gulch quad, 528544E/4344488N, T9S, R65W, Sec. 21, SE, 26Jul08								
528544	4344488	132	16	5	3	poor	NM	NM
528645	4344286	158	18	5	4	good	NM	NM
RG027, Russellville Gulch quad, 526048E/4345262N, T9S, R65W, Sec. 20, NW, 8Aug08								
526048	4345262	204	31	7	4	good	3	NM
526037	4345277	190	NA	4	3	poor	NA	NA
526001	4345349	168	20	5	3	poor	6	NM
525968	4345387	204	28	4	5	fair	2	NM
RG028, Russellville Gulch quad, 526130E/4345941N, T9S, R65W, Sec. 17, SW, 8Aug08								
526130	4345941	156	22	5	5	good	4	NM
526120	4345951	164	15	5	5	good	7	Twm
526097	4345960	165	11	9	4	very good	11	Twm
526093	4345974	162	23	8	4	good	18	granitic
526063	4345990	163	17	5	2	poor	9	granitic
526062	4346029	143	7	10	4	fair	5	NM
526007	4346056	120	20	3	4	fair	9	granitic
526007	4346046	174	20	15	5	good	5	granitic
525993	4346058	171	10	9	2	good	11	Twm
525996	4346067	151	NA	6	2	poor	4	granitic
525984	4346095	157	NA	9	4	poor	8	Twm
RG029, Russellville Gulch quad, 526179E/4348055N, T9S, R65W, Sec. 8, NW, 8Aug08								
upper unit								
526179	4348055	157	15	6	5	fair	NM	NM
NM	NM	103	NA	5	3	poor	NM	NM
526262	4348001	161	NA	6	5	poor	NM	NM
526203	4348032	177	20	4	4	poor	NM	NM
526199	4348037	163	22	5	4	poor	NM	NM
lower unit								
525979	4348032	347	NA	3	3	fair	NM	NM
525979	4348032	12	5	3	3	fair	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS031, JA Ranch, Castle Rock South quad, 511262E/4346840N, T9S, R67W, Sec. 15, NE, 19Aug08 and 22Aug08								
511262	4346840	325	NA	5	4	poor	NA	NA
511242	4346821	298	NA	6	4	poor	NA	NA
511235	4346806	297	NA	6	3	poor	NA	NA
511220	4346843	314	27	8	5	poor	NA	NA
511220	4346849	337	NA	6	7	poor	NA	NA
511202	4346831	300	NA	7	7	poor	NA	NA
511196	4346844	298	NA	14	4	poor	NA	NA
511195	4346594	355	NA	15	4	poor	NA	NA
NM	NM	18	NA	7	6	poor	11	NM
511165	4346862	314	NA	7	4	poor	12	Twm
NM	NM	306	NA	5	4	poor	5	Twm
511186	4346604	328	NA	5	5	poor	20	Twm
511179	4346601	338	14	4	4	poor	12	Twm
511177	4346607	318	15	4	4	poor	13	Twm
511171	4346606	309	NA	5	4	poor	10	Twm
511261	4346727	343	NA	9	4	poor	16	Twm
CRS032, JA Ranch, Castle Rock South quad, 511234E/4347074N, T9S, R67W, Sec. 10, SE, 22Aug08								
511234	4347074	332	NA	5	4	poor	NA	NA
511272	4347082	349	NA	11	5	poor	10	NM
511266	4347113	353	NA	11	2	poor	9	Twm
511239	4347096	336	22	5	3	fair	7	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS033, JA Ranch, Castle Rock South quad, 511869E/4347774N, T9S, R67W, Sec. 11, SW, 22Aug08								
511869	4347774	316	13	6	5	fair	16	Twm
511869	4347764	317	NA	4	4	poor	NA	NA
511877	4347760	344	NA	8	5	poor	NA	NA
511872	4347755	326	12	5	4	poor	NA	NA
511866	4347751	326	NA	3	3	poor	NA	NA
511899	4347730	321	10	13	4	fair	10	Twm
NM	NM	303	NA	12	6	poor	7	Twm
511924	4347699	333	NA	11	3	poor	4	Twm
CRS034, JA Ranch, Castle Rock South quad, 511715E/4347627N, T9S, R67W, Sec. 11, SW, 22Aug08								
	4347627	4	NA	4	2	poor	15	Twm
511712	4347633	355	23	1	4	fair	6	Twm
CRS035, JA Ranch, Castle Rock South quad, 511137E/4346565N, T9S, R67W, Sec. 15, NE, 22Aug08								
511137	4346565	132	8	11	5	poor	6	granitic
511129	4346561	127	NA	5	5	poor	16	Twm
511093	4346528	150	14	4	4	fair	7	Twm
511060	4346588	236	NA	3	3	poor	7	granitic
511065	4346573	63	17	6	13	fair	55	Twm
511185	4346603	342	NA	4	2	poor	19	Twm
511192	4346604	20	13	8	6	poor	11	Twm
511196	4346599	357	NA	4	2	poor	NA	NA

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
RG036, Russellville Gulch quad, 527939E/4346257N, T9S, R65W, Sec. 16, SW, 13Sep08								
527939	4346257	188	27	6	8	fair	3	granitic
527939	4346200	174	11	7	5	poor	7	quartzite
527950	4346162	185	23	7	4	poor	3	quartzite
527954	4346146	180	12	5	4	fair	13	granitic
527951	4346136	167	13	8	5	good	4	granitic
527944	4346121	155	10	7	4	poor	3	fg crystalline
527948	4346103	162	9	5	5	poor	5	Twm (?)
527937	4346084	152	14	8	4	poor	6	fg crystalline
527937	4346049	182	NA	4	3	poor	2	granitic
527918	4346057	157	NA	3	3	poor	9	Twm (?)
527912	4346036	137	17	5	3	poor	4	Twm (?)
527934	4346040	178	20	8	5	fair	12	Twm (?)
527904	4346011	166	25	6	5	poor	4	granitic
527911	4345994	150	15	9	6	poor	5	Twm
527931	4345995	163	18	8	4	fair	6	granitic
527929	4345859	187	10	9	5	poor	5	granitic
527921	4345847	189	18	9	5	poor	10	Twm
527923	4345833	162	NA	5	4	poor	9	Twm
527922	4345788	200	NA	3	3	poor	NA	NA
527937	4345774	157	5	5	3	fair	3	granitic
527961	4345769	198	NA	3	3	poor	NA	NA
527965	4345768	159	10	3	5	good	7	Twm
527984	4345783	173	NA	13	6	fair	NA	NA
527999	4345785	206	18	5	4	poor	8	Twm
528018	4345780	112	17	5	9	fair	8	Twm
528033	4345759	179	20	30	15	good	11	Twm
528028	4345713	164	13	10	4	fair	15	Twm
528040	4345699	185	NA	7	4	poor	4	Twm
528043	4345675	174	NA	4	3	poor	4	granitic
528034	4345668	149	14	3	4	poor	3	granitic
528019	4345704	200	23	16	5	good	11	Twm
527943	4345648	212	14	7	5	poor	19	Twm
527937	4345625	161	22	15	5	poor	10	Twm
527936	4345596	180	21	6	3	fair	NA	NA
527940	4345593	177	16	5	3	fair	8	granitic
527949	4345588	167	17	24	6	poor	7	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
RG037, Russellville Gulch quad, 527910E/4347550N, T9S, R65W, Sec. 9, SW, 15Sep08								
527910	4347550	151	23	7	4	fair	3	Twm
527919	4347547	142	18	5	5	good	5	Twm
527915	4347527	140	13	4	3	good	6	granitic
527891	4347619	155	17	5	4	fair	6	Twm
RG038, Russellville Gulch quad, 526274E/4348008N, T9S, R65W, Sec. 8, NW, 19Sep08								
526274	4348008	148	NA	5	3	poor	9	granitic
526288	4347980	147	20	8	5	fair	9	Twm
RG039, Russellville Gulch quad, 526478E/4349692N, T9S, R65W, Sec. 5, NW, 19Sep08								
526478	4349692	147	NA	4	3	poor	2	quartz
526522	4349736	190	NA	3	2	poor	3	granitic
526525	4349748	214	17	4	3	poor	2	quartz

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
RG040, Russellville Gulch quad, 526346E/4349737N, T9S, R65W, Sec. 5, NW, 19Sep08								
526346	4349737	152	NA	5	2	good	15	Twm
526338	4349747	125	23	3	2	poor	11	granitic
526277	4349719	159	NA	4	2	poor	4	granitic
526624	4349705	118	NA	3	3	poor	4	granitic
526249	4349701	134	25	5	5	very good	10	granitic
526249	4349697	157	18	5	2	poor	5	Twm
526245	4349702	154	22	5	3	poor	2	granitic
526113	4349716	165	NA	7	6	fair	4	granitic
526090	4349711	144	NA	13	5	fair	8	granitic
526070	4349735	149	NA	8	5	poor	5	Twm
526001	4349725	164	21	12	10	fair	11	granitic
526044	4349748	167	17	21	6	fair	8	Twm
526051	4349763	156	19	13	5	poor	6	granitic
526068	4349790	153	16	5	3	poor	18	Twm
526057	4349799	135	NA	6	5	poor	9	Twm
526044	4349824	184	23	6	4	poor	7	Twm
526035	4349810	135	21	5	5	poor	8	granitic
525981	4349745	130	20	5	5	fair	NA	NA
525990	4349732	162	19	11	6	fair	NA	NA
525984	4349718	172	18	9	5	fair	NA	NA
525837	4349861	157	16	5	5	fair	26	Twm
525030	4349881	193	18	8	4	fair	NA	NA
525877	4349930	186	8	12	11	poor	17	Twm
525852	4349942	217	22	15	9	very good	29	Twm

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
RG041, Russellville Gulch quad, 525640E/4349836N, T9S, R66W, Sec. 6, NE, 19Sep08								
525640	4349836	348	9	12	4	fair	13	granitic
525669	4349825	169	13	4	3	poor	5	granitic
525680	4349823	198	5	5	7	fair	8	granitic
525697	4349826	170	8	5	8	very good	5	Twm
525735	4349786	215	18	5	8	poor	7	granitic
525745	4349764	151	28	4	5	fair	25	Twm
526032	4349625	224	32	5	6	fair	10	granitic
526100	4349545	148	14	15	10	poor	6	granitic
526135	4349518	159	NA	23	8	poor	23	Twm
RG042, Russellville Gulch quad, 522637E/4355256N, T8S, R66W, Sec. 13, SW, 26Sep08								
upper unit								
522655	4354998	58	23	7	5	fair	NA	NA
lower unit								
522637	4355256	53	20	5	4	fair	8	Twm
522596	4355275	34	9	9	7	good	13	Twm
522570	4355244	92	11	7	9	fair	13	granitic
522615	4355229	182	7	7	5	fair	3	granitic
522617	4355212	164	17	3	5	fair	6	Twm
522569	4355163	129	13	7	5	poor	8	granitic
522599	4355170	144	13	3	5	poor	5	granitic
522727	4355119	115	11	6	5	poor	22	Twm
522756	4355134	127	13	11	10	poor	13	granitic
522753	4355098	118	5	6	6	poor	7	granitic
522761	4355083	131	14	15	11	poor	9	granitic
522740	4355068	175	18	2	4	poor	7	Twm
522734	4355059	138	12	22	11	fair	6	Twm
522703	4355018	200	10	3	4	poor	NA	NA
522748	4355017	128	17	14	6	good	10	Twm
522783	4354997	118	NA	10	11	fair	NA	NA

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
RG043, Russellville Gulch quad, 521644E/4355309N, T8S, R66W, Sec. 14, SW, 26Sep08								
521644	4355309	55	24	12	11	good	25	Twm
521655	4355296	147	29	12	8	fair	19	granitic
521671	4355282	92	30	7	6	fair	22	granitic
521605	4355275	104	NA	9	11	poor	39	Twm
521718	4355244	141	21	4	3	fair	5	granitic
521707	4355240	148	34	15	7	fair	13	Twm
521638	4355066	78	NA	8	7	poor	9	Twm
521608	4355107	64	22	19	10	good	13	Twm
521598	4355122	66	27	22	5	fair	13	Twm
CRS046, Castle Rock South quad, 515644E/4348307N, T9S, R66W, Sec. 6, NE, 21Oct08								
515644	4348907	80	NA	6	4	poor	NA	NA
515780	4348836	133	NA	5	4	poor	NA	NA
515783	4348835	118	NA	4	4	poor	NA	NA
515779	4348835	125	NA	4	2	poor	NA	NA
515725	4348825	142	26	11	8	fair	3	granitic
515722	4348832	109	11	4	3	poor	NA	NA
515728	4348829	123	NA	3	4	poor	NA	NA
CRS047, Castle Rock South quad, 515396E/4348035N, T9S, R66W, Sec. 7, NW, 21Oct08								
515396	4348035	204	14	5	4	poor	6	granitic
515400	4348023	179	21	2	3	fair	6	granitic
515385	4348018	181	11	12	6	fair	4	granitic
CRS048, Castle Rock South quad, 515995E/4349482N, T9S, R66W, Sec. 6, NE, 21Oct08								
515995	4349482	64	19	5	6	NM	NA	NA
CRS049, Castle Rock South quad, 517996E/4351659N, T8S, R66W, Sec. 32, NE, 22Oct08								
517996	4351659	74	11	9	5	poor	1	NM
518034	4351692	7	23	2	3	fair	1	NM
518114	4351679	60	17	3	4	poor	3	granitic

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS050, Castle Rock South quad, 518272E/4351634N, T8S, R66W, Sec. 33, NW, 22Oct08								
518272	4351634	139	21	5	6	poor	NA	NA
518292	4351652	147	15	2	3	poor	9	Twm
CRS051, Castle Rock South quad, 518215E/4351499N, T8S, R66W, Sec. 33, NW, 22Oct08								
518215	4351499	72	NA	7	5	poor	9	Twm
518167	4351464	81	NA	5	4	poor	13	Twm
518138	4351419	13	10	9	6	poor	34	Twm
518099	4351366	21	16	8	5	poor	6	granitic
518107	4351328	320	20	2	4	poor	8	Twm
CRS052, Castle Rock South quad, 517768E/4351132N, T8S, R66W, Sec. 32, SE, 22Oct08								
517768	4351132	115	NA	5	4	poor	19	Twm
CRS053, Castle Rock South quad, 515649E/4350572N, T8S, R66W, Sec. 31, SE, 16Nov08								
515649	4350572	98	20	5	5	fair	15	Twm
515650	4350593	36	NA	4	3	poor	21	Twm
515655	4350588	33	13	7	5	poor	18	Twm
515733	4350573	83	15	19	5	fair	24	Twm
515745	4350579	57	14	5	4	good	8	Twm
CRS054, Castle Rock South quad, 516166E/4352377N, T8S, R66W, Sec. 30, SE, 16Nov08								
516166	4352377	347	12	5	3	good	4	Twm
CRS055, Castle Rock South quad, 515313E/4354055N, T8S, R66W, Sec. 19, SW, 16Nov08								
515313	4354055	25	20	1	3	poor	2	granitic

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS056, Castle Rock South quad, 515490E/4354845N, T8S, R66W, Sec. 19, NE, 16Nov08								
515490	4354845	324	23	3	4	fair	1	granitic
515491	4354855	327	23	4	6	poor	NA	NA
515507	4354845	324	NA	11	5	poor	granules	NM
515517	4354849	59	10	3	5	fair	4	granitic
515525	4354812	344	10	6	3	poor	4	granitic
515598	4354735	327	NA	5	5	poor	NA	NA
CRS057, Castle Rock South quad, 519112E/4352937N, T8S, R66W, Sec. 28, NE, 19Nov08								
519112	4352937	38	25	1	2	poor	NA	NA
519116	4352924	31	22	4	5	fair	NA	NA
CRS058, Castle Rock South quad, 515674E/4355524N, T8S, R66W, Sec. 18, SE, 13Oct09								
515674	4355524	40	13	5	5	poor	NA	NA
515586	4355647	108	NA	4	5	poor	NA	NA
515673	4355587	23	13	6	3	poor	NA	NA
515775	4355484	50	19	3	5	poor	14	granitic
515767	4355475	80	NA	3	5	poor	4	fg crystalline
CRS059, Castle Rock South quad, 515067E/4355611N, T8S, R66W, Sec. 18, SW, 13Oct09								
515067	4355611	358	16	5	5	poor	6	Twm
515064	4355589	3	15	4	3	poor	3	Twm
515196	4355612	138	16	3	5	poor	6	Twm
515248	4355639	104	16	3	3	poor	4	fg crystalline
515274	4355643	97	27	9	5	fair	14	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS060, Castle Rock South quad, 515512E/4356024N, T8S, R66W, Sec. 18, NE, 13Oct09								
515512	4356024	17	19	5	5	poor	7	Twm
515335	4355975	63	NA	2	3	poor	NA	NA
515302	4355965	74	NA	2	3	poor	NA	NA
515298	4355966	50	NA	8	5	poor	6	granitic
515295	4355966	61	NA	2	2	poor	NA	NA
515280	4355971	120	24	2	4	poor	NA	NA
515131	4355861	47	NA	8	5	poor	7	Twm
CRS061, Castle Rock South quad, 518826E/4356945N, T8S, R66W, Sec. 9, SE, 13Oct09								
518826	4356945	109	14	5	4	fair	5	granitic
518849	4357024	178	13	16	10	poor	15	Twm
518833	4357038	204	8	18	12	poor	20	granitic
518880	4356958	197	9	16	12	poor	29	Twm
518894	4356933	205	9	5	6	poor	25	granitic
518896	4356881	177	21	3	4	fair	6	Twm
518895	4356872	167	14	10	5	fair	29	Twm
518944	4356833	196	15	4	5	poor	7	fg crystalline
CRS062, Castle Rock South quad, 518904E/4357179N, T8S, R66W, Sec. 9, SE, 14Oct09								
518904	4357179	178	23	13	8	poor	14	fg crystalline
518902	4357172	211	NA	10	7	poor	9	Twm
518936	4357108	187	17	23	9	poor	20	granitic
518935	4357158	176	14	34	7	poor	16	granitic
518931	4357132	175	20	2	3	poor	11	granitic
CRS063, Castle Rock South quad, 518508E/4357879N, T8S, R66W, Sec. 9, NW, 14Oct09								
518508	4357879	206	13	6	9	good	vcs to granules	NM
518532	4357830	238	15	3	5	fair	vcs to granules	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS064, Castle Rock South quad, 516694E/4356164N, T8S, R66W, Sec. 17, NW, 14Oct09								
516694	4356164	146	17	6	5	poor	NA	NA
516613	4356168	110	NA	19	6	fair	13	granitic
516605	4356155	138	14	3	4	fair	cs to granules	NM
516610	4356143	122	22	3	5	poor	NA	NA
516727	4356157	88	18	5	7	poor	13	Twm
CRS065, Castle Rock South quad, 516964E/4355813N, T8S, R66W, Sec. 17, SW, 17Oct09								
516964	4355813	136	22	9	5	poor	7	granitic
516984	4355805	152	12	2	2	poor	6	fg crystalline
516928	4355822	148	9	5	5	poor	44	Twm
516927	4355812	135	NA	5	4	poor	15	granitic
516957	4355792	140	12	8	5	fair	15	granitic
CRS066, Castle Rock South quad, 517378E/4355789N, T8S, R66W, Sec. 17, SE, 17Oct09								
517378	4355789	128	28	5	5	poor	3	granitic
517387	4355733	146	NA	5	6	poor	9	Twm
517437	4355813	147	NA	1	2	poor	4	Twm
517523	4355747	132	12	3	4	poor	5	granitic
517492	4355791	108	15	2	6	poor	8	granitic
517512	4355818	115	16	3	4	poor	5	granitic
CRN067, Castle Rock North quad, 518189E/4358393N, T8S, R66W, Sec. 9, NW, 17Oct09								
518189	4358393	192	25	5	5	poor	8	quartzite
CRN068, Castle Rock North quad, 517938E/4358749N, T8S, R66W, Sec. 4, SW, 17Oct09								
517938	4358749	192	9	13	6	fair	28	Twm
517931	4358754	211	21	5	6	poor	18	Twm
517920	4358762	163	21	11	6	fair	16	fg crystalline
517982	4358798	145	15	3	4	poor	cs to granules	NM
518022	4358833	172	15	10	5	poor	21	Twm
518244	4358878	115	NA	4	5	poor	NA	NA

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN069, Castle Rock North quad, 518329E/4358419N, T8S, R66W, Sec. 4, SW, 19Oct09								
518329	4358419	119	10	19	12	poor	14	Twm
518347	4358403	152	NA	5	5	poor	NA	NA
518383	4358393	117	17	11	5	fair	vcs to granules	NM
518398	4358386	141	15	5	2	poor	NA	NA
518350	4358228	84	24	3	6	fair	7	quartz
518375	4358201	126	9	5	5	poor	NA	NA
518357	4358186	113	NA	4	3	poor	NA	NA
518460	4358135	151	6	7	7	poor	8	fg crystalline
CRN070, Castle Rock North quad, 517697E/4358377N, T8S, R66W, Sec. 5, SE, 19Oct09								
517697	4358377	109	16	10	6	fair	13	granitic
517697	4358370	114	20	5	5	poor	29	Twm
517738	4358374	145	NA	12	4	poor	10	granitic
CRS071, Castle Rock South quad, 515424E/4356803N, T8S, R66W, Sec. 7, SW, 19Oct09								
515424	4356803	102	6	4	2	poor	NA	NA
515431	4356803	143	23	6	5	poor	15	granitic
CRN072, Castle Rock North quad, 516656E/4358392N, T8S, R66W, Sec. 5, SW, 19Oct09								
516656	4358392	57	NA	7	5	poor	4	Twm
516658	4358386	30	8	3	2	poor	vcs to small pebs	NM
516666	4358388	42	10	7	5	poor	51	Twm
516665	4358400	47	15	6	5	poor	NA	NA
516699	4358390	20	9	4	3	poor	19	Twm
516705	4358394	20	NA	3	4	poor	6	quartz
516708	4358399	355	19	4	2	poor	NA	NA
516717	4358388	329	7	3	3	poor	68	Twm
516730	4358392	42	26	10	6	fair	21	Twm
516781	4358390	83	15	3	4	poor	7	granitic
516727	4358420	47	NA	11	8	poor	12	Twm
516711	4358438	23	NA	7	5	poor	NA	NA

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN073, Castle Rock North quad, 513666E/4358837N, T8S, R67W, Sec. 1, SW, 20Oct09								
513666	4358837	116	19	9	3	fair	12	Twm
513674	4358839	98	31	5	4	poor	16	Twm
513650	4358855	96	25	5	3	poor	31	Twm
513876	4358726	123	12	4	3	poor	43	Twm
513853	4358691	141	12	10	5	fair	11	granitic
513881	4358693	163	25	4	2	poor	NA	NA
513902	4358720	98	15	5	5	poor	10	Twm
513945	4358687	146	22	4	3	poor	vcs to granules	NM
513942	4358667	142	22	4	3	poor	vcs to small pebs	NM
513937	4358667	157	18	4	5	poor	23	Twm
CRN074, Castle Rock North quad, 514070E/4358198N, T8S, R67W, Sec. 12, NE, 20Oct09								
514070	4358198	134	24	8	2	poor	22	granitic gneiss
514079	4358195	95	14	5	3	poor	5	granitic
514103	4358175	129	22	5	6	poor	12	quartzite
514110	4358168	145	21	3	5	poor	21	Twm
CRS075, Castle Rock South quad, 513470E/4358069N, T8S, R67W, Sec. 12, NW, 20Oct09								
513470	4358069	240	25	5	6	fair	12	granitic
513419	4358090	227	15	5	5	poor	4	granitic
513410	4358091	228	18	5	5	fair	6	granitic
513347	4358100	234	20	3	4	poor	12	granitic
CRN076, Castle Rock North quad, 514494E/4358856N, T8S, R67W, Sec. 1, SE, 20Oct09								
514494	4358856	112	17	5	5	fair	21	Twm
514509	4358846	87	NA	3	3	poor	12	granitic

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS077, Castle Rock South quad, 514676E/4358154N, T8S, R66W, Sec. 7, NW, 23Oct09								
514676	4358154	182	7	5	3	poor	4	granitic
514681	4358150	164	14	4	3	poor	11	granitic
514686	4358139	130	15	10	3	fair	3	quartz
514693	4358146	134	18	9	6	fair	NA	NA
514703	4358140	153	25	2	2	poor	4	granitic
514712	4358124	95	NA	2	4	poor	NA	NA
514729	4358119	161	15	11	6	poor	11	granitic
514736	4358113	160	15	7	4	poor	21	Twm
514776	4358073	116	15	7	6	poor	7	granitic
514890	4358002	129	17	13	5	fair	vcs to small pebs	NM
514930	4357961	123	25	2	4	poor	NA	NA
CRS078, Castle Rock South quad, 515043E/4357635N, T8S, R66W, Sec. 7, NW, 23Oct09								
515043	4357635	151	13	2	4	poor	vcs to small pebs	NM
515035	4357640	132	19	2	4	poor	3	fg crystalline
515034	4357637	156	13	5	3	poor	6	fg crystalline
515031	4357623	181	10	4	4	poor	vcs to small pebs	NM
515036	4357623	167	24	5	3	poor	3	granitic
CRS079, Castle Rock South quad, 515000E/4357246N, T8S, R66W, Sec. 7, SW, 23Oct09								
515000	4357246	174	26	5	3	fair	4	quartz
515005	4357241	175	15	5	5	good	vcs to small pebs	NM
515018	4357235	187	12	5	4	poor	15	granitic
515022	4357235	181	10	4	2	poor	NA	NA
514968	4357225	159	7	7	4	poor	26	Twm
514978	4357195	179	8	9	5	fair	30	Twm
515104	4357132	189	18	11	5	poor	23	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN080, Castle Rock North quad, 515242E/4358221N, T8S, R66W, Sec. 6, SW, 24Oct09								
upper unit								
515554	4357978	92	9	3	5	poor	6	Twm
lower unit								
515242	4358221	187	8	13	5	poor	6	quartz
515176	4358280	209	NA	5	3	poor	43	Twm
515290	4358178	177	11	5	3	poor	7	fg crystalline
515295	4358179	154	NA	5	4	poor	NA	NA
515402	4358105	199	12	9	5	poor	12	granitic
515408	4358106	197	17	3	5	fair	NA	NA
515423	4358097	156	12	8	2	poor	6	granitic
515447	4358074	165	12	2	4	poor	4	granitic
515452	4358072	183	12	5	4	poor	8	quartz
515464	4358040	154	9	5	3	poor	6	granitic
515467	4358017	160	4	5	3	poor	5	granitic
515475	4358019	168	8	4	4	poor	20	granitic
515510	4358042	120	24	5	5	fair	36	Twm
515558	4358030	147	4	5	5	poor	5	granitic
515551	4357955	145	23	6	3	poor	7	granitic
515550	4357940	154	3	5	5	poor	NA	NA
515656	4357924	173	NA	6	4	poor	7	granitic
515574	4357892	165	7	5	5	poor	15	granitic
515578	4357880	181	17	9	7	good	12	granitic
515568	4357866	155	11	11	4	fair	10	Twm
515578	4357808	137	10	13	8	fair	21	Twm
515511	4357839	164	3	11	5	poor	NA	NA
515509	4357832	156	NA	4	3	poor	NA	NA
CRN081, Castle Rock North quad, 514392E/4359367N, T8S, R67W, Sec. 1, NE, 24Oct09								
514392	4359367	115	28	8	6	fair	9	granitic
CRN082, Castle Rock North quad, 517138E/4363793N, T7S, R66W, Sec. 32, NE, 26Oct09								
517138	4363793	188	29	11	7	good	11	quartz

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN083, Castle Rock North quad, 517427E/4361271N, T7S, R66W, Sec. 32, NE, 27Oct09								
517427	4361271	178	17	7	6	fair	vcs to granules	NM
CRN084, Castle Rock North quad, 517270E/4361286N, T7S, R66W, Sec. 32, NE, 27Oct09								
517270	4361286	116	13	5	5	poor	vcs to granules	NM
517253	4361288	201	15	5	5	fair	6	quartz
517527	4361311	189	13	2	3	poor	NA	NA
CRN086, Castle Rock North quad, 517876E/4361709N, T7S, R66W, Sec. 28, SW, 27Oct09								
517876	4361709	117	10	5	5	poor	vcs to granules	NM
CRN087, Castle Rock North quad, 518216E/4361584N, T7S, R66W, Sec. 28, SW, 27Oct09								
518216	4361584	175	26	4	5	poor	vcs to granules	NM
518218	4361583	171	NA	5	5	poor	7	fg crystalline
518200	4361656	162	14	5	2	poor	NA	NA
518041	4361574	160	29	1	3	poor	vcs to granules	NM
CRN089, Castle Rock North quad, 517566E/4360909N, T7S, R66W, Sec. 32, NE, 27Oct09								
517566	4360909	138	25	6	4	poor	NA	NA
517553	4360904	63	13	3	4	poor	NA	NA
517549	4360892	61	21	3	7	poor	vcs to granules	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN090, Castle Rock North quad, 517380E/4360941N, T7S, R66W, Sec. 32, NE, 27Oct09								
517380	4360941	166	16	5	4	fair	vcs to granules	NM
517372	4360942	3	9	4	5	fair	vcs to granules	NM
517365	4360976	135	15	3	3	poor	vcs to granules	NM
517361	4361027	124	14	4	4	poor	vcs to granules	NM
517352	4361025	171	18	1	2	poor	vcs to granules	NM
517314	4361058	135	14	5	5	poor	vcs to granules	NM
517313	4361063	148	13	5	5	fair	vcs to granules	NM
517327	4361064	116	13	11	5	poor	NA	NA
517341	4361061	131	19	12	5	good	19	Twm
517356	4361068	132	10	6	5	fair	vcs to granules	NM
517371	4361081	124	8	6	6	fair	vcs to granules	NM
517338	4361097	122	16	5	5	fair	vcs to granules	NM
CRN091, Castle Rock North quad, 516456E/4358901N, T8S, R66W, Sec. 5, SW, 02Nov09								
516456	4358901	39	13	5	4	poor	9	granitic
516469	4358890	7	20	25	6	poor	7	granitic
516480	4358928	6	14	21	6	fair	8	granitic
516467	4358938	11	18	4	3	poor	4	granitic
516499	4358940	12	25	16	10	fair	6	quartz
516510	4358956	24	14	15	8	fair	5	granitic
CRN092, Castle Rock North quad, 516596E/4358883N, T8S, R66W, Sec. 5, SW, 02Nov09								
516596	4358883	25	8	14	10	poor	38	Twm
516599	4358910	24	NA	5	3	poor	25	Twm
516593	4358940	45	13	7	7	fair	11	granitic gneiss
516578	4358955	42	12	15	10	poor	14	fg crystalline
516619	4358997	72	18	5	5	poor	NA	NA

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN093, Castle Rock North quad, 516629E/4358999N, T8S, R66W, Sec. 5, SW, 02Nov09								
516629	4358999	42	14	10	5	fair	47	Twm
516648	4358919	61	22	1	2	poor	<1	NM
516675	4359004	25	NA	5	6	poor	8	Twm
516665	4359001	40	NA	8	5	poor	9	granitic
516645	4359013	25	18	5	5	poor	22	granitic
516669	4359047	52	NA	5	6	poor	26	Twm
516661	4359051	37	NA	7	8	poor	5	granitic
516674	4359063	25	NA	6	6	poor	18	Twm
516656	4359127	60	NA	10	2	poor	7	granitic
516659	4359133	37	NA	6	6	poor	19	Twm
CRN094, Castle Rock North quad, 516657E/4359232N, T8S, R66W, Sec. 5, NW, 02Nov09								
upper unit								
516657	4359232	220	15	5	5	fair	cs to granules	NM
516665	4359212	197	23	3	1	poor	cs to granules	NM
516658	4359232	215	16	5	5	poor	cs to granules	NM
516651	4359242	181	24	3	5	fair	cs to granules	NM
516702	4359381	160	9	3	5	poor	cs to granules	NM
lower unit								
516705	4359285	40	NA	6	6	poor	12	granitic
CRN096, Castle Rock North quad, 517369E/4359696N, T8S, R66W, Sec. 5, NE, 03Nov09								
517369	4359696	154	11	5	9	good	cs to granules	NM
CRN097, Castle Rock North quad, 517497E/4360086N, T7S, R66W, Sec. 32, SE, 03Nov09								
517497	4360086	134	10	5	5	fair	cs to granules	NM
517503	4360085	143	13	3	2	fair	3	quartz
517502	4360088	157	13	5	7	good	cs to granules	NM
517549	4360077	143	23	4	5	fair	cs to granules	NM
517531	4360075	161	13	11	6	fair	7	Twm
517565	4360109	72	2	10	3	poor	cs to granules	NM
517591	4360124	39	12	4	6	fair	cs to granules	NM
517607	4360120	148	24	1	4	fair	8	granitic
517606	4360086	178	18	1	6	fair	11	quartz
CRN098, Castle Rock North quad, 517757E/4360220N, T7S, R66W, Sec. 32, SE, 03Nov09								
517757	4360220	48	11	5	7	poor	7	gray quartzite
517774	4360176	136	23	5	5	fair	cs to granules	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN099, Castle Rock North quad, 517830E/4359937N, T8S, R66W, Sec. 4, NW, 03Nov09								
517830	4359937	173	NA	3	5	poor	6	granitic
517827	4359932	193	8	1	5	poor	cs to granules	NM
CRN100, Castle Rock North quad, 517918E/4359751N, T8S, R66W, Sec. 4, NW, 03Nov09								
517918	4359751	195	15	5	7	fair	cs to granules	NM
517924	4359747	236	8	5	5	fair	4	quartz
517953	4359749	174	NA	3	5	poor	cs to granules	NM
517975	4359784	194	22	5	7	poor	cs to granules	NM
CRN101, Castle Rock North quad, 517942E/4359525N, T8S, R66W, Sec. 4, NW, 03Nov09								
517942	4359525	50	18	6	5	fair	7	granitic
CRN102, Castle Rock North quad, 517903E/4359704N, T8S, R66W, Sec. 4, NW, 04Nov09								
517903	4359704	210	9	5	6	poor	cs to granules	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN103, Castle Rock North quad, 517786E/4359414N, T8S, R66W, Sec. 5, NE, 04Nov09								
517786	4359414	23	17	4	3	poor	9	granitic
517789	4359431	22	17	3	5	poor	50	Twm
517785	4359369	100	16	2	2	poor	8	granitic
517782	4359354	111	13	5	5	poor	14	Twm
517781	4359287	168	14	3	4	poor	cs to granules	NM
517759	4359272	119	15	11	12	fair	15	granitic
517675	4359292	145	9	6	4	fair	cs to granules	NM
517674	4359287	164	18	5	4	good	9	granitic
517679	4359284	157	13	23	5	good	12	granitic
517682	4359330	45	9	11	11	poor	22	granitic
CRN104, Castle Rock North quad, 517077E/4359703N, T8S, R66W, Sec. 5, NE, 04Nov09								
517077	4359703	30	21	4	5	fair	cs to granules	NM
517073	4359703	21	12	4	4	poor	NA	NA
517072	4359693	22	19	10	4	poor	48	Twm
CRN105, Castle Rock North quad, 515114E/4358364N, T8S, R66W, Sec. 7, NW, 04Nov09								
515114	4358364	220	21	7	5	fair	12	Twm
515098	4358371	233	20	5	3	poor	8	granitic
CRN106, Castle Rock North quad, 516684E/4359771N, T8S, R66W, Sec. 5, NW, 04Nov09								
516684	4359771	85	25	3	5	poor	NA	NA

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS107, Castle Rock South quad, 518570E/4357448N, T8S, R66W, Sec. 9, SW, 06Nov09								
518570	4357448	130	17	5	7	fair	21	Twm
518601	4357475	122	14	2	4	poor	6	granitic
518581	4357490	145	10	4	5	poor	NA	NA
518602	4357557	140	18	5	5	fair	8	quartz
518632	4357590	158	NA	4	4	poor	4	granitic
518626	4357657	157	NA	3	5	poor	10	granitic
518625	4357652	143	12	2	5	poor	3	granitic
518626	4357647	148	7	3	4	poor	3	granitic
518618	4357658	140	7	3	3	poor	NA	NA
518470	4357422	171	NA	5	8	fair	10	granitic
518476	4357419	139	NA	5	4	poor	19	granitic
518520	4357344	181	13	10	5	good	cs to granules	NM
CRS108, Castle Rock South quad, 518796E/4357370N, T8S, R66W, Sec. 9, SE, 06Nov09								
518796	4357370	174	19	5	5	fair	11	granitic
518806	4357392	207	17	9	10	good	23	granitic
518787	4357421	223	7	5	7	fair	29	Twm
518754	4357453	201	7	11	8	fair	28	granitic
518714	4357475	152	7	7	5	poor	cs to <0.5	NM
518694	4357472	154	8	3	3	poor	cs to <0.5	NM
518742	4357429	164	9	5	5	poor	11	granitic
518789	4357381	180	NA	7	7	poor	12	granitic

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN109, Castle Rock North quad, 518369E/4358617N, T8S, R66W, Sec. 4, SW, 07Nov09								
518369	4358617	98	18	9	4	fair	11	granitic
518370	4358616	157	12	1	3	poor	4	fg crystalline
518404	4358491	116	18	6	3	poor	9	granitic
518413	4358485	140	24	5	5	fair	9	granitic
518368	4358418	121	8	6	4	poor	11	granitic
518383	4358394	136	18	11	5	fair	cs to granules	NM
518397	4358387	117	19	7	5	fair	9	Twm
518385	4358375	112	16	5	4	poor	6	granitic
518363	4358364	111	20	2	3	poor	cs to granules	NM
518379	4358295	100	22	8	3	poor	cs to granules	NM
518352	4358274	115	12	3	8	poor	9	granitic
518348	4358235	100	18	7	9	fair	13	Twm
518377	4358202	128	10	6	5	fair	cs to granules	NM
518421	4358266	150	25	5	4	poor	NA	NA
518438	4358269	126	NA	5	5	poor	26	Twm
518469	4358176	184	16	1	5	poor	cs to granules	NM
518510	4358046	147	16	4	5	fair	cs to granules	NM
CRN110, Castle Rock North quad, 518505E/4358613N, T8S, R66W, Sec. 4, SW, 07Nov09								
518505	4358613	180	22	12	11	fair	6	granitic
518535	4358621	145	15	5	10	fair	4	granitic
518533	4358631	82	12	5	9	fair	cs to granules	NM
518563	4358622	83	14	7	7	poor	19	granitic
518556	4358652	183	12	3	6	fair	cs to granules	NM
518532	4358929	169	22	8	6	poor	13	granitic
518515	4358932	138	23	30	7	good	cs to granules	NM
518485	4358965	151	10	11	5	fair	9	granitic
518457	4358936	51	17	9	11	good	9	granitic
518393	4358773	60	14	5	5	fair	26	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN111, Castle Rock North quad, 517463E/4358265N, T8S, R66W, Sec. 8, NE, 08Nov09								
517463	4358265	7	20	4	3	poor	38	Twm
517443	4358261	62	12	10	11	good	7	granitic
517429	4358282	50	20	6	7	fair	5	Twm
517439	4358286	45	NA	4	5	poor	NA	NA
517390	4358311	26	NA	7	7	poor	30	Twm
517382	4358321	55	20	2	2	poor	cs to granules	NM
517376	4358303	352	18	4	6	fair	5	granitic
517356	4358315	31	21	8	5	fair	7	Twm
517362	4358335	11	7	5	4	fair	5	granitic
517377	4358436	121	26	5	5	fair	5	quartz
517373	4358389	106	10	8	7	poor	5	quartz
517361	4358334	12	13	5	5	poor	6	Twm
CRS112, Castle Rock South quad, 517437E/4358001N, T8S, R66W, Sec. 8, NE, 08Nov09								
517437	4358001	96	23	22	21	fair	36	Twm
517410	4357949	80	11	4	5	fair	6	fg crystalline
517495	4357750	69	23	5	5	fair	20	Twm
CRS113, Castle Rock South quad, 517410E/4357458N, T8S, R66W, Sec. 8, SE, 08Nov09								
517410	4357418	107	NA	4	4	poor	33	Twm
517362	4357294	161	20	10	4	fair	12	Twm
CRN114, Castle Rock North quad, 517207E/4358464N, T8S, R66W, Sec. 8, NE, 08Nov09								
517207	4358464	40	12	12	6	good	44	Twm
517230	4358480	68	22	5	4	poor	30	Twm
517264	4358496	92	NA	3	5	poor	NA	NA
517234	4358507	75	25	8	8	fair	6	Twm
517216	4358529	48	18	9	7	fair	14	Twm

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRN116, Castle Rock North quad, 517262E/4358555N, T8S, R66W, Sec. 5, SE, 13Nov09								
517262	4358555	91	9	8	11	fair	12	granitic
517260	4358569	45	9	22	14	fair	43	Twm
517356	4358608	85	25	20	10	fair	12	granitic
517436	4358689	153	14	10	5	fair	10	granitic
517443	4358794	86	16	7	9	poor	8	granitic
517492	4358809	97	15	6	5	poor	8	Twm
517546	4358832	136	10	15	12	fair	7	lt gy quartzite
517549	4358791	122	15	7	4	poor	17	lt gy quartzite
CRS122, Castle Rock South quad, 517833E/4356141N, T8S, R66W, Sec. 16, NW, 19Nov09								
517833	4356141	355	11	5	7	poor	cs to granules	NM
517792	4356028	22	NA	5	5	poor	22	granitic
517679	4356032	19	NA	6	4	poor	16	Twm
517679	4356035	23	NA	3	3	poor	8	granitic
517668	4356031	38	12	5	2	poor	6	granitic
517667	4356034	24	NA	3	3	poor	9	granitic
517643	4356043	12	NA	4	3	poor	6	fg crystalline
517587	4356027	28	NA	4	3	poor	7	granitic
517528	4356022	62	NA	5	5	poor	cs to granules	NM
517509	4356022	43	13	4	3	poor	10	granitic
517718	4356026	48	13	4	4	poor	8	granitic
517789	4356026	18	6	5	3	poor	19	Twm

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
CRS129, Castle Rock South quad, 519111E/4354655N, T8S, R66W, Sec. 21, NE, 21Nov09								
upper unit								
519048	4354802	90	6	2	2	poor	cs to granules	NM
519058	4354927	85	13	8	5	poor	NA	NA
middle unit								
519111	4354655	184	22	4	3	poor	8	granitic
519124	4354667	212	NA	3	3	poor	cs to granules	NM
519121	4354674	182	NA	4	3	poor	cs to granules	NM
519124	4354664	214	20	7	5	poor	cs to granules	NM
519113	4354656	182	25	5	4	poor	3	granitic
519102	4354783	168	12	2	2	poor	<1	NM
lower unit								
519187	4354744	102	5	6	5	poor	13	Twm
519178	4354743	96	6	3	5	poor	14	granitic
519081	4354777	100	NA	5	5	poor	NA	NA
CV130, Cherry Valley School quad, 529168E/4343158N, T9S, R65W, sec. 27, NW, 23Jun10								
529168	4343158	270	NA	4	3	poor	NA	NA
529173	4343135	301	15	5	3	poor	vcs-granules	NM
529201	4343105	134	NA	5	3	poor	11	granitic
529198	4343158	309	NA	7	5	poor	11	granitic
529350	4343017	35	23	3	4	poor	3	granitic
529359	4343011	45	9	4	3	poor	4	granitic
RG131, Russellville Gulch quad, 524447E/4350818N, T8S, R65W, sec. 31, SW, 24Jun10								
524447	4350818	118	25	3	4	fair	15	Twm
524445	4350811	58	23	2	4	fair	6	Twm
524447	4350811	122	27	4	5	good	NA	NA
524452	4350807	120	6	12	5	NM	vcs-granules	NM
524470	4350815	131	22	5	7	fair	vcs-granules	NM
524539	4350822	100	21	8	8	fair	13	granitic
RG132, Russellville Gulch quad, 524571E/4350814N, T8S, R65W, sec. 31, SW, 24Jun10								
524571	4350814	82	18	2	4	NM	NA	NA
524578	4350802	88	30	2	4	poor	vcs-granules	NM
524604	4350788	68	16	4	5	poor	NA	NA
524602	4350815	14	21	2	3	fair	8	fg crystalline
524634	4350835	105	13	5	7	poor	9	quartz
524638	4350830	145	8	9	11	fair	11	fg crystalline
524646	4350820	156	19	7	7	poor	NA	NA

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
524655	4350819	95	11	6	9	poor	8	granitic
524657	4350768	47	24	4	4	fair	cs-pebbles	NM
524673	4350793	114	16	4	7	poor	cs-granules	NM
524700	4350790	115	15	10	5	fair	12	fg crystalline
524701	4350725	158	19	7	8	poor	8	granitic
524735	4350729	152	18	3	4	poor	NA	NA
524737	4350697	203	15	6	5	poor	9	fg crystalline
524760	4350691	166	18	5	5	fair	cs-granules	NM
524776	4350693	162	15	4	3	poor	12	Twm
524798	4350688	128	34	3	3	poor	6	Twm
524814	4350671	200	23	5	5	good	cs-granules	NM
524839	4350654	168	14	4	4	poor	5	granitic
524835	4350642	232	29	3	5	poor	16	granitic
524840	4350625	173	15	6	5	fair	10	fg crystalline
524853	4350619	115	14	5	5	poor	19	Twm
524859	4350722	136	13	3	4	poor	12	fg crystalline
524857	4350739	207	10	3	4	poor	cs-pebbles	NM
524796	4350761	130	17	5	5	fair	42	Twm
524797	4350754	87	15	4	4	poor	10	fg crystalline
524783	4350760	62	16	4	4	fair	4	quartz
524790	4350768	121	12	9	9	fair	cs-granules	NM
524797	4350796	104	18	7	8	fair	5	fg crystalline
524772	4350836	164	NA	2	4	poor	4	fg crystalline
524830	4350785	264	15	3	5	fair	5	Twm
524834	4350782	200	26	13	8	fair	7	fg crystalline
524869	4350736	151	10	5	5	fair	7	granitic
524945	4350723	178	21	13	10	fair	43	Twm
524949	4350687	63	10	5	5	fair	9	Twm
524951	4350664	160	14	4	4	poor	cs-granules	NM
524947	4350664	198	18	4	5	poor	cs-granules	NM
524882	4350655	162	5	6	5	fair	11	fg crystalline
524915	4350602	162	13	4	4	poor	3	quartz
RG133, Russellville Gulch quad, 525013E/4351049N, T8S, R65W, sec. 31, SW, 06Jul10								
525013	4351049	176	17	13	5	good	6	fg crystalline
525024	4351034	195	10	8	5	good	46	Twm
525026	4351024	180	17	3	4	poor	cs-granules	NM
525023	4351048	189	11	3	6	fair	5	granitic
525025	4351048	163	5	6	5	fair	4	fg crystalline
525028	4351038	184	6	2	2	poor	cs-granules	NM

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525033	4351046	188	NA	5	4	poor	8	granitic
525036	4351052	158	5	8	2	poor	4	granitic
525002	4351065	157	17	10	4	fair	9	granitic
525006	4351074	152	17	5	4	poor	37	Twm
525005	4351097	124	28	4	5	poor	12	Twm
525021	4351140	138	NA	6	2	poor	9	Twm
525012	4351164	165	3	15	11	poor	30	Twm
524986	4351124	152	NA	7	6	poor	15	granitic
524981	4351133	186	NA	5	5	poor	6	granitic
524971	4351159	190	NA	8	6	poor	15	fg crystalline
524949	4351166	165	11	12	5	poor	14	Twm
524950	4351152	152	19	8	5	poor	13	Twm
524948	4351150	173	NA	5	5	poor	7	fg crystalline
524940	4351150	205	27	27	14	good	33	Twm
524949	4351123	167	18	8	5	poor	10	granitic
524940	4351106	194	8	10	5	fair	11	Twm
524965	4351062	180	13	7	8	poor	8	fg crystalline
524932	4351075	120	7	12	8	poor	6	granitic
524918	4351016	163	NA	4	9	poor	15	fg crystalline
524916	4351103	131	25	8	5	fair	6	fg crystalline
524910	4351131	171	10	15	10	fair	10	quartz
524903	4351119	152	10	5	5	poor	7	quartz
524898	4351086	160	15	9	7	poor	14	Twm
524889	4351080	140	NA	7	9	poor	8	granitic
524871	4351077	110	22	5	5	poor	15	fg crystalline
524858	4351079	135	NA	16	7	poor	10	granitic
524874	4351128	200	NA	5	5	poor	13	granitic gneiss
524796	4351143	153	6	11	7	fair	15	Twm
524846	4351145	108	10	6	6	fair	11	granitic
524843	4351132	131	NA	3	7	poor	cs-granules	NM
524827	4351160	90	20	18	14	fair	30	fg crystalline
524899	4351136	149	16	6	6	poor	12	granitic
524861	4351221	206	5	5	5	poor	4	fg crystalline
524846	4351229	151	NA	6	5	poor	NA	NA
524870	4351242	126	NA	5	6	poor	NA	NA
524875	4351232	139	5	4	4	fair	6	granitic
524878	4351231	107	15	13	6	good	53	Twm
524885	4351249	146	NA	10	5	poor	28	Twm
524861	4351255	134	NA	7	4	poor	4	fg crystalline
524859	4351262	141	NA	9	5	poor	17	Twm

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524852	4351271	90	14	5	5	poor	15	fg crystalline
524869	4351311	194	10	4	5	poor	7	fg crystalline
524867	4351327	165	5	8	5	poor	13	granitic
RG134, Russellville Gulch quad, 524946E/4351449N, T8S, R65W, sec. 31, NW, 07Jul10								
524946	4351449	157	18	5	3	poor	6	fg crystalline
524931	4351477	141	13	5	5	poor	cs-pebbles	NM
524932	4351489	128	10	4	5	poor	cs-pebbles	NM
524766	4351477	148	10	10	7	poor	15	Twm
524761	4351481	167	NA	13	5	poor	6	granitic
524750	4351480	146	NA	4	4	poor	7	granitic gneiss
524753	4351481	168	NA	3	4	poor	9	granitic
524756	4351494	168	22	13	8	good	31	Twm
524715	4351487	159	NA	12	5	poor	43	Twm
524700	4351483	180	16	6	5	poor	9	fg crystalline
524730	4351535	173	NA	15	5	poor	11	granitic
524727	4351529	154	NA	6	5	poor	cs-granules	NM
524745	4351505	196	18	5	4	poor	cs-granules	NM
524869	4351522	142	NA	5	5	poor	5	fg crystalline
524870	4351570	143	7	18	16	poor	9	granitic
524829	4351582	152	15	14	8	fair	5	granitic
RG135, Russellville Gulch quad, 525028E/4351868N, T8S, R65W, sec. 31, NW, 07Jul10								
525028	4351868	99	3	5	5	poor	4	granitic
524983	4351889	148	5	3	4	poor	5	granitic
524934	4351976	142	9	7	5	poor	NA	NA
524888	4351911	109	16	5	5	poor	8	quartz
524705	4351961	100	NA	8	5	NM	14	Twm
RG136, Russellville Gulch quad, 524827E/4351186N, T8S, R65W, sec. 31,SW, 13Jul10								
524827	4351186	76	27	10	21	good	40	Twm
524827	4351202	149	NA	5	5	poor	8	granitic
524803	4351266	119	NA	9	5	poor	10	fg crystalline
524708	4351298	139	16	7	9	good	8	fg crystalline
524665	4351393	66	NA	4	5	poor	30	Twm
524705	4351441	152	NA	13	7	poor	13	granitic
524589	4351417	131	16	5	8	poor	8	quartz
524544	4351446	143	15	14	7	poor	12	fg crystalline
524416	4351569	125	NA	8	5	poor	15	granitic
524400	4351585	119	NA	5	4	poor	10	fg crystalline

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
524411	4351581	137	22	7	11	fair	20	Twm
524432	4351583	45	5	4	5	poor	4	granitic
524375	4351635	168	17	7	7	fair	15	Twm
524335	4351677	182	NA	5	4	fair	5	granitic
524318	4351727	221	NA	4	5	poor	cs-granules	NM
524246	4351740	188	18	20	18	good	10	fg crystalline
524261	4351757	121	24	6	15	fair	23	white quartzite
524237	4351773	184	18	8	11	fair	19	Twm
524356	4351817	191	NA	11	7	poor	15	Twm
524286	4351848	171	NA	5	4	poor	11	fg crystalline
524199	4351834	160	27	9	10	fair	19	Twm
524105	4351881	115	NA	9	6	poor	12	fg crystalline
524130	4351887	166	11	23	18	fair	20	granitic
RG137, Russellville Gulch quad, 524791E/4351184N, T8S, R65W, sec. 31, NW, 14Jul10								
524791	4351184	135	NA	5	4	poor	9	Twm
524738	4351183	142	15	12	5	poor	9	granitic
524700	4351149	159	18	10	5	poor	20	fg crystalline
524688	4351154	142	NA	7	8	poor	11	fg crystalline
524686	4351172	115	12	5	5	poor	cs-granules	NM
524700	4351205	122	23	12	12	fair	cs-granules	NM
524639	4351216	133	8	6	4	poor	8	granitic
524592	4351221	161	20	3	4	fair	6	granitic
524583	4351224	181	17	6	5	good	7	granitic
524581	4351284	215	18	6	5	fair	cs-granules	NM
524578	4351294	192	20	5	7	fair	6	fg crystalline
524569	4351310	108	15	5	4	fair	cs-granules	NM
524551	4351310	148	15	6	5	poor	5	fg crystalline
524541	4351309	184	19	10	5	good	7	Twm
524565	4351284	103	16	5	5	fair	4	granitic
524563	4351259	157	7	5	5	fair	11	fg crystalline
524551	4351291	184	13	12	7	fair	9	fg crystalline
524518	4351283	141	25	8	5	fair	cs-granules	NM
524485	4351315	165	20	4	3	good	cs-granules	NM
524488	4351255	180	15	6	10	fair	cs-granules	NM
524487	4351220	137	12	5	5	poor	8	granitic
524471	4351200	134	NA	11	11	poor	13	granitic
524392	4351331	202	16	13	11	fair	18	Twm
524377	4351362	184	10	3	4	poor	NA	NA
524349	4351294	205	5	5	4	poor	cs-granules	NM

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
524295	4351342	204	NA	5	5	poor	cs-granules	NM
524287	4351346	196	14	5	4	poor	12	granitic
524251	4351354	198	10	9	6	poor	6	quartz
524243	4351355	177	11	3	3	poor	cs-granules	NM
524176	4351408	196	NA	5	4	poor	9	granitic
524196	4351421	168	13	5	4	poor	cs-granules	NM
524210	4351427	182	NA	4	3	poor	46	Twm
524193	4351474	167	20	5	5	poor	9	granitic
524158	4351490	225	NA	4	5	poor	5	granitic
524126	4351431	159	20	21	10	poor	15	Twm
524154	4351547	192	26	4	5	poor	7	fg crystalline
524154	4351559	173	26	13	5	poor	NA	NA
524159	4351568	159	20	6	5	fair	10	granitic
524150	4351629	70	15	4	5	poor	30	Twm
524094	4351613	119	NA	5	5	poor	5	quartz
524086	4351586	127	9	6	5	poor	cs-granules	NM
524065	4351608	151	15	10	5	poor	12	quartz
524039	4351619	120	10	7	10	poor	cs-granules	NM
524023	4351637	125	13	11	11	poor	21	granitic
523811	4351686	159	30	7	5	poor	23	Twm
RG138, Russellville Gulch quad, 523805E/4351660N, T8S, R66W, sec. 36, NE, 15Jul10								
upper unit								
523805	4351660	85	13	5	5	poor	20	Twm
523887	4351538	68	NA	10	11	poor	cs-granules	NM
523871	4351480	128	17	18	9	poor	5	granitic
524004	4351433	186	NA	9	7	poor	12	Twm
524006	4351431	163	18	4	4	fair	18	granitic
524019	4351423	176	15	8	9	poor	15	Twm
524016	4351353	163	18	12	8	fair	cs-pebbles	NM
524049	4351232	131	NA	6	6	poor	11	Twm
524061	4351163	187	8	11	6	poor	7	granitic
524150	4351253	168	NA	5	4	poor	15	Twm
524145	4351236	147	8	3	4	poor	cs-granules	NM
524130	4351096	172	11	3	3	poor	cs-pebbles	NM
524169	4351091	90	17	8	6	poor	cs-granules	NM
524164	4351067	142	5	4	5	poor	3	fg crystalline
524152	4351014	163	6	10	5	poor	12	Twm
524174	4351005	184	25	14	5	poor	NA	NA
524181	4351013	108	26	6	5	fair	9	Twm

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
524191	4351017	121	11	5	7	poor	7	Twm
524412	4351009	115	11	6	4	poor	cs-pebbles	NM
524400	4350974	97	21	5	5	poor	10	granitic
524408	4350990	109	13	7	10	fair	33	Twm
524414	4351006	100	13	5	4	fair	cs-pebbles	NM
524423	4350978	148	17	4	4	poor	cs-granules	NM
524417	4350976	166	19	3	4	poor	cs-granules	NM
524432	4350986	141	14	5	5	poor	cs-granules	NM
524440	4350989	144	27	7	6	good	cs-granules	NM
524462	4350977	118	21	4	5	good	9	granitic
524486	4350960	137	NA	8	NM	poor	5	fg crystalline
524521	4350960	138	31	5	NM	fair	cs-pebbles	NM
524533	4350948	98	14	2	NM	poor	cs-pebbles	NM
524516	4350916	114	22	4	NM	poor	7	granitic
lower unit								
523789	4351587	277	17	9	6	poor	17	fg crystalline
524141	4350972	242	15	6	9	poor	cs-granules	NM
524131	4350944	139	24	3	4	poor	5	Twm

RG139, Russellville Gulch quad, 524861E/4350488N, T8S, R65W, sec. 31, SW, 16Jul10
upper unit

524861	4350488	64	34	11	6	fair	60	Twm
524900	4350454	6	24	7	5	good	cs-granules	NM
524921	4350448	90	14	8	7	fair	10	Twm
524951	4350426	174	12	5	5	poor	cs-granules	NM
524961	4350419	178	15	5	5	poor	5	Twm
524946	4350362	45	21	6	6	fair	cs-granules	NM
525211	4350388	14	18	5	5	poor	4	quartz
525222	4350368	33	13	8	7	poor	5	granitic
525207	4350354	62	22	6	10	fair	29	Twm
525194	4350318	42	20	7	11	good	10	Twm
525202	4350294	42	NA	6	10	poor	cs-pebbles	NM
525236	4350374	7	NA	6	3	poor	11	Twm
525240	4350378	348	NA	2	4	poor	25	Twm
525240	4350381	25	NA	3	4	poor	5	granitic
525250	4350381	27	4	6	4	poor	11	granitic
525241	4350368	18	13	5	4	poor	9	granitic
525252	4350360	21	13	5	4	poor	cs-granules	NM
525223	4350367	29	12	8	5	fair	9	granitic

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
525229	4350359	30	12	4	7	fair	cs-granules	NM
525205	4350354	66	21	9	11	good	30	Twm
525199	4350331	80	26	25	16	good	cs-granules	NM
525195	4350291	58	23	11	12	fair	cs-pebbles	NM
525205	4350286	47	12	16	10	good	12	granitic
525223	4350281	128	19	14	10	fair	cs-granules	NM
525233	4350295	97	22	5	3	poor	4	granitic
525286	4350327	53	23	5	3	fair	15	granitic
525308	4350322	38	24	5	4	poor	cs-pebbles	NM
525454	4350243	342	29	19	10	good	34	Twm
525462	4350211	27	NA	5	4	poor	10	granitic
525461	4350201	27	7	6	5	fair	7	granitic
525502	4350207	85	23	5	9	good	cs-granules	NM
525542	4350163	140	26	9	9	fair	25	Twm
525553	4350172	127	13	5	6	poor	cs-granules	NM
525566	4350199	342	28	3	3	good	cs-vcs	NM
525586	4350215	359	15	3	11	poor	cs-granules	NM
525589	4350213	64	NA	7	8	poor	12	Twm
525613	4350163	10	20	8	6	fair	21	Twm
525635	4350227	234	18	9	9	good	12	Twm
525638	4350208	174	22	14	7	fair	19	Twm
525646	4350242	212	28	6	7	good	12	fg crystalline
525646	4350176	186	14	8	5	fair	9	granitic
525638	4350166	173	14	5	5	fair	NA	NA
525651	4350165	187	21	16	6	fair	cs-pebbles	NM
525668	4350176	208	23	8	5	fair	cs-granules	NM
525673	4350167	195	24	16	4	poor	7	granitic
525653	4350157	179	15	22	4	fair	9	granitic
525663	4350157	204	26	7	6	good	cs-pebbles	NM
525646	4350146	203	20	6	5	poor	cs-pebbles	NM
525654	4350121	172	23	5	5	fair	cs-pebbles	NM
525668	4350112	182	23	11	10	poor	5	granitic
525686	4350115	219	25	5	5	fair	7	quartz
525677	4350046	250	27	9	10	fair	7	Twm
lower unit								
524921	4350185	168	23	7	14	very good	cs-pebbles	NM
525475	4350166	51	23	14	12	fair	12	granitic
525504	4350145	116	28	8	6	fair	27	Twm
525528	4350146	358	29	10	7	good	6	granitic
525536	4350143	11	28	18	9	good	cs-granules	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
525545	4350153	127	23	4	8	fair	7	granitic
RG140, Russellville Gulch quad, 525130E/4349951N, T9S, R65W, sec. 6, NE, 19Jul10								
525130	4349951	168	31	6	6	fair	11	fg crystalline
525104	4349967	147	21	8	8	poor	5	granitic
524560	4350228	75	22	7	7	fair	6	quartz
524560	4350243	86	25	16	10	good	16	Twm
RG141, Russellville Gulch quad, 524123E/4350907N, T8S, R66W, sec. 36, SE, 20Jul10								
524123	4350907	142	8	4	5	fair	4	granitic
524113	4350931	90	14	5	5	good	3	granitic
524111	4350970	139	18	13	10	fair	cs-pebbles	NM
RG142, Russellville Gulch quad, 523772E/4350667N, T8S, R66W, sec. 36, SE, 20Jul10								
523772	4350667	133	11	7	6	fair	16	Twm
523730	4350611	122	20	15	16	poor	37	Twm
523686	4350517	226	10	5	12	fair	46	Twm
523539	4350496	160	15	5	2	poor	cs-pebbles	NM
523513	4350520	193	23	10	7	fair	cs-pebbles	NM
RG143, Russellville Gulch quad, 524430E/4350692N, T8S, R65W, sec. 31, SW, 20Jul10								
524430	4350692	212	21	2	4	poor	7	granitic
524437	4350706	173	22	12	7	fair	32	Twm
524483	4350637	152	NA	7	6	poor	31	Twm
524484	4350630	178	27	3	5	poor	10	granitic
524525	4350607	246	25	5	5	poor	19	Twm
524539	4350605	235	19	6	5	fair	29	Twm
524501	4350667	157	18	11	6	fair	cs-granules	NM
CV144, Cherry Valley School quad, 529127E/4342808N, T9S, R65W, sec. 27, SW, 21Jul10								
529127	4342808	98	4	5	5	fair	cs-granules	NM
529119	4342810	92	11	5	4	fair	cs-granules	NM
529125	4342810	98	NA	3	3	poor	cs-granules	NM
529119	4342807	122	8	3	3	poor	cs-granules	NM
529103	4342807	75	12	3	3	poor	cs-granules	NM
529086	4342812	91	11	4	4	poor	cs-granules	NM
529065	4342819	126	14	5	3	poor	cs-granules	NM
529047	4342817	83	23	5	5	fair	cs-granules	NM
529067	4342833	47	18	10	7	poor	cs-granules	NM
529001	4342834	97	14	7	3	poor	cs-granules	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
528900	4342862	82	29	5	5	poor	cs-granules	NM
528800	4342871	130	12	5	8	poor	cs-granules	NM
528776	4342860	58	21	3	4	poor	cs-granules	NM
528850	4342858	86	20	6	4	poor	4	quartz
528848	4342833	86	17	7	5	poor	cs-granules	NM
528872	4342831	91	12	4	3	poor	cs-granules	NM
528871	4342827	140	23	3	5	poor	cs-granules	NM
528907	4342815	80	24	6	5	poor	cs-granules	NM
528944	4342826	101	15	6	3	poor	cs-pebbles	NM
528967	4342754	77	5	6	5	poor	cs-pebbles	NM
528995	4342748	91	16	8	5	poor	cs-granules	NM
529025	4342760	27	9	9	12	good	cs-granules	NM
529053	4342751	101	13	12	8	fair	cs-granules	NM
529054	4342722	69	14	5	3	poor	cs-granules	NM
529068	4342704	40	NA	4	7	poor	cs-pebbles	NM
529079	4342697	96	10	10	9	fair	cs-pebbles	NM
CV145, Cherry Valley School quad,528635E/4343165N, T9S, R65W, sec. 28, NE, 21Jul10								
528635	4343165	148	21	6	5	poor	cs-pebbles	NM
528650	4343145	170	NA	6	7	poor	cs-granules	NM
528674	4343131	117	12	3	3	poor	cs-granules	NM
528665	4343132	155	16	3	5	poor	cs-granules	NM
528709	4343117	98	9	6	3	poor	cs-granules	NM
528745	4343031	40	NA	3	3	poor	cs-granules	NM
528732	4343021	55	15	8	8	poor	cs-granules	NM
528703	4342960	12	18	3	3	poor	cs-pebbles	NM
528722	4343015	80	NA	5	3	poor	cs-pebbles	NM
528620	4343265	50	NA	4	3	poor	cs-granules	NM
528639	4343277	57	15	4	3	poor	cs-granules	NM
CV146, Cherry Valley School quad,528496E/4343325N, T9S, R65W, sec. 28, NE, 22Jul10								
528496	4343325	41	NA	3	4	poor	cs-granules	NM
528429	4343407	94	NA	4	3	poor	cs-granules	NM
528436	4343410	107	12	6	4	fair	cs-granules	NM
528442	4343400	130	NA	2	2	poor	cs-granules	NM
CV147, Cherry Valley School quad,528755E/4343657N, T9S, R65W, sec. 28, NE, 22Jul10								
528755	4343657	188	NA	8	4	fair	cs-granules	NM
528780	4343655	99	NA	3	3	poor	cs-granules	NM
528802	4343644	131	16	3	3	poor	cs-granules	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
528830	4343627	119	16	4	5	poor	cs-granules	NM
528854	4343529	132	NA	5	3	poor	cs-granules	NM
528868	4343457	175	14	5	4	poor	cs-granules	NM
528839	4343497	45	17	3	3	poor	6	fg crystalline
CV148, Cherry Valley School quad,528974E/4343942N, T9S, R65W, sec. 21, SE, 22Jul10								
528974	4343942	230	NA	4	6	poor	9	granitic
528904	4344026	107	NA	5	5	poor	cs-granules	NM
528898	4344040	122	NA	3	4	poor	cs-granules	NM
528881	4344033	122	NA	3	3	poor	NA	NA
528871	4344043	149	NA	7	5	poor	cs-granules	NM
528860	4344056	174	NA	5	5	poor	cs-granules	NM
528864	4344064	93	NA	3	3	poor	cs-granules	NM
528843	4344091	125	15	5	5	poor	cs-granules	NM
528820	4344107	123	15	4	5	fair	cs-pebbles	NM
528818	4344106	133	NA	6	5	poor	cs-granules	NM
528815	4344106	126	12	4	6	poor	cs-pebbles	NM
528802	4344109	93	16	4	6	poor	cs-pebbles	NM
528798	4344110	102	19	8	5	poor	cs-granules	NM
528746	4344144	100	NA	3	3	poor	cs-pebbles	NM
CV149, Cherry Valley School quad,531378E/4343112N, T9S, R65W, sec. 26, NW, 23Jul10								
531378	4343112	68	NA	4	5	poor	cs-granules	NM
531390	4343106	46	NA	2	2	poor	cs-granules	NM
531390	4343108	47	NA	2	2	poor	cs-granules	NM
531378	4343123	82	NA	4	3	poor	cs-granules	NM
531381	4343129	68	NA	2	2	poor	cs-granules	NM
531335	4343139	203	NA	7	6	poor	cs-pebbles	NM
531338	4343141	85	8	5	5	poor	cs-granules	NM
531343	4343147	138	NA	3	4	poor	cs-granules	NM
531350	4343152	109	21	6	5	fair	cs-granules	NM
531371	4343204	185	NA	5	3	poor	cs-granules	NM
531373	4343204	110	NA	2	3	poor	cs-granules	NM
531383	4343212	163	NA	5	4	poor	cs-pebbles	NM
531378	4343214	168	12	5	5	poor	cs-pebbles	NM
531372	4343220	181	10	10	4	fair	cs-pebbles	NM
531378	4343245	177	10	13	4	fair	cs-pebbles	NM
531380	4343256	213	23	2	4	poor	cs-granules	NM
531387	4343266	108	NA	4	5	fair	cs-pebbles	NM
531382	4343260	128	7	5	6	fair	7	granitic

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
531385	4343287	86	5	9	10	fair	cs-granules	NM
531391	4343295	49	15	8	4	fair	6	granitic
531360	4343301	154	5	3	3	poor	cs-pebbles	NM
531361	4343309	96	17	4	5	poor	cs-granules	NM
531345	4343298	100	8	18	9	fair	cs-granules	NM
531362	4343310	97	10	10	7	fair	cs-pebbles	NM
531435	4343368	40	NA	8	6	poor	cs-pebbles	NM
531493	4343390	67	10	5	5	poor	cs-granules	NM
531509	4343389	55	5	17	8	poor	6	fg crystalline
531528	4343398	23	13	5	6	poor	cs-pebbles	NM
531538	4343443	128	NA	4	4	poor	cs-granules	NM
531528	4343443	159	NA	13	5	fair	cs-granules	NM
531536	4343464	158	NA	8	4	poor	cs-granules	NM
531541	4343473	148	10	10	5	good	cs-granules	NM
531535	4343479	160	NA	4	4	poor	cs-granules	NM
531538	4343483	158	NA	4	2	poor	cs-granules	NM
CV150, Cherry Valley School quad,530902E/4343142N, T9S, R65W, sec. 26, NW, 23Jul10								
530902	4343142	142	NA	4	3	poor	cs-granules	NM
530918	4343151	76	12	14	5	poor	cs-granules	NM
530927	4343151	73	9	10	4	good	cs-granules	NM
530942	4343159	82	10	9	7	poor	cs-granules	NM
530961	4343166	75	24	5	8	fair	cs-pebbles	NM
530976	4343155	85	NA	5	5	poor	cs-granules	NM
530980	4343169	83	NA	5	5	poor	cs-pebbles	NM
530980	4343175	62	NA	5	7	poor	cs-pebbles	NM
531004	4343166	72	NA	3	5	poor	cs-pebbles	NM
531001	4343171	70	NA	18	10	fair	cs-pebbles	NM
531013	4343167	64	NA	3	4	poor	14	granitic
531021	4343167	84	NA	4	4	poor	cs-pebbles	NM
531013	4343183	53	8	2	2	poor	cs-pebbles	NM
531010	4343186	54	NA	2	3	poor	cs-pebbles	NM
531013	4343193	68	NA	4	4	poor	cs-pebbles	NM
531005	4343224	192	NA	5	5	poor	cs-granules	NM
531007	4343225	59	NA	7	7	poor	cs-granules	NM
531024	4343243	66	NA	7	7	poor	cs-pebbles	NM
531087	4343298	38	NA	3	3	poor	cs-pebbles	NM
531103	4343308	42	NA	5	2	poor	cs-pebbles	NM
531097	4343324	188	NA	10	5	poor	cs-pebbles	NM
531109	4343324	50	NA	3	3	poor	cs-pebbles	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
531111	4343329	75	7	2	3	poor	cs-pebbles	NM
531123	4343340	62	13	5	3	good	cs-pebbles	NM
531124	4343344	52	NA	4	3	fair	cs-pebbles	NM
531132	4343348	35	NA	2	2	poor	cs-pebbles	NM
531133	4343356	115	NA	9	7	good	cs-pebbles	NM
531141	4343357	80	NA	2	4	poor	cs-pebbles	NM
531104	4343405	107	NA	4	4	poor	cs-pebbles	NM
531111	4343408	88	NA	3	2	poor	cs-pebbles	NM
531098	4343417	110	NA	4	4	poor	cs-pebbles	NM
531105	4343418	110	NA	15	10	poor	cs-pebbles	NM
531130	4343411	96	NA	4	4	poor	cs-pebbles	NM
531141	4343411	80	NA	8	7	fair	cs-pebbles	NM
531143	4343405	163	NA	11	14	poor	cs-pebbles	NM
531147	4343406	73	NA	14	11	poor	cs-pebbles	NM
531163	4343402	93	NA	8	6	poor	cs-pebbles	NM
531160	4343418	68	NA	6	4	poor	cs-pebbles	NM
531160	4343421	56	NA	8	5	poor	cs-pebbles	NM
531185	4343444	25	NA	12	12	poor	cs-pebbles	NM
531191	4343444	118	9	8	7	fair	cs-pebbles	NM
531199	4343449	142	NA	6	5	fair	cs-pebbles	NM
531224	4343445	153	NA	4	5	poor	cs-pebbles	NM
531250	4343454	137	22	5	4	fair	cs-pebbles	NM
531298	4343471	52	NA	12	21	fair	cs-pebbles	NM
531316	4343477	24	NA	3	5	poor	cs-pebbles	NM
531134	4343361	127	NA	7	5	poor	cs-pebbles	NM
531123	4343343	69	7	7	4	poor	cs-pebbles	NM
531098	4343326	172	NA	11	7	poor	cs-pebbles	NM
531101	4343268	75	NA	6	6	poor	cs-pebbles	NM
531101	4343245	55	NA	7	4	poor	cs-pebbles	NM
RG151A, Russellville Gulch quad, 522883E/4353195N, T8S, R66W, sec. 25, NW, 26Jul10 (Castlewood Canyon State Park)								
522883	4353195	116	29	4	4	poor	12	granitic
522884	4353197	63	17	3	4	poor	cs-granules	NM
522902	4353199	78	NA	4	3	poor	cs-granules	NM
522871	4353226	37	NA	11	9	poor	9	granitic
522880	4353229	81	23	3	5	poor	6	quartz
RG151B, Russellville Gulch quad, 522880E/4353252N, T8S, R66W, sec. 24, SW, 26Jul10 (Castlewood Canyon State Park)								
522880	4353252	139	11	6	3	poor	7	Twm
522893	4353263	155	9	5	5	poor	13	granitic

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
522899	4353294	194	8	5	4	poor	cs-granules	NM
522881	4353304	172	NA	8	5	poor	cs-granules	NM
522885	4353310	146	NA	10	6	poor	11	granitic
522898	4353294	202	16	5	3	poor	5	granitic
522897	4353333	116	NA	4	5	poor	13	Twm
522905	4353331	50	17	6	5	fair	7	granitic
522908	4353351	113	NA	3	2	poor	3	granitic
522919	4353357	85	8	4	5	poor	11	Twm
522920	4353375	155	NA	5	5	poor	15	Twm
522900	4353383	60	NA	3	7	poor	10	Twm
522898	4353401	93	12	3	4	poor	4	quartz
522905	4353397	120	11	5	5	poor	15	Twm
522910	4353448	154	NA	7	3	poor	8	granitic
522908	4353446	192	16	4	4	poor	6	fg crystalline
522879	4353438	135	15	5	4	poor	4	fg crystalline
522891	4353495	173	NA	15	13	poor	20	Twm
522882	4353605	142	NA	13	10	poor	28	granitic gneiss
522874	4353618	143	13	5	3	poor	cs-pebbles	NM
522842	4353545	156	NA	18	6	poor	22	Twm
522756	4353566	85	19	5	6	poor	9	fg crystalline
522729	4353572	136	20	4	4	poor	cs-pebbles	NM
522725	4353567	160	13	10	5	poor	14	Twm
522696	4353573	137	17	9	5	poor	11	granitic
522710	4353591	163	NA	6	4	poor	cs-granules	NM
522724	4353594	145	NA	6	7	poor	13	granitic
522708	4353611	160	5	6	2	fair	cs-granules	NM
522541	4353792	162	NA	5	4	poor	cs-granules	NM
522521	4353768	156	NA	10	11	poor	13	granitic
522509	4353766	173	12	14	5	fair	9	Twm
522499	4353794	129	NA	5	3	poor	45	Twm
522461	4353826	147	NA	32	14	fair	22	Twm
522479	4353929	116	17	7	3	fair	cs-pebbles	NM
522372	4353893	148	19	5	3	poor	7	granitic
522368	4353876	139	NA	10	5	poor	8	granitic
522329	4353931	160	NA	7	3	poor	14	fg crystalline
522236	4354001	123	11	16	14	fair	cs-granules	NM
522224	4354025	20	8	7	6	poor	25	Twm
522212	4354022	146	NA	7	7	poor	11	NM
522236	4353972	114	13	9	5	poor	12	Twm
522247	4353960	120	NA	9	9	poor	20	granitic

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
522186	4354014	80	NA	5	5	poor	24	fg crystalline
522199	4354049	70	NA	5	10	poor	cs-pebbles	NM
522188	4354072	143	NA	4	3	poor	NA	NA
522178	4354063	186	23	4	4	poor	18	Twm
522166	4354062	135	27	5	5	fair	11	Twm
522160	4354053	151	23	4	5	fair	6	fg crystalline
522048	4354104	340	12	5	5	poor	cs-granules	NM
521970	4354110	162	NA	7	5	poor	14	granitic
521957	4354111	163	11	4	3	poor	cs-pebbles	NM
521955	4354050	107	18	6	3	poor	cs-pebbles	NM
521958	4354054	104	NA	5	3	poor	20	Twm
521950	4354045	111	22	4	4	good	8	granitic
521954	4354034	141	10	12	8	fair	12	granitic
521960	4354019	152	NA	5	4	poor	6	fg crystalline
522005	4354026	82	11	10	9	good	29	Twm
522000	4354011	141	NA	4	2	poor	5	Twm
521974	4353999	74	4	5	6	fair	18	granitic
521957	4353978	194	NA	7	8	poor	14	granitic
521937	4353958	136	18	7	4	poor	17	Twm
521929	4353966	168	18	16	12	fair	24	Twm
521901	4353999	140	19	7	6	fair	18	Twm
521806	4354088	158	12	17	8	fair	23	Twm
CRS151C, Castle Rock South quad, 521976E/4354124N, T8S, R66W, sec. 23, NW, 27Jul10 (Castlewood Canyon State Park)								
521796	4354124	82	NA	5	5	poor	14	granitic
521643	4354379	5	NA	16	23	poor	24	Twm
521555	4354418	72	10	4	5	poor	7	Twm
521516	4354518	172	10	20	5	good	9	granitic
521267	4354619	87	9	5	4	poor	cs-granules	NM
521260	4354685	67	NA	4	4	fair	5	granitic
521263	4354681	80	NA	2	4	poor	8	Twm
521257	4354840	87	5	8	5	poor	14	Twm
520993	4355149	95	NA	5	5	poor	10	Twm
520876	4355271	57	4	7	16	fair	cs-pebbles	NM
520880	4355352	4	15	5	5	poor	9	granitic
520889	4355360	337	NA	7	6	poor	15	bl-gy quartzite
520905	4355360	58	NA	10	6	fair	18	granitic gneiss
521031	4355441	92	NA	4	5	poor	9	granitic
520988	4355491	25	16	11	7	fair	9	granitic
520978	4355820	125	NA	4	5	poor	cs-granules	NM

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
520960	4356013	112	NA	3	5	poor	7	granitic
CRS152, Castle Rock South quad, 521308E/4355662N, T8S, R66W, sec. 14, SW, 28Jul10								
521308	4355662	167	14	4	5	poor	cs-pebbles	NM
521168	4355720	44	4	5	5	fair	cs-pebbles	NM
521179	4355710	37	9	6	12	fair	cs-pebbles	NM
CRS153, Castle Rock South quad, 521341E/4355838N, T8S, R66W, sec. 14, SW, 28Jul10								
521341	4355838	182	NA	3	3	poor	cs-granules	NM
521397	4355757	160	NA	6	3	poor	7	Twm
521494	4355695	154	15	8	8	fair	cs-pebbles	NM
521514	4355691	163	17	10	4	poor	cs-granules	NM
521528	4355679	158	21	7	7	poor	9	granitic
521551	4355686	97	18	5	8	poor	8	bl-gy quartzite
521559	4355671	71	20	7	13	fair	cs-pebbles	NM
521548	4355665	131	11	10	5	poor	cs-granules	NM
521450	4355604	145	NA	7	5	poor	11	granitic
RG154, Russellville Gulch quad, 521631E/4355627N, T8S, R66W, sec. 14, SW, 28Jul10								
521631	4355627	81	NA	13	7	poor	6	granitic
521653	4355645	87	20	3	5	poor	8	granitic
521670	4355609	76	7	3	5	poor	cs-pebbles	NM
521686	4355606	87	21	3	4	poor	5	Twm
521709	4355584	105	NA	10	6	poor	17	Twm
521709	4355555	159	20	8	5	poor	cs-granules	NM
CRS155, Castle Rock South quad, 520818E/4354475N, T8S, R66W, sec. 22, NE, 29Jul10 (Castlewood Canyon State Park)								
upper unit								
520818	4354475	78	16	4	3	poor	11	granitic
520830	4354487	110	14	5	5	poor	cs-pebbles	NM
520711	4354585	59	14	9	12	fair	11	Twm
520687	4354616	142	23	5	5	fair	4	quartz
520690	4354612	122	17	5	6	poor	7	granitic
520673	4354621	95	23	3	5	fair	cs-granules	NM
520601	4354650	161	NA	8	10	poor	18	Twm
520609	4354610	94	NA	4	5	poor	6	granitic
520606	4354603	138	9	5	5	poor	8	Twm
520537	4354550	24	NA	5	3	poor	cs-granules	NM
520524	4354553	350	21	11	7	fair	cs-pebbles	NM
520550	4354504	120	13	18	12	fair	cs-pebbles	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
520564	4354512	165	18	6	7	poor	cs-pebbles	NM
520573	4354496	154	15	14	6	fair	14	Twm
520869	4354642	36	NA	5	5	poor	8	Twm
520870	4354649	22	6	3	4	fair	7	Twm
520865	4354652	9	10	6	3	fair	cs-pebbles	
520820	4354670	86	15	5	5	fair	12	Twm
520774	4354648	45	5	4	4	poor	4	Twm
520781	4354690	346	6	5	3	poor	5	quartz
520746	4354647	155	7	4	4	poor	10	granitic
520678	4354609	163	19	5	3	poor	cs-granules	NM
520707	4354583	46	21	7	9	fair	6	granitic
520692	4354646	158	NA	6	5	poor	12	granitic
520692	4354662	159	24	12	7	fair	14	fg crystalline
520672	4354755	250	NA	9	8	poor	cs-granules	NM
520701	4354757	305	NA	12	8	poor	9	Twm
520709	4354746	350	NA	3	3	poor	cs-pebbles	NM
520706	4354760	333	NA	3	2	poor	cs-pebbles	NM
520669	4354766	80	NA	1	3	poor	8	granitic
520670	4354774	77	19	2	3	poor	cs-pebbles	NM
520666	4354773	38	NA	3	4	poor	cs-granules	NM
520659	4354775	11	15	3	2	poor	cs-granules	NM
520661	4354783	23	14	10	5	fair	cs-pebbles	NM
520642	4354793	355	30	13	5	poor	cs-pebbles	NM
520613	4354805	342	14	15	15	fair	9	Twm
520587	4354790	173	NA	8	8	fair	18	Twm
520577	4354846	172	NA	8	13	poor	cs-pebbles	NM
520547	4354812	170	NA	4	4	poor	56	Twm
520555	4354812	156	NA	7	5	poor	cs-granules	NM
520562	4354808	154	NA	16	10	poor	25	Twm
520548	4354799	152	15	16	9	poor	23	Twm
520546	4354762	141	NA	8	7	poor	23	Twm
520544	4354754	168	NA	7	4	poor	44	Twm
520539	4354751	158	NA	9	6	poor	22	Twm
520501	4354807	80	NA	6	8	poor	cs-pebbles	NM
520477	4354790	168	15	6	6	fair	30	Twm
520491	4354712	128	10	6	5	fair	cs-granules	NM
520478	4354790	170	12	6	5	fair	cs-pebbles	NM
520438	4354829	121	NA	31	16	poor	9	Twm
520407	4354855	161	NA	16	17	poor	41	Twm
520381	4354843	143	NA	13	10	fair	12	granitic

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
520409	4354880	116	NA	8	5	poor	21	granitic
520404	4354896	162	15	8	7	fair	12	granitic
520398	4354887	175	NA	8	6	poor	12	granitic
520357	4354893	148	20	21	11	fair	16	Twm
520373	4354925	161	NA	8	5	fair	cs-granules	NM
520377	4354939	62	NA	5	6	poor	9	bl-gy quartzite
520386	4354943	101	17	7	8	fair	18	Twm
520349	4354937	90	25	19	11	good	cs-pebbles	NM
520348	4354980	125	15	9	10	fair	41	bl-gy quartzite
520345	4354995	353	NA	4	3	poor	8	Twm
520327	4354998	166	17	19	9	poor	24	Twm
520324	4354921	83	NA	5	5	poor	5	granitic
520323	4354918	174	NA	9	9	poor	11	granitic
520309	4354921	142	8	11	6	fair	12	Twm
520239	4354917	170	12	4	3	good	cs-granules	NM
520216	4354889	100	20	8	7	fair	cs-granules	NM
520227	4354879	137	NA	8	6	fair	9	fg crystalline
520232	4354870	104	NA	8	6	poor	27	quartz
520123	4354862	74	NA	4	7	poor	7	granitic
520080	4354874	134	NA	3	3	poor	18	bl-gy quartzite
520043	4354969	181	NA	7	4	poor	13	Twm
520055	4354975	72	NA	7	7	fair	7	granitic
520089	4354995	138	NA	7	5	poor	7	Twm
520140	4355061	101	18	15	11	good	cs-granules	NM
520004	4355166	128	NA	4	3	poor	7	Twm
520026	4355152	92	NA	7	7	poor	19	Twm
520103	4355159	61	22	9	16	fair	9	bl-gy quartzite
520024	4355333	174	NA	6	4	poor	8	granitic
519954	4355424	127	NA	5	4	poor	9	granitic
519920	4355466	177	23	13	18	good	8	granitic
519928	4355488	150	NA	5	4	poor	12	Twm
519908	4355584	135	NA	7	6	poor	10	Twm
519887	4355725	157	16	12	7	poor	19	granitic
519865	4355861	119	15	6	7	poor	15	granitic
519828	4355895	149	NA	7	5	poor	34	granitic
519556	4355880	187	NA	6	3	poor	23	granitic
519667	4355781	172	20	7	6	poor	cs-granules	NM
519752	4355679	165	NA	10	8	poor	33	Twm
lower unit								
520284	4354918	75	13	6	5	poor	cs-granules	NM

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
520286	4354916	58	3	3	4	poor	cs-granules	NM
520282	4354913	56	9	3	4	fair	cs-granules	NM
520277	4354913	37	20	8	6	fair	11	granitic
CRS156, Castle Rock South quad, 522126E/4354012N, T8S, R66W, sec. 23, SW, [xxyyy]10 (Castlewood Canyon State Park) (Matt Morgan)								
522126	4354012	131	NM	9	8	NM	NM	NM
521996	4354010	85	NM	15	9	NM	NM	NM
521983	4354007	137	NM	11	5	NM	NM	NM
521967	4354031	30	NM	5	3	NM	NM	NM
521956	4354025	159	NM	0	0	NM	NM	NM
521956	4354033	65	NM	14	8	NM	NM	NM
521925	4354007	143	NM	9	5	NM	NM	NM
521868	4354011	138	NM	9	5	NM	NM	NM
521865	4354012	140	NM	12	6	NM	NM	NM
521612	4354007	152	NM	12	15	NM	18	quartz
521579	4354031	162	NM	13	6	NM	NM	NM
521577	4354040	128	NM	6	4	NM	NM	NM
521573	4354060	105	NM	11	11	NM	NM	NM
521563	4354068	120	NM	6	6	NM	NM	NM
521556	4354093	70	NM	9	19	NM	20	Twm
521524	4354127	126	NM	9	5	NM	25	Twm
521507	4354118	175	NM	9	18	NM	27	NM
521486	4354135	95	NM	12	12	NM	NM	NM
521438	4354186	90	NM	8	6	NM	NM	NM
521460	4354142	115	NM	12	6	NM	NM	NM
521565	4354196	133	NM	15	7	NM	NM	NM
521599	4354183	155	NM	NM	NM	NM	NM	NM
521621	4354147	140	NM	9	5	NM	NM	NM
521628	4354157	143	NM	5	5	NM	60	Twm
521540	4354195	45	NM	13	6	NM	30	Twm
521550	4354178	104	NM	9	6	NM	NM	NM
521493	4354216	130	NM	10	9	NM	25	Twm
521469	4354250	176	NM	37	18	NM	NM	NM
521459	4354268	100	NM	10	13	NM	15	granitic
521420	4354366	0	NM	14	9	NM	NM	NM
521394	4354384	41	NM	11	9	NM	NM	NM
521372	4354359	55	NM	8	9	NM	NM	NM
521390	4354321	40	NM	9	11	NM	25	Twm
521388	4354296	150	NM	NM	NM	NM	NM	NM
521359	4354303	135	NM	8	5	NM	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
521332	4354310	40	NM	5	9	NM	15	Twm
521333	4354297	107	NM	5	5	NM	NM	NM
521321	4354283	75	NM	13	8	NM	NM	NM
521296	4354277	27	NM	5	7	NM	NM	NM
521290	4354327	25	NM	18	5	NM	NM	NM
521224	4354274	140	NM	NM	NM	NM	NM	NM
521269	4354279	55	NM	NM	NM	NM	NM	NM
521378	4354241	145	NM	8	5	NM	NM	NM
521396	4354232	179	NM	34	12	NM	NM	NM
521390	4354212	167	NM	18	5	NM	NM	NM
RG157, Russellville Gulch quad, 522573E/4353533N, T8S, R66W, sec. 23, SE, [xxyyy]10 (Castlewood Canyon State Park) (Matt Morgan)								
522573	4353533	95	NM	6	5	NM	NM	NM
522608	4353543	65	NM	7	11	NM	NM	NM
522624	4353515	90	NM	9	10	NM	NM	NM
522633	4353512	140	NM	6	7	NM	NM	NM
522651	4353518	122	NM	5	7	NM	NM	NM
522651	4353518	100	NM	16	5	NM	NM	NM
522694	4353529	88	NM	21	9	NM	NM	NM
522699	4353521	120	NM	7	6	NM	NM	NM
522706	4353515	75	NM	5	6	NM	NM	NM
522699	4353503	50	NM	18	9	NM	NM	NM
522695	4353474	90	NM	9	8	NM	NM	NM
522682	4353462	95	NM	61	8	NM	NM	NM
522670	4353448	150	25	10	5	NM	60	Twm
522677	4353429	117	10	11	5	NM	NM	NM
522518	4353558	175	NM	18	6	NM	NM	NM
522501	4353642	180	NM	27	12	NM	NM	NM
522492	4353645	64	15	11	16	NM	45	Twm
522512	4353661	90	NM	8	10	NM	NM	NM
522517	4353662	135	NM	7	5	NM	NM	NM
522532	4353671	160	NM	35	11	NM	NM	NM
522589	4353639	105	NM	5	7	NM	25	granitic
522576	4353659	132	NM	9	4	NM	NM	NM
522573	4353676	180	NM	8	7	NM	NM	NM
522567	4353690	75	NM	8	4	NM	NM	NM
522560	4353697	100	NM	NM	NM	NM	NM	NM
522529	4353691	173	NM	18	21	NM	NM	NM
522499	4353680	80	NM	5	7	NM	NM	NM
522489	4353694	54	NM	11	12	NM	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
522436	4353690	99	NM	16	5	NM	NM	NM
522430	4353709	345	NM	10	5	NM	NM	NM
522412	4353679	185	NM	30	6	NM	NM	NM
522449	4353740	180	NM	9	6	NM	NM	NM
522464	4353745	170	NM	14	9	NM	NM	NM
522485	4353757	183	NM	6	8	NM	NM	NM
522491	4353747	83	NM	9	6	NM	NM	NM
522489	4353756	346	NM	3	3	NM	NM	NM
522438	4353763	180	NM	17	4	NM	NM	NM
522432	4353802	180	NM	12	9	NM	NM	NM
522432	4353802	178	NM	7	5	NM	120	Twm
522376	4353769	144	NM	13	6	NM	NM	NM
522343	4353758	210	NM	9	5	NM	NM	NM
522343	4353758	170	NM	14	5	NM	NM	NM
522333	4353792	180	NM	13	6	NM	NM	NM
522333	4353792	72	NM	NM	NM	NM	NM	NM
522322	4353808	175	NM	25	6	NM	NM	NM
522300	4353801	190	NM	12	6	NM	NM	NM
522301	4353801	115	NM	9	8	NM	NM	NM
522289	4353831	160	NM	6	3	NM	NM	NM
522256	4353834	138	NM	7	4	NM	NM	NM
522276	4353832	70	NM	11	5	NM	NM	NM
522264	4353846	115	NM	7	5	NM	20	Twm
522258	4353890	160	NM	12	6	NM	NM	NM
522274	4353895	168	NM	15	5	NM	NM	NM
522288	4353900	139	NM	10	6	NM	NM	NM
522302	4353899	70	NM	3	5	NM	NM	NM
522303	4353922	175	NM	15	9	NM	NM	NM
522286	4353946	90	NM	4	5	NM	NM	NM
522285	4353911	185	NM	12	6	NM	NM	NM
522269	4353957	130	NM	6	5	NM	NM	NM
522249	4353926	175	NM	9	5	NM	NM	NM
522242	4353914	160	NM	13	6	NM	NM	NM
522240	4353991	135	NM	9	6	NM	NM	NM
522241	4353955	65	NM	6	5	NM	NM	NM
522103	4353910	170	NM	5	4	NM	NM	NM
522108	4353905	80	NM	5	4	NM	NM	NM
522133	4353934	185	NM	16	5	NM	NM	NM
522133	4353934	155	NM	5	5	NM	NM	NM
522156	4353917	35	NM	NM	NM	NM	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
522138	4353933	166	NM	12	6	NM	NM	NM
522149	4353935	165	NM	18	9	NM	NM	NM
522149	4353958	155	NM	NM	NM	NM	NM	NM
522172	4353952	125	NM	18	7	NM	NM	NM
522115	4353966	165	NM	7	5	NM	NM	NM
522098	4353955	179	NM	8	5	NM	NM	NM
522110	4353940	184	NM	10	4	NM	NM	NM
522097	4353937	150	NM	16	5	NM	NM	NM
522074	4353923	215	NM	9	2	NM	NM	NM
522059	4353984	160	NM	18	6	NM	NM	NM
522065	4353974	171	NM	13	5	NM	NM	NM
522040	4353999	135	NM	5	5	NM	NM	NM
522026	4353986	130	NM	4	3	NM	NM	NM
521919	4353997	140	NM	NM	NM	NM	NM	NM
521923	4353955	166	NM	15	8	NM	NM	NM
521911	4353972	170	NM	18	5	NM	NM	NM
521897	4353983	142	NM	8	5	NM	NM	NM
521888	4353975	170	NM	NM	NM	NM	NM	NM
521885	4353990	158	NM	NM	NM	NM	NM	NM
521848	4353982	165	NM	NM	NM	NM	NM	NM
521832	4353958	139	NM	3	5	NM	NM	NM
521833	4353957	220	NM	8	4	NM	NM	NM
521804	4353974	171	NM	NM	NM	NM	NM	NM
521973	4353855	165	NM	3	5	NM	NM	NM
521802	4353904	142	NM	11	7	NM	NM	NM
521793	4353856	199	NM	18	20	NM	NM	NM
521760	4353856	130	NM	6	3	NM	NM	NM
521754	4353889	140	NM	6	4	NM	NM	NM
521753	4353891	30	NM	5	3	NM	NM	NM
521761	4353901	45	NM	5	4	NM	NM	NM
521719	4353921	115	NM	6	3	NM	NM	NM
521671	4353919	185	NM	5	8	NM	NM	NM
521689	4353927	180	NM	5	7	NM	NM	NM
521671	4353879	90	NM	5	6	NM	NM	NM
521664	4353883	180	NM	6	4	NM	NM	NM
521686	4353887	49	NM	5	5	NM	NM	NM
521690	4353872	140	NM	14	3	NM	NM	NM
521716	4353814	140	NM	20	7	NM	NM	NM
521715	4353811	158	NM	7	9	NM	NM	NM
521740	4353804	136	NM	4	18	NM	15	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
521662	4353977	30	NM	5	5	NM	NM	NM
521663	4353959	170	NM	NM	NM	NM	NM	NM
521644	4353944	120	NM	8	6	NM	NM	NM
521654	4353979	42	NM	7	5	NM	NM	NM
521656	4353971	55	NM	3	4	NM	NM	NM
522333	4353600	170	NM	37	13	NM	NM	NM
522350	4353612	185	NM	20	9	NM	NM	NM
522347	4353590	145	NM	9	9	NM	NM	NM
522347	4353557	165	NM	0	0	NM	NM	NM
RG158, Russellville Gulch quad, 522524E/4353322N, T8S, R66W, sec. 25, NW, [xxyyy]10 (Castlewood Canyon State Park) (Matt Morgan)								
522524	4353322	200	NM	14	9	NM	NM	NM
522520	4353300	115	NM	15	9	NM	NM	NM
522528	4353292	116	NM	9	7	NM	25	Twm
522670	4353351	80	NM	9	11	NM	NM	NM
522686	4353354	170	NM	5	3	NM	NM	NM
522699	4353346	18	NM	9	6	NM	NM	NM
522710	4353354	153	NM	5	5	NM	NM	NM
522732	4353343	145	NM	7	6	NM	180	Twm
522732	4353343	121	NM	9	5	NM	NM	NM
522775	4353353	128	NM	9	7	NM	15	granitic
522775	4353353	72	NM	8	14	NM	120	Twm
522751	4353369	55	NM	5	9	NM	NM	NM
522753	4353358	10	NM	5	3	NM	180	Twm
522748	4353339	195	NM	14	9	NM	NM	NM
522737	4353307	70	NM	4	4	NM	NM	NM
522737	4353307	91	NM	7	4	NM	NM	NM
522674	4353294	85	NM	18	4	NM	NM	NM
522623	4353292	83	NM	18	7	NM	NM	NM
522598	4353263	95	NM	11	7	NM	NM	NM
522590	4353273	78	NM	13	9	NM	180	Twm
522587	4353247	40	NM	5	9	NM	NM	NM
522608	4353258	72	NM	9	6	NM	NM	NM
522608	4353258	120	NM	5	2	NM	NM	NM
522664	4353235	65	NM	15	9	NM	NM	NM
522664	4353235	122	NM	5	4	NM	NM	NM
522709	4353218	65	NM	9	9	NM	180	Twm
522727	4353189	114	NM	20	4	NM	NM	NM
522762	4353171	115	NM	6	4	NM	NM	NM
522762	4353171	128	NM	4	4	NM	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
522753	4353121	50	NM	5	4	NM	NM	NM
522752	4353121	140	NM	11	6	NM	NM	NM
522766	4353053	90	NM	34	14	NM	NM	NM
522744	4353008	96	NM	37	9	NM	NM	NM
522766	4353010	75	NM	34	5	NM	NM	NM
522776	4352990	120	NM	5	13	NM	NM	NM
522745	4352981	114	NM	5	8	NM	NM	NM
522745	4352957	95	NM	14	9	NM	NM	NM
522758	4352955	134	NM	19	11	NM	NM	NM
522773	4352939	131	NM	14	23	NM	180	Twm
522805	4352922	140	NM	12	14	NM	NM	NM
522829	4352890	80	NM	15	8	NM	NM	NM
522791	4352875	126	NM	8	12	NM	180	Twm
522808	4352845	121	NM	9	8	NM	NM	NM
522801	4352848	145	NM	2	4	NM	NM	NM
EL159, Elizabeth quad, 533565E/4344752N, T9S, R65W, sec. 24, NE (Krupa property), [xxyyyzz] (Matt Morgan)								
533565	4344752	50	NM	7.0	5	good	20	Twm
533598	4344779	73	NM	7.0	5	good	25	Twm
533610	4344811	85	NM	7.0	5	good	15	Twm
533646	4344824	330	NM	9.0	5	good	20	Twm
533646	4344824	84	NM	6.0	6	good	15	Twm
533670	4344836	30	NM	8.0	6	good	18	Twm
533674	4344862	29	NM	NM	NM	good	NM	NM
533644	4344877	345	NM	NM	NM	good	NM	NM
533644	4344877	20	NM	NM	NM	good	NM	NM
533644	4344877	310	NM	8.0	5	good	25	Twm
533620	4344907	305	NM	NM	NM	good	NM	NM
533666	4344930	270	NM	NM	NM	good	NM	NM
533690	4344894	270	NM	NM	NM	good	NM	NM
533511	4344819	210	NM	NM	NM	good	NM	NM
533722	4344754	10	NM	NM	NM	good	NM	NM
533712	4344748	40	NM	7.0	5	good	30	Twm
533000	4344753	240	NM	NM	NM	good	NM	NM
533092	4344764	275	NM	NM	NM	good	NM	NM
533088	4344808	210	NM	7.0	7	good	35	Twm
533123	4344785	305	NM	8.0	5	good	25	Twm
533166	4344814	276	NM	NM	NM	good	NM	NM
533131	4344776	95	NM	NM	NM	good	NM	NM
533170	4344827	78	NM	NM	NM	good	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
533163	4344853	115	NM	6.0	4	good	20	Twm
533159	4344830	40	NM	7.0	5	good	15	Twm
533263	4344835	115	NM	7.0	6	good	15	Twm
533288	4344825	50	NM	NM	NM	good	NM	NM
533324	4344815	90	NM	5.0	6	good	28	Twm
533420	4344894	102	NM	NM	NM	good	NM	NM
533420	4344894	25	NM	NM	NM	good	NM	NM
533441	4344911	115	NM	6.0	5	good	30	Twm
533467	4344956	90	NM	NM	NM	good	NM	NM
533456	4344988	55	NM	NM	NM	good	NM	NM
533564	4345535	105	NM	5	5	good	NM	NM
EL160, Elizabeth quad, 532776E/4347385N, T9S, R65W, sec. 12, SW ("view lots"), [xxyyyzz] (Matt Morgan)								
532776	4347385	150	NM	5	4	good	15	granitic
532716	4347428	100	NM	6	5	good	15	Twm
532640	4347369	10	NM	6	6	good	18	Twm
532437	4347490	112	NM	7	5	good	20	Twm
532412	4347482	95	NM	7	7	good	12	granitic
532447	4347424	60	NM	7	7	good	12	granitic
532379	4347360	185	NM	5	6	good	15	Twm
532362	4347356	115	NM	6	5	good	18	granitic
532328	4347158	53	NM	6	5	good	20	granitic
532432	4347192	204	NM	6	6	good	15	Twm
532439	4347307	5	NM	7	8	good	18	Twm
EL161, Elizabeth quad, 539392E/4344441N, T9S, R65W, sec. 22, SW (Raun property), [xxyyyzz] (Matt Morgan)								
539392	4344441	120	NM	8	7	good	15	granitic
539263	4344621	73	NM	7	5	good	12	Twm
539197	4344684	157	NM	7	6	good	18	Twm
539160	4344687	130	NM	7	6	good	15	granitic
539073	4344785	155	NM	6	5	good	10	granitic
539025	4344886	71	NM	8	6	good	12	Twm
538821	4344818	95	NM	9	6	good	10	granitic
538682	4344778	46	NM	8	5	good	12	granitic
538842	4344747	43	NM	5	4	good	15	granitic
538911	4344721	125	NM	6	4	good	15	granitic
539140	4344556	130	NM	8	6	good	18	granitic
538739	4345194	96	NM	8	5	good	10	granitic

CRN162, Castle Rock North quad, 512419E/4358863N, T8S, R67W, sec. 2, SE (top of Castle Rock Butte Park), [xxyyyzz] (Matt Morgan)

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
512419	4358863	85	26	44	14	excellent	60	granitic
512385	4358863	10	5	6	5	poor	60	granitic
512405	4358859	20	24	8	6	good	45	Twm
512391	4358845	20	24	11	8	good	60	Twm
512426	4358853	25	25	7	6	poor	60	Twm
512397	4358820	232	8	5	9	good	30	Twm
512450	4358832	25	10	10	5	excellent	20	Twm
512409	4358800	38	27	25	7	excellent	68	Twm
512450	4358807	15	20	14	8	good	60	Twm
512432	4358786	160	10	4	3	good	91	Twm
512447	4358790	145	18	9	5	good	121	Twm
512454	4358789	66	20	4	10	excellent	121	Twm
512483	4358765	350	20	3	5	good	152	Twm
512488	4358755	0	10	5	5	poor	137	Twm

EB163, Elbert quad, 535800E/4342538N, T9S, R64W, sec. 29, SE ("group 1") , [xxyyyzz] (Matt Morgan)
Group 1, centroid: 535,800.191 4,342,538.429 (Matt Morgan)
EB163

536082	4343237	140	NM	4	2	poor	pebble	NM
536172	4343201	40	NM	5	3	poor	pebble	NM
535330	4343279	140	NM	4	4	good	pebble	NM
535387	4343175	98	NM	15	5	excellent	30	Twm
535393	4341824	98	NM	2	3	good	NM	NM
535394	4341822	85	NM	6	2	good	NM	NM
536099	4342612	155	NM	3	3	good	NM	NM
536106	4342608	160	NM	6	3	good	NM	NM
536242	4342334	140	NM	7	3	poor	NM	NM
536342	4342125	200	NM	6	3	good	NM	NM
536338	4342118	205	NM	6	2	good	NM	NM

EB164, Elbert quad, 534498E/4337612N, T10S, R64W, sec. 7, SW ("group 2") , [xxyyyzz] (Matt Morgan)

534485	4337572	100	NM	6	3	poor	NM	NM
534594	4337456	270	NM	5	3	good	NM	NM
534596	4337443	130	NM	4	3	good	NM	NM

EB165, Elbert quad, 541776E/4337547N, T10S, R64W, sec. 11, SE ("group 3") , [xxyyyzz] (Matt Morgan)

541490	4338482	95	NM	15	5	good	NM	NM
541482	4338479	80	NM	25	5	good	NM	NM
541474	4338479	90	NM	30	10	good	NM	NM
541461	4338481	70	NM	23	5	good	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
541429	4338507	153	NM	6	6	good	NM	NM
541414	4338484	90	NM	3	3	good	NM	NM
541416	4338477	111	NM	4	4	good	NM	NM
541359	4338487	112	NM	4	2	good	NM	NM
541349	4338486	80	NM	12	6	good	NM	NM
541341	4338493	70	NM	10	7	good	NM	NM
541330	4338497	105	NM	35	10	good	NM	NM
541190	4338474	160	NM	7	8	good	NM	NM
541179	4338467	145	NM	5	5	good	NM	NM
541187	4338457	200	NM	5	4	good	NM	NM
541196	4338453	180	NM	7	5	good	NM	NM
541097	4338522	210	NM	2	4	good	NM	NM
541096	4338518	190	NM	7	3	good	NM	NM
541089	4338518	185	NM	7	3	good	NM	NM
541080	4338517	175	NM	5	2	good	NM	NM
541086	4338529	175	NM	10	7	good	NM	NM
541070	4338519	186	NM	7	1	good	NM	NM
541066	4338514	155	NM	7	2	good	NM	NM
541071	4338320	87	NM	3	4	good	NM	NM
541083	4338325	135	NM	3	4	good	NM	NM
541099	4338326	115	NM	4	3	good	NM	NM
541112	4338329	95	NM	5	3	good	NM	NM
541124	4338337	45	NM	5	3	good	NM	NM
541626	4338419	110	NM	5	3	poor	NM	NM
541633	4338406	140	NM	3	2	poor	NM	NM
541643	4338401	100	NM	7	3	poor	NM	NM
541642	4338337	143	NM	6	8	good	NM	NM
541624	4338341	160	NM	10	7	good	NM	NM
541616	4338337	150	NM	7	7	good	NM	NM
541601	4338328	180	NM	11	5	good	NM	NM
541609	4338325	150	NM	5	5	good	NM	NM
541613	4338320	145	NM	7	4	good	NM	NM
541608	4338310	135	NM	5	3	good	NM	NM
541564	4338315	145	NM	10	5	good	NM	NM
541586	4338295	89	NM	5	2	good	NM	NM
541593	4338281	140	NM	8	6	good	NM	NM
541573	4338274	65	NM	3	3	good	NM	NM
541596	4338268	140	NM	11	5	good	NM	NM
541610	4338267	105	NM	3	3	good	NM	NM
541620	4338261	139	NM	10	7	good	NM	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
541613	4338236	170	NM	7	6	good	NM	NM
541626	4338241	190	NM	7	4	good	NM	NM
541641	4338228	201	NM	2	3	good	NM	NM
540893	4337790	165	NM	4	7	poor	NM	NM
540862	4337817	236	NM	10	7	poor	NM	NM
540813	4337900	252	NM	5	4	poor	NM	NM
540789	4338143	60	NM	25	2	poor	3	quartz
540710	4338192	60	NM	10	3	poor	NM	NM
542170	4337021	106	NM	8	7	poor	NM	NM
542085	4337109	56	NM	10	15	poor	20	Twm
542399	4336814	104	NM	3	5	poor	NM	NM
542371	4336801	119	NM	8	3	poor	NM	NM
542323	4336873	143	NM	12	5	poor	NM	NM
542670	4336474	215	NM	5	4	poor	NM	NM
542707	4336468	162	NM	15	12	poor	8	granitic
542796	4336423	100	NM	12	5	poor	NM	NM
542796	4336317	137	NM	40	20	excellent	NM	NM
542841	4336338	96	NM	11	6	excellent	NM	NM
EB166, Elbert quad, 542549E/4335914N, T10S, R64W, sec. 13, SW ("group 4"), [xxyyyzz] (Matt Morgan)								
542675	4335766	58	NM	5	5	poor	NM	NM
542696	4335739	63	NM	2	2	poor	NM	NM
542696	4335739	55	NM	15	2	good	NM	NM
542706	4335622	40	NM	4	5	good	NM	NM
542773	4335740	70	NM	11	6	excellent	NM	NM
542760	4335766	45	NM	7	6	good	NM	NM
542743	4335780	115	NM	4	4	good	NM	NM
542748	4335786	60	NM	8	5	good	NM	NM
542589	4335930	111	NM	3	3	good	NM	NM
542554	4335996	10	NM	3	1	poor	NM	NM
542459	4336053	60	NM	4	6	good	NM	NM
542434	4336313	33	NM	2	4	good	NM	NM
542585	4335844	112	NM	3	4	good	NM	NM
542448	4335802	55	NM	8	3	excellent	NM	NM
542437	4335810	50	NM	20	5	excellent	NM	NM
542454	4335826	125	NM	4	3	poor	NM	NM
542472	4335865	20	NM	10	4	poor	NM	NM
542449	4335965	51	NM	2	3	poor	NM	NM

EB167, Elbert quad, 542418E/4335148N, T10S, R64W, sec. 23, NE ("group 5"), [xxyyyzz] (Matt Morgan)

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
542384	4335378	79	NM	10	15	good	7	quartz
542497	4335136	96	NM	20	5	good	NM	NM
541886	4334763	134	NM	4	2	poor	NM	NM
541748	4334645	172	NM	3	2	poor	NM	NM
541292	4335023	90	NM	2	4	good	NM	NM
540650	4335493	85	NM	3	4	poor	NM	NM
540764	4335705	50	NM	5	2	poor	NM	NM
SD168, Sedalia quad, 505383E/4366493N, T7S, R67W, sec. 7, SW, 10Aug10 (Cherokee Ranch)								
505383	4366493	98	23	31	19	very good	15	fg crystalline
505371	4366508	76	19	14	21	NM	15	granitic
505461	4366560	45	18	3	3	poor	cs-granules	NM
505475	4366564	30	16	5	4	fair	cs-granules	NM
505429	4366475	83	12	12	7	good	17	Twm
505498	4366460	90	NA	5	4	poor	11	granitic
505516	4366461	92	NA	10	6	poor	6	granitic
505530	4366474	92	NA	9	6	poor	7	granitic
505588	4366485	97	NA	5	5	poor	13	granitic
505585	4366491	8	22	4	6	poor	9	granitic
505740	4366479	82	23	2	5	poor	11	granitic
505778	4366489	79	24	7	4	poor	12	granitic
EB169, Elbert quad, 532593E/4343850N, T9S, R65W, sec. 25, NW, 18Aug10								
532593	4343850	11	20	9	6	poor	cs-pebbles	NM
532595	4343870	5	17	2	3	poor	cs-pebbles	NM
CV170, Cherry Valley School quad, 530772E/4342990N, T9S, R65W, sec. 26, SW, 19Aug10								
530772	4342990	51	NA	3	3	poor	cs-pebbles	NM
531567	4342851	161	NA	3	4	poor	cs-granules	NM
531421	4343006	41	NA	5	5	poor	cs-pebbles	NM
531393	4343022	31	NA	6	7	poor	cs-granules	NM
531357	4343074	47	NA	5	3	poor	cs-pebbles	NM
531355	4343070	61	NA	4	5	poor	cs-pebbles	NM
531375	4342977	44	NA	8	8	poor	cs-pebbles	NM
531366	4342971	78	NA	5	4	poor	cs-pebbles	NM
531357	4342998	106	NA	6	5	poor	cs-granules	NM
531342	4343020	85	NA	7	5	poor	cs-granules	NM
EA171X, Eastonville quad, 533042E/4329656N, T11S, R65W, sec. 1, SW [xxyy]10 (Matt Morgan)								
533042	4329656	110	18	10	5	excellent	15	quartz

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
533042	4329656	105	15	8	4	excellent	20	quartz
533042	4329656	100		10	5	excellent	NM	NM
533082	4329614	170	10	10	4	good	20	Twm
RG171, Russellville Gulch quad, 522339E/4348322N, T9S, R66W, sec. 11, NE, 26Aug10								
522339	4348322	138	13	8	8	fair	cs-pebbles	NM
522276	4348346	147	NA	7	5	poor	cs-pebbles	NM
522229	4348382	152	21	13	6	fair	cs-pebbles	NM
522313	4348526	146	NA	5	4	poor	cs-pebbles	NM
522309	4348549	165	18	5	6	fair	cs-pebbles	NM
522298	4348531	124	NA	2	2	poor	cs-pebbles	NM
RG172, Russellville Gulch quad, 523057E/4347253N, T9S, R66W, sec. 12, SW, 26Aug10								
523057	4347253	213	NA	1	2	poor	NM	NM
523058	4347255	206	18	3	3	fair	cs-pebbles	NM
523070	4347278	195	23	6	9	fair	NM	NM
523228	4347275	186	18	3	3	poor	cs-pebbles	NM
523543	4347527	192	15	10	5	fair	cs-granules	NM
523564	4347498	181	NA	9	5	fair	cs-pebbles	NM
523573	4347415	181	NA	5	4	poor	cs-granules	NM
523535	4347352	163	NA	2	2	poor	cs-granules	NM
523439	4347588	67	NA	2	3	poor	cs-granules	NM
523513	4347577	59	NA	2	3	poor	cs-pebbles	NM
524031	4347758	73	NA	2	3	poor	cs-pebbles	NM
522831	4347895	180	NA	7	4	poor	cs-pebbles	NM
522845	4347863	162	24	3	3	poor	cs-granules	NM
522845	4347861	186	NA	10	12	poor	cs-pebbles	NM
CV173, Cherry Valley School quad, 525732E/4332959N, T10S, R65W, sec. 30, SE, 27Aug10								
525732	4332959	355	NA	2	3	poor	cs-pebbles	NM
524989	4332866	91	NA	4	3	poor	NM	granitic
525068	4332600	57	NA	3	2	poor	NM	NM
525228	4332659	41	NA	2	3	poor	cs-pebbles	
525226	4332661	52	NA	1	3	poor	cs-pebbles	
525342	4332682	118	NA	9	5	poor	NM	NM
525468	4332665	5	NA	4	3	poor	NM	NM
EB182, Elbert quad, 540078E/4330796N, T11S, R64W, sec. 3, NE, 7Sep10								
540078	4330096	29	14	3	3	poor	cs-granules	NM
540091	4330799	99	NA	7	4	poor	cs-pebbles	NM

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
540159	4330782	147	NA	3	3	poor	cs-pebbles	NM
540271	4330844	331	NA	2	4	poor	cs-granules	NM
EB189, Elbert quad, 532383E/4340949N, T9S, R65W, sec. 36, SW, 15Sep10								
main ledge								
532426	4340953	199	NA	2	3	poor	5	granitic
532502	4340940	128	NA	5	3	poor	cs to <1	NM
532549	4340893	98	NA	3	4	poor	cs to <1	NM
532580	4340989	138	24	6	5	fair	cs to <2	NM
532594	4340875	128	NA	9	7	fair	cs to <2	NM
532602	4340883	156	15	7	9	fair	cs to <1	NM
532640	4340866	107	NA	2	3	poor	cs to <2	NM
532644	4340871	120	NA	18	7	poor	cs to <1	NM
532639	4340882	74	20	8	10	fair	6	granitic
532630	4340887	170	NA	2	2	poor	cs to <1	NM
532620	4340892	142	28	3	3	good	cs to <2	NM
532593	4340893	72	13	6	9	good	6	granitic
532565	4340917	144	NA	4	4	poor	3	granitic
532542	4341114	160	19	2	2	poor	cs-granules	NM
532545	4341118	124	NA	3	2	poor	cs-granules	NM
532544	4341116	152	NA	7	3	poor	cs-granules	NM
532552	4341126	142	16	2	3	poor	cs-granules	NM
532560	4341125	183	NA	2	1	poor	cs-granules	NM
532567	4341139	149	18	6	7	fair	10	blue-gray quartzite
532505	4341230	172	18	40	10	fair	cs to <1	NM
532462	4341171	127	21	6	6	fair	cs to <2	NM
532516	4341223	181	13	13	6	fair	cs to <1	NM
532582	4341542	207	23	23	10	good	cs to <2	NM
532591	4341547	141	19	16	10	fair	cs to <1	NM
532598	4341555	150	NA	5	3	poor	cs to <1	NM
532596	4341564	186	NA	6	3	poor	cs-granules	NM
532547	4341546	201	26	10	5	fair	cs to <1	NM
532551	4341561	161	18	2	3	fair	cs to <1	NM
532595	4341563	179	7	6	3	poor	cs-granules	NM
532469	4341165	169	15	3	3	poor	cs to <2	NM
532474	4341605	146	NA	3	6	poor	cs to <2	NM
532466	4341603	207	17	6	9	fair	cs to <2	NM
532465	4341584	187	NA	3	4	poor	cs to <2	NM
532450	4341583	215	17	1	3	poor	cs to <1	NM
532447	4341577	258	14	4	4	fair	cs-granules	NM

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
532443	4341566	156	11	2	7	poor	3	granitic
532432	4341550	211	17	11	8	good	cs to <2	NM
532423	4341528	188	NA	6	6	good	cs to <2	NM
532418	4341518	197	17	6	4	fair	cs-granules	NM
532415	4341494	171	NA	9	5	poor	4	Twm
532388	4341504	178	8	4	3	poor	cs-granules	NM
532386	4341500	212	13	5	7	fair	cs to <2	NM
532396	4341535	201	NA	9	6	poor	cs to <1	NM
532401	4341560	217	3	13	13	fair	cs to <1	NM
532412	4341558	210	11	8	12	fair	cs to <2	NM
532423	4341566	207	NA	2	2	poor	cs to <1	NM
532423	4341564	213	NA	2	2	poor	cs-granules	NM
532441	4341600	246	12	3	3	fair	cs to <2	NM
532454	4341886	200	4	7	4	poor	6	granitic
532448	4341916	224	NA	4	4	poor	cs to <2	NM
532444	4341916	203	13	5	4	poor	cs to <2	NM
532396	4341961	257	8	2	4	fair	cs-granules	NM
532409	4341959	263	15	5	4	poor	cs to <2	NM
532419	4341967	227	NA	3	3	poor	cs to <2	NM
532437	4341968	270	NA	5	3	poor	5	fg crystalline
532453	4341987	301	15	2	3	fair	cs to <2	NM
532457	4341988	263	6	8	4	fair	10	Twm
532462	4341997	310	17	3	4	very good	cs to <2	NM
532458	4342061	311	NA	3	3	poor	cs to <1	NM
532470	4342069	298	11	5	4	fair	cs to <2	NM
532480	4342073	322	7	3	2	poor	cs to <2	NM
532576	4342175	200	NA	7	6	poor	15	granitic
532586	4342182	220	NA	7	7	poor	3	granitic
532612	4342186	232	14	8	3	good	4	granitic
532635	4342230	232	18	6	4	poor	6	quartz
532609	4342176	187	NA	10	6	fair	cs to <1	NM
lower unit								
532599	4342076	160	NA	13	5	poor	11	granitic
532619	4342075	147	20	7	3	poor	cs to <2	NM
532628	4342093	187	NA	5	4	poor	cs-granules	NM
532635	4342086	194	NA	5	5	poor	cs to <2	NM
532633	4342109	182	13	5	5	poor	3	granitic
532643	4342091	176	4	7	3	poor	7	granitic
532561	4341141	131	NA	1	2	poor	cs to <1	NM
532583	4341123	198	17	2	2	poor	cs to <2	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
532577	4341120	156	NA	9	9	fair	cs to <2	NM
532568	4341144	167	30	6	7	good	16	Twm
532559	4341142	127	NA	2	2	poor	cs-granules	NM
532558	4341137	112	38	3	3	fair	cs to <1	NM
532555	4341236	176	15	7	7	good	cs-granules	NM
532544	4341251	209	19	14	7	fair	cs to <2	NM
532533	4341249	175	NA	3	4	poor	cs to <2	NM
532543	4341268	199	19	7	4	fair	5	granitic
532550	4341261	204	14	3	2	fair	cs to <1	NM
532535	4341283	130	13	7	7	fair	3	granitic
532525	4341326	175	NA	7	2	fair	cs to <2	NM
532517	4341326	199	NA	3	2	poor	cs to <1	NM
532476	4341361	160	NA	13	7	fair	7	fg crystalline
532481	4341368	212	NA	4	4	poor	cs to <2	NM
532481	4341371	193	3	1	2	poor	3	granitic
532496	4341368	164	9	3	4	poor	cs to <2	NM
532483	4341376	198	3	16	5	fair	7	fg crystalline
532500	4341456	210	17	4	3	poor	cs-granules	NM
532528	4341497	208	9	4	3	fair	cs-granules	NM
532550	4341506	227	6	4	10	fair	9	Twm
532560	4341522	207	14	14	9	fair	cs-granules	NM
532503	4341684	187	7	1	1	poor	cs to <1	NM
532494	4341668	169	NA	5	3	poor	cs-granules	NM
532488	4341660	194	6	11	7	good	cs to <1	NM
532483	4341649	211	11	5	4	fair	cs to <1	NM
532476	4341630	190	17	5	4	fair	cs to <1	NM
532467	4341628	210	9	5	2	very good	cs-granules	NM
532424	4341637	225	13	6	5	fair	14	NM
532428	4341657	243	NA	10	6	fair	cs to <2	NM
532458	4341660	230	14	4	4	fair	cs to <1	NM
532464	4341681	221	7	18	8	fair	cs to <2	NM
532475	4341694	208	23	11	5	poor	cs to <2	NM
532491	4341682	220	14	2	4	good	cs to <1	NM
532429	4341685	207	NA	10	7	poor	cs to <1	NM
532530	4342012	117	21	3	3	fair	4	granitic
532417	4342128	45	NM	9	6	good	4	quartz
532442	4342102	63	8	3	4	fair	cs to <1	NM
532515	4342033	134	NA	4	4	fair	8	granitic
532549	4342021	137	15	6	4	fair	38	Twm
532584	4342042	106	23	6	7	fair	23	Twm

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
532468	4342212	52	32	5	6	fair	4	quartzite
532609	4342212	60	17	7	7	fair	cs to <1	NM
EB190, Elbert quad, 534026E/4339593N, T10S, R65W, sec. 1, NE, 21Sep10								
534026	4339593	79	18	4	4	poor	cs to <1	NM
534098	4339412	152	16	15	6	poor	cs to <1	NM
534166	4339400	153	19	11	6	poor	cs to <1	NM
534222	4339093	56	13	4	4	poor	cs to <1	NM
534226	4339130	112	12	2	3	poor	cs to <1	NM
534120	4339288	35	6	5	5	fair	cs-granules	NM
533996	4339618	134	17	8	7	good	cs-granules	NM
533967	4339650	233	12	11	7	fair	cs-granules	NM
533812	4339779	116	NA	2	3	poor	cs-granules	NM
533783	4339745	207	12	5	5	poor	cs to <1	NM
533738	4339747	217	NA	2	2	poor	cs-granules	NM
533460	4339864	173	17	3	3	poor	cs to <1	NM
533454	4339878	232	18	3	3	poor	cs to <1	NM
533463	4339927	269	11	5	7	fair	cs to <1	NM
533417	4339963	92	12	6	7	fair	cs to <2	NM
533271	4340041	101	NA	4	4	poor	cs-granules	NM
533253	4340050	115	18	12	4	poor	cs-granules	NM
533206	4340103	138	8	2	2	poor	cs to <1	NM
533090	4340667	86	15	3	2	fair	5	quartzite
533093	4340669	72	5	4	4	fair	cs to <1	NM
533020	4340690	76	NA	8	11	fair	3	granitic
533017	4340706	83	NA	3	4	poor	6	granitic
533002	4340705	137	NA	2	2	poor	cs to <2	NM
532994	4340692	67	NA	2	3	poor	cs to <2	NM
532993	4340688	138	22	11	5	fair	6	granitic
532987	4340697	80	NA	3	5	fair	cs to <1	NM
532983	4340722	180	NA	3	3	poor	cs to <1	NM
532961	4340715	132	NA	6	6	poor	cs to <2	NM
532974	4340679	146	NA	7	9	fair	6	granitic
EB191, Elbert quad, 534932E/4341344N, T9S, R64W, sec. 31, SE, 22Sep10								
main ledge								
534932	4341344	139	NA	5	7	poor	cs to <1	NM
534919	4341355	90	12	3	3	poor	cs-granules	NM
535014	4341316	174	NA	4	4	poor	cs to <1	NM
535028	4341293	171	16	3	3	poor	cs to <1	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
535165	4341259	61	NA	8	3	poor	cs to <1	NM
535172	4341259	56	NA	7	2	poor	cs to <1	NM
535176	4341261	25	12	5	2	poor	cs to <2	NM
535143	4341242	43	NA	3	3	poor	cs to <1	NM
535135	4341251	12	NA	4	3	poor	cs to <1	NM
535022	4341195	167	NA	11	4	poor	cs to <2	NM
535019	4341184	177	NA	4	6	poor	cs to <2	NM
534855	4340976	75	23	5	4	fair	cs to <2	NM
534848	4340987	67	11	2	2	poor	3	granitic
534853	4340988	120	13	4	3	poor	cs to <1	NM
534851	4340985	92	NA	2	1	poor	cs to <2	NM
534850	4340985	77	15	11	6	poor	cs to <1	NM
534815	4340990	12	17	6	9	fair	cs to <1	NM
534812	4341005	334	14	2	2	poor	cs to <1	NM
lower unit								
534962	4341214	173	23	6	4	fair	5	granitic
534973	4341211	179	NA	6	5	fair	cs to <1	NM
534981	4341195	134	NA	5	5	poor	cs-granules	NM
534986	4341187	136	18	3	4	poor	cs-granules	NM
EB192, Elbert quad, 534167E/4341665N, T9S, R64W, sec. 31, NW, 22Sep10								
main ledge								
534167	4341665	25	11	15	3	good	18	granitic
534173	4341677	78	18	4	4	fair	6	granitic
534188	4341704	2	12	5	4	poor	cs to <2	NM
534204	4341731	357	12	7	4	very good	cs to <2	NM
534209	4341739	34	16	3	3	fair	cs to <1	NM
534278	4341717	355	NA	8	9	fair	cs-granules	NM
534331	4341558	18	15	3	2	poor	cs-granules	NM
534327	4341561	334	NA	2	3	poor	cs to <1	NM
534325	4341558	351	4	2	1	fair	cs-granules	NM
534376	4341551	335	18	6	6	fair	cs to <2	NM
534394	4341554	60	NA	4	9	fair	7	granitic
534409	4341554	342	NA	4	7	poor	9	granitic
534681	4341501	129	NA	1	2	poor	cs to <2	NM
534677	4341504	187	NA	5	4	poor	cs to <1	NM
534668	4341506	139	12	6	6	fair	cs to <2	NM
534653	4341499	75	19	6	10	good	cs to <1	NM
534651	4341505	115	5	5	4	fair	cs to <1	NM
534648	4341516	126	NA	2	2	poor	NA	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
534645	4341514	107	13	5	9	fair	cs to <1	NM
534638	4341517	105	NA	5	9	poor	cs-granules	NM
534627	4341513	113	13	5	7	fair	cs to <1	NM
534622	4341515	115	17	5	7	fair	cs-granules	NM
534621	4341534	114	NA	4	4	poor	6	quartz
534585	4341572	162	NA	6	10	poor	cs to <2	NM
534520	4341625	107	15	10	7	very good	cs to <1	NM
534400	4341705	118	21	12	7	good	cs to <1	NM
534410	4341696	177	NA	4	6	fair	cs to <1	NM
534359	4341753	131	7	6	6	fair	cs-granules	NM
534360	4341968	142	14	5	3	fair	cs to <2	NM
534364	4341970	145	12	5	4	fair	cs to <2	NM
534270	4342025	142	4	7	5	fair	cs-granules	NM
534246	4342020	157	NA	9	5	fair	cs to <2	NM
534156	4341981	188	18	4	2	poor	4	granitic
534128	4341990	124	17	20	13	good	7	Twm
lower unit								
534436	4341563	85	17	4	8	good	ms-granules	NM
534460	4341556	48	24	4	10	good	ms to <1	NM
534497	4341504	91	14	7	8	fair	ms-cs	NM
EB193, Elbert and Cherry Valley School quads, 532220E/4344512N, T9S, R65W, sec. 23, SE, 23Sep10								
main ledge								
532220	4344512	262	23	2	3	fair	ms-granules	NM
532218	4344501	201	NA	2	1	poor	cs to <1	NM
532204	4344494	198	14	6	3	fair	cs-granules	NM
532169	4344462	189	10	8	3	fair	ms-granules	NM
532175	4344446	197	NA	7	7	poor	7	fg crystalline
532180	4344432	250	NA	2	3	poor	8	granitic
532192	4344412	219	NA	4	4	poor	5	granitic
532181	4344416	218	4	6	5	good	5	granitic
532177	4344406	204	5	11	5	fair	ms to <1	NM
532172	4344415	204	NA	6	6	fair	cs to <1	NM
532167	4344400	175	9	5	3	fair	ms-granules	NM
532169	4344396	169	8	4	4	fair	ms-granules	NM
532165	4344383	199	NA	5	3	poor	5	granitic
532163	4344372	196	NA	6	9	fair	cs to <1	NM
532177	4344395	193	13	2	2	poor	cs to <1	NM
532179	4344387	215	NA	6	6	fair	8	granitic

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
532148	4344429	192	15	32	8	good	cs to <1	NM
532156	4344151	190	18	5	6	fair	cs-granules	NM
532152	4344454	209	8	10	3	fair	ms to <1	NM
532143	4344451	191	12	13	4	fair	ms-granules	NM
532143	4344447	212	13	7	3	fair	ms to <2	NM
532130	4344446	209	NA	3	3	poor	ms-granules	NM
532119	4344427	216	13	8	5	fair	ms-granules	NM
532120	4344421	215	17	18	7	fair	ms to <1	NM
532116	4344410	199	18	12	8	good	ms-granules	NM
532133	4344461	194	10	22	4	good	ms-granules	NM
532123	4344418	210	11	25	5	good	cs-granules	NM
532129	4344412	195	NA	8	5	fair	cs to <2	NM
532141	4344368	190	12	7	4	fair	ms-granules	NM
532133	4344357	208	NA	12	6	fair	ms to <1	NM
532094	4344379	212	4	20	9	good	cs to <2	NM
532094	4344342	199	22	41	20	good	cs to <2	NM
532128	4344341	183	NA	8	5	fair	cs-granules	NM
532067	4344333	202	NA	8	3	poor	cs to <1	NM
532067	4344332	196	NA	9	3	poor	NA	NM
532062	4344311	180	7	30	7	fair	ms-granules	NM
532069	4344236	182	NA	14	21	fair	ms-granules	NM
532447	4344421	140	9	21	12	good	cs to <1	NM
532533	4344370	147	NA	6	7	poor	11	Twm
532550	4344365	155	9	12	4	poor	23	Twm
532321	4344195	123	NA	5	3	poor	7	granitic
532295	4344189	115	NA	6	6	poor	12	Twm
532212	4344067	113	NA	5	5	poor	5	granitic
532366	4343981	117	NA	7	7	poor	cs-granules	NM
532401	4344042	117	NA	11	17	poor	16	Twm
532391	4344139	90	12	7	5	poor	5	granitic
532434	4344087	118	19	15	6	fair	cs to <1	NM
lower unit								
532110	4344189	83	8	5	5	fair	cs to <1	NM
532173	4344285	207	NA	8	4	fair	cs to <2	NM
532161	4344280	210	11	4	4	fair	cs to <2	NM
532257	4344382	211	NA	3	3	poor	cs to <1	NM
532406	4344412	187	14	5	3	fair	cs to <1	NM
532412	4344393	223	13	3	5	good	cs to <2	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
EB194, Elbert quad, 534288E/4338021N, T10S, R64W, sec. 7, SW, 24Sep10								
534288	4338021	223	15	5	6	fair	cs to <1	NM
534294	4337972	203	15	5	4	fair	cs-granules	NM
534542	4338797	275	18	5	5	poor	cs-granules	NM
534630	4338515	187	22	6	4	poor	cs-granules	NM
EB204, Elbert quad, 538117E/4342203N, T9S, R64W, sec. 33, NE, 6Oct10								
main ledge								
538117	4342203	47	12	7	12	fair	cs to <1	NM
538106	4342213	67	7	6	3	fair	cs to <1	NM
537935	4341921	78	22	8	9	fair	12	Twm
lower unit								
537866	4341963	123	16	8	3	good	10	Twm
537856	4341956	118	21	9	7	good	8	granitic
537837	4341971	130	NA	7	10	fair	cs to 2 cm	NM
537891	4341911	92	14	11	4	good	6	granitic
538077	4341930	60	12	3	4	poor	cs to 1 cm	NM
EB205, Elbert quad, 537748E/4342687N, T9S, R64W, sec. 28, SE, 8Oct10								
537748	4342687	233	10	3	3	poor	cs to granules	NM
537743	4342610	130	NA	4	3	poor	8	white quartzite
537752	4342608	149	16	5	3	poor	cs to 2 cm	NM
EB206, Elbert quad, 538925E/4343276N, T9S, R64W, sec. 27, NW, 8Oct10								
538925	4343276	86	NA	7	5	fair	42	Twm
CV207, Cherry Valley School quad, 524546E/4332962N, T10S, R65W, sec. 30, SW, 13Oct10								
524546	4332962	192	NA	2	3	poor	18	Twm
RG209, Russellville Gulch quad, 527707E/4344990N, T9S, R65W, sec. 21, NW, 14Oct10								
upper unit								
527670	4345076	145	9	12	5	fair	cs to 0.5 cm	NM
527668	4345080	147	13	5	2	fair	cs to 1 cm	NM
lower unit								NM
527707	4344990	53	16	5	5	poor	8	granitic
527709	4344961	32	13	2	4	poor	6	granitic
527718	4344957	63	12	3	3	fair	47	Twm
RG210, Russellville Gulch quad, 528030E/4345160N, T9S, R65W, sec. 21, NW, 15Oct10								

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
528030	4345160	127	NA	6	6	fair	cs to granules	NM
528059	4345145	138	25	5	4	fair	cs to 2 cm	NM
528059	4345135	114	13	9	7	fair	cs to 1 cm	NM
528076	4345149	136	15	8	3	fair	cs to 1 cm	NM
528097	4345137	145	5	7	11	good	cs to 2 cm	NM
528122	4345124	113	22	4	5	fair	cs to 2 cm	NM
528083	4345155	107	NA	14	10	poor	cs to 2 cm	NM
528071	4345176	155	6	11	6	poor	cs to 1 cm	NM
528121	4345146	110	2	12	12	good	cs to 2 cm	NM
528141	4345138	136	NA	5	3	poor	cs to 0.5 cm	NM
528150	4345126	126	NA	7	2	fair	cs to 2 cm	NM
528051	4345221	104	NA	5	5	poor	NA	NM
528051	4345239	133	NA	4	8	poor	NA	NM
528042	4345256	96	NA	6	7	poor	NA	NM
528015	4345270	150	NA	11	4	poor	cs to 1 cm	NM
527979	4345280	161	17	6	4	fair	cs to 1 cm	NM
EL212, Elizabeth quad, 535911E/4345018N, T9S, R64W, sec. 20, NW, 21Oct10								
535911	4345018	118	29	11	9	good	8	Twm
535438	4345818	41	8	11	11	good	4	granitic
535445	4345806	33	NA	5	4	poor	cs to 2 cm	NM
535455	4345827	26	17	3	4	poor	cs to 2 cm	NM
EL213, Elizabeth quad, 535818E/4346099N, T9S, R64W, sec. 17, SW, 21Oct10								
535818	4346099	96	16	6	5	fair	cs to 1 cm	NM
535805	4346100	91	20	7	5	fair	cs to 1 cm	NM
535770	4346109	100	6	9	6	poor	cs to granules	NM
535707	4346137	129	8	5	4	poor	cs to granules	NM
535677	4346151	122	15	6	6	poor	cs to 1 cm	NM
535640	4346170	135	14	8	8	fair	cs to 1 cm	NM
535642	4346181	126	NA	4	4	poor	cs to granules	NM
535633	4346190	153	17	4	5	fair	cs to 1 cm	NM
535622	4346199	121	8	3	3	poor	cs to 0.5 cm	NM
CRS215, Castle Rock South quad, 518331E/4354285N, T8S, R66W, sec. 21, NW, 25Oct10								
518331	4354285	337	NA	5	10	poor	41	Twm
518319	4354312	75	19	5	8	poor	15	Twm
518283	4354371	330	NA	4	4	poor	12	Twm
518262	4354419	332	NA	5	2	poor	NA	NM
518359	4354365	327	16	9	8	fair	16	Twm

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
518355	4354422	330	13	2	6	fair	14	Twm
518355	4354442	334	12	5	5	fair	cs to 2 cm	NM
518354	4354448	332	NA	5	3	fair	12	Twm
CRS219, Castle Rock South quad, 520592E/4354425N, T8S, R66W, sec. 22, NE, 30Oct10								
520592	4354425	155	22	5	8	fair	22	Twm
520556	4354505	160	15	12	18	fair	cs to 1 cm	NM
520388	4354429	46	17	4	4	fair	8	granitic
520282	4354403	80	NA	7	8	fair	14	granitic
CRN220, Castle Rock North quad, 513512E/4372021N, T6S, R66W, sec. 25, SE, 1Nov10								
513512	4372021	21	9	3	4	poor	cs to granules	NM
513513	4372475	152	<5	8	6	poor	cs to granules	NM
513231	4371994	138	22	8	6	fair	cs to granules	NM
513092	4371873	167	13	3	3	fair	cs to granules	NM
513121	4371794	191	9	4	4	good	cs to granules	NM
513364	4371470	147	12	5	5	fair	cs to granules	NM
EB221, Elbert quad, 542947E/4333841N, T10S, R64W, sec. 25, NE, 2Nov10								
542947	4333841	150	NA	6	5	poor	17	granitic
CRS227, Castle Rock South quad, 519173E/4352091N, T8S, R66W, sec. 28, SE, 13Jul11								
519173	4352091	224	20	7	5	good	10	Twm
519164	4352090	196	24	7	5	good	7	Twm
CRS228, Castle Rock South quad, 518080E/4354829N, T8S, R66W, sec. 21, NW, 13Jul11								
518080	4354829	343	NA	4	3	poor	NA	NA
518076	4354835	332	NA	3	3	poor	NA	NA
518060	4354846	312	NA	2	3	poor	NA	NA
518054	4354868	337	NA	3	3	poor	NA	NA
518101	4354911	327	NA	3	3	poor	NA	NA
518093	4354912	357	NA	3	5	poor	NA	NA
518073	4354934	290	NA	4	5	poor	NA	NA
518072	4354992	321	NA	5	3	poor	NA	NA
518062	4355007	338	NA	2	2	poor	NA	NA
518055	4355005	317	NA	4	4	poor	NA	NA
518036	4355068	328	NA	2	3	poor	NA	NA
518034	4355078	272	NA	3	5	poor	NA	NA
518145	4355079	66	15	3	4	poor	5	granitic
518138	4355088	91	7	3	2	poor	7	Twm

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CRS229, Castle Rock South quad, 517291E/4353651N, T8S, R66W, sec. 20, SE, 15Jul11								
517291	4353651	351	NA	2	3	poor	15	Twm
517105	4353767	21	21	9	11	fair	8	Twm
517106	4353785	7	NA	15	8	fair	10	Twm
517096	4353785	5	18	5	3	poor	4	granitic
517091	4353786	347	NA	5	3	poor	8	Twm
517295	4353633	16	NA	3	2	poor	4	granitic
CRS230, Castle Rock South quad, 516810E/4355097N, T8S, R66W, sec. 20, NW, 15Jul11								
516810	4355097	274	NA	2	3	poor	16	fg xtall
516810	4355095	285	18	1	1	poor	NA	NA
516769	4355125	335	NA	6	4	poor	27	Twm
RG231A, Russellville Gulch quad, 523250E/4352860N, T8S, R66W, sec. 25, NW, 19Jul11								
522981	4352883	135	22	11	10	good	12	Twm
522987	4352874	122	19	5	4	poor	21	Twm
523020	4352831	100	12	4	5	poor	4	quartzite
523059	4352808	163	NA	19	12	fair	10	Twm
522975	4352925	104	7	4	3	fair	5	granitic
522988	4352920	70	12	5	4	fair	6	Twm
522922	4352915	123	13	8	4	poor	44	Twm
522999	4352917	132	12	11	10	fair	11	fg granitic
523007	4352918	154	12	4	4	poor	ms to granules	NM
523034	4352902	115	10	9	5	fair	6	quartzite
523056	4352907	57	28	6	5	fair	ms to granules	NM
523057	4352892	128	20	6	5	fair	6	quartzite
523057	4352853	122	16	16	12	fair	5	granitic
523071	4352913	46	16	7	12	fair	13	Twm
523167	4352795	118	NA	14	6	poor	32	Twm
523201	4352805	196	17	10	6	fair	13	Twm
523171	4352834	67	NA	2	3	poor	9	granitic
523166	4352881	130	NA	3	5	poor	75	Twm
523193	4352860	82	NA	6	7	poor	14	granitic
523186	4352883	148	11	6	6	good	ms to granules	NM
523189	4352872	114	20	3	5	fair	6	Twm
RG231B, Russellville Gulch quad, 523380E/4352667N, T8S, R66W, sec. 25, SW, 19Jul11								
523240	4352841	187	NA	22	13	fair	10	granitic
523256	4352775	185	7	48	9	fair	25	Twm

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523298	4352783	173	18	10	7	poor	3	granitic
523293	4352758	173	12	35	10	good	38	Twm
523312	4352738	179	9	11	9	poor	5	granitic
523315	4352716	160	7	71	11	fair	38	Twm
523281	4352735	137	NA	6	8	poor	24	Twm
523316	4352657	180	15	24	9	fair	27	Twm
523346	4352597	172	7	74	14	good	20	granitic
523359	4352595	166	20	21	10	fair	15	Twm
523365	4352597	162	NA	31	9	fair	6	granitic
523406	4352566	173	NA	41	17	poor	25	Twm
523374	4352545	152	15	40	15	poor	7	granitic
523362	4352542	170	NA	15	6	poor	31	Twm
523014	4352675	172	18	13	6	fair	6	granitic
523014	4352656	132	23	7	5	fair	11	granitic
523036	4352626	172	18	19	8	fair	31	Twm
523062	4352514	168	22	9	9	good	40	Twm
523076	4352496	234	27	4	7	good	5	granitic
523083	4352496	173	21	5	5	fair	ms to granules	NM
RG231C, Russellville Gulch quad, 523220E/4352313N, T8S, R66W, sec. 25, SW, 20Jul11								
main ledge								
523097	4352515	147	12	15	10	good	59	Twm
523122	4352500	112	NA	7	5	poor	7	granitic
523133	4352500	121	NA	4	3	poor	ms to granules	NM
523139	4352498	96	NA	3	4	poor	ms to granules	NM
523347	4352596	172	10	8	4	poor	26	Twm
523354	4352598	166	21	13	6	poor	75	Twm
523344	4352581	168	7	36	10	poor	20	granitic
523327	4352573	128	NA	5	4	poor	NM	NM
523316	4352575	157	17	11	6	poor	3	granitic
523300	4352565	148	20	28	19	fair	15	Twm
523382	4352532	134	18	9	8	poor	11	Twm
523355	4352529	168	26	31	14	poor	9	quartzite
523313	4352552	166	29	15	14	good	16	granitic gneiss
523251	4352554	142	16	5	4	fair	47	blue quartzite
523226	4352546	190	NA	4	4	poor	NA	NA
523199	4352490	133	NA	6	3	poor	ms to granules	NM
523193	4352482	124	NA	5	5	poor	8	granitic
523208	4352472	176	NA	5	8	poor	15	granitic
523213	4352447	170	8	5	5	poor	7	granitic

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523210	4352434	140	18	7	7	poor	30	Twm
523204	4352414	171	6	9	4	fair	8	Twm
523182	4352351	172	27	9	9	fair	7	Twm
523154	4352322	103	19	6	9	poor	ms to granules	NM
523172	4352241	193	15	31	17	fair	30	Twm
523175	4352220	114	8	14	25	fair	43	Twm
523175	4352174	79	11	3	6	fair	ms to granules	NM
523141	4352170	61	11	1	3	poor	ms to cs	NM
523121	4352156	127	20	24	17	fair	32	Twm
523121	4352147	142	8	4	4	poor	19	Twm
523044	4352142	68	19	11	7	fair	8	granitic
523056	4352138	75	17	9	7	fair	7	Twm
523067	4352133	172	NA	5	5	poor	8	quartz
523060	4352149	165	12	5	7	poor	15	Twm
523077	4352149	218	12	3	4	poor	11	granitic
523120	4352160	133	19	37	23	good	22	Twm
523139	4352164	135	23	33	19	good	11	Twm
523152	4352161	117	14	4	4	fair	15	Twm
523123	4352115	152	10	18	14	fair	32	Twm
523080	4352011	139	11	9	6	fair	3	granitic
523111	4352023	95	24	8	6	fair	ms to 1 cm	NM
523193	4352961	110	23	26	13	fair	3	fg crystalline
523206	4351938	157	NA	1	2	poor	NA	NA
523222	4351909	171	15	4	4	fair	5	granitic
523215	4351915	105	8	13	8	poor	18	fg crystalline
lower unit								
523411	4352711	107	14	5	5	poor	ms to granules	NM
523449	4352696	124	NA	6	4	poor	ms to granules	NM
523464	4352689	89	22	7	7	fair	12	Twm
523467	4352680	167	13	5	5	fair	18	Twm
523472	4352678	93	28	5	5	fair	23	Twm
523486	4352637	120	22	7	8	poor	16	Twm
523489	4352577	155	16	6	6	fair	9	Twm
523480	4352566	162	17	17	10	fair	7	Twm
523475	4352522	133	20	4	4	poor	16	Twm
523418	4352492	156	10	6	10	poor	7	Twm
RG232A, Russellville Gulch quad, 523398E/4353172N, T8S, R66W, sec. 25, NE, 21Jul11								
523147	4353350	130	NA	5	5	poor	18	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
523219	4353226	130	NA	12	7	poor	16	Twm
523200	4353234	153	NA	21	11	poor	11	granitic
523186	4353242	191	NA	4	5	poor	11	fg crystalline
523137	4353363	157	NA	7	4	poor	34	Twm
523135	4353380	135	NA	7	3	poor	10	granitic
523097	4353347	116	NA	3	4	poor	ms to 1 cm	NM
523075	4353422	148	NA	6	2	poor	NA	NA
523017	4353254	109	NA	4	4	poor	ms to 2 cm	NM
522999	4353152	96	NA	14	7	poor	ms to cs	NM
523036	4353097	73	NA	12	9	poor	8	granitic
523081	4353098	118	NA	5	4	poor	10	granitic gneiss
523255	4353078	120	NA	7	7	poor	9	fg crystalline
523270	4353109	140	NA	6	6	poor	21	Twm
523269	4353106	133	18	9	8	fair	25	Twm
523268	4353098	135	NA	4	4	poor	8	Twm
523254	4353076	105	19	11	13	fair	9	Twm
523276	4353066	144	NA	10	7	fair	49	Twm
523243	4353252	162	NA	6	6	poor	10	granitic
523215	4353231	133	NA	12	6	poor	11	granitic
523201	4353232	160	NA	20	12	fair	31	Twm
523278	4353265	157	NA	5	5	poor	16	Twm
523308	4353272	166	NA	12	5	poor	3	granitic
523296	4353244	127	29	5	3	poor	4	granitic
523294	4353243	162	NA	8	4	poor	6	granitic
523319	4353240	144	13	7	4	poor	29	Twm
523295	4353197	135	NA	6	6	poor	15	Twm
523288	4353146	161	NA	23	7	poor	17	fg crystalline
523367	4353123	186	10	51	11	fair	51	Twm
523373	4353151	163	NA	10	4	poor	11	granitic
523413	4353211	166	NA	7	5	poor	9	granitic
523427	4353225	157	14	16	11	fair	36	Twm
523444	4353248	155	NA	10	7	fair	14	granitic
523441	4353282	152	NA	12	8	poor	47	Twm
523429	4353265	165	NA	20	17	poor	13	Twm
523374	4353084	170	13	62	28	fair	47	Twm
523389	4353000	190	NA	12	5	poor	29	Twm
523365	4352993	155	NA	13	8	poor	15	Twm
523443	4353026	160	NA	20	8	fair	12	pegmatite
523458	4353029	183	NA	10	7	poor	9	pegmatite
523480	4353064	118	14	3	9	poor	6	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
523479	4353044	135	4	7	7	poor	7	Twm
523475	4353028	141	NA	7	11	poor	15	Twm
523446	4352993	140	NA	8	9	poor	6	Twm
523553	4353030	183	NA	14	6	poor	8	Twm
523674	4353081	100	NA	13	10	poor	11	Twm
523737	4353114	228	13	4	6	poor	12	granitic
523738	4353109	157	NA	14	6	poor	5	quartz
523779	4353140	160	NA	22	10	poor	24	granitic

RG232B, Russellville Gulch quad, 524148E/4352886N, T8S, R66W, sec. 25, SE, 4Aug11
upper unit

523782	4353038	146	12	8	4	poor	30	Twm
523782	4353032	143	15	6	4	poor	19	Twm
523786	4353026	151	NA	14	5	poor	16	pegmatite
523766	4353051	149	5	7	7	poor	47	Twm
523732	4352999	138	6	2	10	poor	12	Twm
523728	4353016	216	NA	10	9	poor	22	Twm
523758	4353088	166	15	6	6	poor	8	granitic
523738	4353108	156	7	13	6	fair	10	Twm
523747	4353119	150	NA	13	8	poor	18	foliated granite
523780	4353141	155	11	21	12	good	15	granitic
523843	4353227	148	NA	8	4	poor	10	foliated granite
523849	4353175	155	NA	11	7	poor	15	quartzite
523855	4353173	117	8	14	16	fair	12	Twm
523881	4353147	146	NA	8	8	poor	19	Twm
523896	4353141	154	NA	9	8	poor	19	blue quartzite
523916	4353101	133	NA	3	4	poor	29	Fountain
523889	4353077	127	NA	7	8	poor	15	blue quartzite
523831	4353013	173	NA	24	20	poor	18	quartz
523844	4352998	120	NA	5	8	poor	8	granitic
523878	4353001	143	NA	12	10	poor	6	quartz
524131	4353043	169	15	6	9	fair	6	granitic
524064	4352908	158	NA	7	4	poor	4	quartz
524005	4352893	87	15	20	26	fair	23	Twm
523992	4352814	164	16	14	8	poor	8	granitic
524007	4352777	48	16	3	4	poor	ms to granules	NM
524042	4352745	193	NA	4	3	poor	11	Twm
524051	4352775	172	18	15	6	fair	34	Twm
524028	4352823	165	12	11	4	poor	22	Twm
524035	4352826	154	10	4	3	poor	4	granitic

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
524186	4352805	80	10	3	25	fair	22	Twm
524186	4352787	143	12	4	5	fair	50	Twm
524195	4352779	147	8	14	7	fair	16	granitic
524194	4352747	143	13	2	3	poor	8	quartz
524187	4352719	178	NA	15	9	fair	15	Twm
524046	4352641	99	8	10	6	good	15	Twm
524050	4352635	132	NA	5	3	poor	78	Twm
524096	4352718	151	15	8	13	fair	25	granitic
524190	4352722	185	NA	13	9	fair	15	Twm
524193	4352765	110	15	3	4	poor	9	granitic
524213	4353032	147	NA	8	6	poor	4	quartzite
524278	4352781	146	2	16	14	poor	25	granitic
524276	4352744	137	23	12	9	fair	6	granitic
524259	4352727	143	5	5	7	fair	10	Twm
524262	4352713	146	15	8	6	poor	10	granitic
524260	4352655	165	11	8	13	fair	21	Twm
524251	4352640	128	12	20	8	fair	22	Twm
524246	4352629	124	NA	18	7	fair	26	Twm
524242	4352624	148	NA	5	4	poor	8	granitic
524230	4352611	138	12	25	9	good	11	granitic
524208	4352610	173	16	15	14	good	32 x 195	petrified log
524390	4352738	168	5	14	14	poor	8	fg granitic
524394	4352708	160	16	12	6	fair	6	quartz
524349	4352478	159	9	13	13	fair	14	Twm
524311	4352529	186	NA	7	5	poor	6	granitic
524302	4352537	174	NA	13	9	fair	10	foliated granitic
524420	4352562	133	8	7	5	poor	10	granitic
524416	4352601	150	NA	10	8	poor	18	granitic
524419	4352578	180	8	16	3	fair	23	Twm
524442	4352690	156	NA	12	5	poor	4	quartz
524445	4352659	148	NA	8	5	poor	4	granitic
524466	4352632	163	NA	10	11	poor	13	Twm
524478	4352574	167	12	4	4	poor	12	foliated granite
524496	4352528	175	NA	7	5	poor	12	granitic
524563	4352603	133	15	15	4	poor	ms to 1 cm	NM
524539	4352534	184	8	8	7	fair	6	granitic
lower unit								
524181	4352272	94	6	8	5	fair	11	Twm

RG232C, Russellville Gulch quad, 523880E/4352622N, T8S, R66W, sec. 25, SW, 8Aug11

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
524555	4352455	151	7	2	3	poor	11	granitic
524542	4352425	142	NA	8	4	poor	ms to 2 cm	NM
524518	4352425	143	NA	9	4	poor	6	foliated granite
524422	4352470	158	NA	6	5	fair	16	Twm
524389	4352371	160	NA	10	11	fair	7	granitic
524434	4352372	130	NA	5	5	poor	18	Twm
524448	4352854	185	13	3	5	good	10	granitic
524102	4352281	96	8	5	5	good	6	quartz
524125	4352269	95	NA	4	4	poor	4	granitic
524231	4352266	157	13	3	3	poor	4	granitic
524250	4352282	155	15	6	5	fair	9	granitic
524267	4352252	158	9	3	2	fair	3	quartzite
524272	4352287	136	8	20	16	good	30	Twm
524288	4352262	162	7	44	24	good	22	Twm
524319	4352158	155	NA	7	11	poor	12	foliated granite
524315	4352126	170	NA	4	6	poor	6	Twm
524447	4352223	172	3	2	3	poor	8	granitic
524452	4352226	147	NA	4	3	poor	12	fg granitic
524466	4352239	146	NA	5	9	poor	19	granitic gneiss
524469	4352206	156	NA	13	5	poor	66	Twm
524465	4352255	177	6	12	6	good	32	Twm
524470	4352257	138	NA	10	14	poor	35	Twm
524473	4352301	143	23	3	5	good	7	granitic
524463	4352338	174	10	7	3	fair	11	granitic
524467	4352344	175	NA	8	5	poor	14	granitic
524467	4352356	142	NA	8	10	poor	9	pegmatite
524423	4352365	160	NA	12	10	poor	27	Twm
524444	4352354	162	22	3	7	fair	11	granitic
524498	4352286	133	NA	31	13	fair	66	Twm
524535	4352213	149	NA	6	4	poor	13	Twm
524540	4352196	133	10	7	8	fair	15	granitic
524561	4352215	154	NA	7	4	poor	5	granitic
524364	4352107	136	NA	3	4	poor	4	granitic
524420	4352016	166	NA	6	7	poor	7	granitic
524313	4352057	153	NA	5	8	poor	34	Twm
524326	4352019	153	NA	7	4	poor	9	Twm
524277	4352041	90	NA	6	8	poor	8	granitic
524160	4352106	163	16	8	15	fair	7	granitic
524155	4352095	161	NA	5	4	poor	9	Twm
524123	4352133	183	NA	12	7	poor	15	Twm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
524179	4352038	111	5	4	5	poor	NA	NA
524016	4352091	117	NA	4	4	poor	10	Twm
523966	4352204	85	NA	6	6	poor	42	Twm
523920	4352010	204	NA	4	5	poor	9	granitic
523912	4352011	202	21	8	5	fair	3	granitic
523710	4352029	218	14	2	4	fair	ms to 1 cm	NM
523639	4352169	132	13	7	6	poor	4	Twm
523638	4352183	142	NA	4	4	poor	4	granitic
523628	4352188	132	NA	12	5	poor	5	Fountain(?)
523520	4352260	212	14	3	4	poor	ms to 0.5 cm	NM
523493	4352302	188	NA	14	13	poor	46	Twm
523749	4352610	103	NA	11	12	poor	11	granitic
523732	4352603	97	16	6	6	fair	22	Twm
523702	4352564	137	NA	8	7	poor	35	Twm
523676	4352609	50	8	9	9	fair	10	Twm
523665	4352740	115	10	5	4	fair	7	granitic
523049	4352743	164	15	5	4	fair	4	foliated granite
523607	4352802	95	13	10	10	fair	12	foliated granite
523600	4352798	90	NA	5	7	poor	37	Twm
523582	4352794	89	NA	13	12	poor	14	Twm
523594	4352821	99	25	7	7	poor	9	pegmatite
523604	4352835	146	19	6	7	fair	29	Twm
523642	4353013	154	17	8	8	good	21	Twm
523443	4353028	161	20	18	7	fair	6	Twm
523446	4352990	138	NA	8	10	poor	8	Twm
523371	4353048	163	8	44	29	fair	22	Twm
523369	4353150	158	NA	14	6	poor	11	granitic
523205	4353235	163	NA	21	10	poor	31	Twm
PY235, Peyton quad, 552553E/4329258N, T11S, R63W, sec. 12, NE, 28Sep11								
553343	4328856	205	NM	3	2	fair	NM	NM
552553	4329258	174	23	4	5	poor	15	Twm
552545	4329283	97	19	6	6	fair	14	granitic
552548	4329280	128	17	5	3	poor	13	granitic
552209	4329214	184	12	3	4	poor	10	Twm
552420	4329144	195	6	16	7	fair	11	Twm
BB236, Bijou Basin quad, 546848E/4334175N, T10S, R63W, sec. 29, NE, 29Sep11								
546848	4334175	204	15	7	13	fair	11	Twm
546777	4333910	232	17	3	5	fair	30	petrified wood

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
546777	4333922	227	3	8	6	fair	14	Twm
546772	4333918	255	5	6	4	good	4	Twm
546759	4333918	237	11	4	4	fair	3	qtzt
546749	4333903	220	12	3	4	good	38	Twm
546749	4333902	286	18	11	5	very good	3	granitic
546746	4333914	254	NA	7	5	poor	8	Twm
546761	4333916	258	9	4	3	poor	5	granitic
546733	4333904	289	9	5	5	good	7	Twm
546790	4333900	264	17	9	7	good	6	granitic
546822	4333890	283	20	17	6	good	12	granitic
546811	4333899	275	12	4	3	poor	6	granitic
546811	4333893	75	18	3	4	fair	3	Twm
547258	4333748	119	15	5	5	fair	5	granitic
547558	4333653	116	9	15	5	poor	4	Twm
547591	4333642	105	12	5	8	fair	9	Twm
547617	4333623	68	NA	3	3	poor	4	Twm
547748	4333584	106	NA	10	4	poor	7	Twm
BB237, Bijou Basin quad, 544659E/4333010N, T10S, R63W, sec. 30, SE, 12Oct11								
544659	4333010	138	NA	3	3	poor	14	Twm
544664	4333017	106	13	4	2	poor	6	granitic
544649	4333060	81	9	5	6	fair	8	granitic
544658	4333051	138	22	3	3	good	ms to vcs	NM
544691	4333052	164	NA	4	4	fair	ms to vcs	NM
544750	4332975	168	NA	5	2	poor	8	granitic
544742	4332967	127	NA	4	2	poor	11	granitic
544743	4332961	161	25	3	2	poor	9	granitic
544744	4332955	159	9	7	3	fair	8	granitic
544720	4332941	167	NA	4	4	poor	8	granitic
544702	4332914	137	22	10	6	good	13	granitic
544712	4332890	140	NA	5	4	poor	12	granitic
BB238, Bijou Basin quad, 544954E/4333886N, T10S, R63W, sec. 30, NE, 12Oct11								
544954	4333886	87	13	6	7	poor	ms to granules	NM
545002	4333834	178	19	9	6	fair	ms to granules	NM
EB239, Elbert quad, 535282E/4340787N, T9S, R64W, sec. 31, SE, 12Oct11								
535282	4340787	153	18	4	3	poor	5	granitic
535272	4340800	124	NA	6	3	poor	ms to granules	NM
535283	4340812	141	NA	6	5	poor	7	granitic

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
535270	4340818	136	NA	6	5	poor	4	granitic
535235	4340846	150	NA	4	3	poor	3	granitic
535239	4340849	153	NA	4	4	poor	5	granitic
535106	4341019	139	13	7	6	fair	5	Twm
535113	4341018	163	13	23	8	good	3	granitic
535126	4340974	156	NA	7	5	poor	ms to granules	NM
535139	4341002	137	NA	8	7	poor	ms to 0.5 cm	NM
535153	4340994	157	18	7	5	fair	4	granitic
535179	4340990	115	21	5	10	good	4	granitic
535192	4340969	132	10	12	5	poor	6	granitic
535231	4340936	170	10	18	10	good	ms to vcs	NM
535253	4340868	119	NA	8	10	fair	cs to 0.5 cm	NM
535268	4340374	119	10	10	6	good	cs to granules	NM
535281	4340865	117	9	11	9	good	cs to granules	NM
535277	4340851	129	8	5	6	fair	cs to granules	NM
535273	4340842	121	5	5	8	poor	cs to granules	NM
535282	4340841	128	NA	7	3	poor	cs to 1 cm	NM
535287	4340838	144	NA	5	4	poor	2	granitic
535299	4340837	145	15	3	3	poor	4	granitic
535299	4340840	130	3	3	4	poor	cs to granules	NM
535297	4340835	125	10	8	7	good	ms to granules	NM
535304	4340833	123	NA	3	3	poor	ms to granules	NM
535311	4340853	153	5	8	7	fair	5	Twm
535349	4340838	177	NA	13	10	fair	cs to 1 cm	NM
535366	4340821	168	NA	8	6	poor	ms to vcs	NM
535392	4340803	164	NA	6	4	poor	ms to granules	NM
535374	4340784	127	NA	5	3	poor	ms to granules	NM
535373	4340768	159	NA	3	4	fair	4	granitic
535391	4340753	152	12	3	3	poor	2	granitic
535772	4340349	136	15	7	4	fair	ms to vcs	NM
535775	4340357	122	NA	6	4	fair	ms to granules	NM
535783	4340356	144	NA	5	4	fair	ms to granules	NM
535797	4340337	158	7	6	6	fair	ms to vcs	NM
535623	4340469	103	20	7	9	good	ms to granules	NM
535544	4340521	96	NA	2	3	poor	ms to cs	NM
535543	4340515	117	12	8	5	fair	ms to cs	NM
535528	4340530	81	8	2	2	fair	2	granitic
535501	4340544	118	NA	4	4	poor	ms to granules	NM
535473	4340566	177	6	7	4	poor	ms to cs	NM

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
EB243, Elbert quad, 538855E/4337387N, T10S, R64W, sec. 15, NW, 2010 (Matt's Elbert "group 6")								
538835	4337354	85	NM	6	5	good	NM	NM
538801	4337334	82	NM	6	5	good	NM	NM
538842	4337346	41	NM	6	3	good	5.0	granitic
538824	4337363	88	NM	5	7	good	NM	NM
538849	4337399	110	NM	15	8	good	5.0	granitic
538872	4337385	45	NM	5	6	good	1.0	granitic
538874	4337401	10	NM	10	5	excellent	NM	NM
538879	4337413	340	NM	19	4	excellent	1.0	granitic
538897	4337384	70	NM	8	15	excellent	NM	NM
538900	4337360	80	NM	13	13	excellent	NM	NM
538895	4337346	140	NM	4	5	excellent	NM	NM
538901	4337363	120	NM	4	4	good	15.0	Twm
538924	4337365	66	NM	15	7	good	13.0	granitic
538951	4337363	90	NM	5	10	good	NM	NM
538950	4337374	86	NM	4	5	good	3.0	granitic
538955	4337414	5	NM	6	3	good	NM	NM
538875	4337449	351	NM	11	8	good	3.0	granitic
538796	4337426	140	NM	6	8	good	1.0	qtz
538812	4337413	145	NM	8	12	poor	1.0	granitic
538780	4337359	144	NM	3	3	poor	NM	NM
538599	4337412	88	NM	NM	NM	poor	7.0	qtz
EB244, Elbert quad, 539113E/4337896N, T10S, R64W, sec. 10, SW, 2010 (Matt's Elbert "group 7")								
539182	4337953	150	NM	3	5	poor	NM	NM
539117	4337937	85	NM	16	2	poor	4.0	gran
539066	4337897	116	NM	4	7	poor	NM	NM
539062	4337926	52	NM	3	1	poor	NM	NM
EB245, Elbert quad, 539151E/4338440N, T10S, R64W, sec. 10, NW, 2010 (Matt's Elbert "group 8")								
539197	4338411	55	NM	NM	NM	poor	NM	NM
539174	4338467	80	NM	10	8	poor	NM	NM
EB246, Elbert quad, 539525E/4338913N, T10S, R64W, sec. 10, NW, 2010 (Matt's Elbert "group 9")								
539496	4338680	95	NM	3	1	good	5.0	Twm
539597	4338778	96	NM	3	1	poor	30.0	Twm
539754	4339074	93	NM	4	2	good	45.0	Twm
539796	4339155	185	NM	2	3	good	15.0	blue qtzite
539705	4339193	175	NM	2	2	poor	NM	NM
539504	4338997	165	NM	2	8	poor	NM	NM

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539337	4338927	116	NM	15	6	good	20.0	Twm
539368	4338799	28	NM	2	3	poor	1.0	qtz
539309	4338695	95	NM	6	4	good	20.0	blue qtzite
539295	4338657	90	NM	10	3	good	2.0	granitic
EB247, Elbert quad, 539525E/4338913N, T9S, R65W, sec. 36, SW, 2010 (Matt's Gresham property data, near SMK EB189, also on Gresham)								
532788	4340973	170	NM	8	3	good	3.0	granitic
532807	4340963	180	NM	7	5	poor	5.0	Twm
532851	4340978	138	NM	12	7	poor	3.0	granitic
532869	4340951	169	NM	8	10	good	7.0	qtz
532847	4341000	130	NM	8	5	good	5.0	granitic
532841	4341038	171	NM	9	5	good	3.0	granitic
532836	4341056	141	NM	7	4	good	1.0	granitic
532829	4341026	150	NM	9	7	good	3.0	granitic
532821	4341053	140	NM	10	5	excellent	1.0	qtz
532810	4341050	145	NM	8	6	excellent	10.0	Twm
532815	4341051	133	NM	6	4	excellent	5.0	Twm
532791	4341070	165	NM	15	3	excellent	3.0	granitic
532788	4341081	144	NM	27	6	excellent	5.0	granitic
532784	4341098	148	NM	7	5	good	1.0	granitic
532773	4341083	156	NM	12	8	good	4.0	granitic
532746	4341064	200	NM	6	6	good	1.0	granitic
532801	4341101	167	NM	7	3	poor	0.5	qtz
532747	4341108	110	NM	9	6	good	5.0	granitic
532771	4341138	128	NM	5	4	poor	0.5	qtz
532750	4341220	124	NM	7	16	good	0.5	qtz
532753	4341226	161	NM	2	2	good	0.5	qtz
532802	4341296	60	NM	9	11	good	2.5	granitic
532696	4341256	121	NM	10	7	good	0.5	qtz
532665	4341314	105	NM	4	4	poor	0.5	qtz
532680	4341337	106	NM	7	6	good	0.5	qtz
532780	4341400	80	NM	6	4	good	5.0	granitic
532822	4341430	111	NM	4	3	good	8.0	granitic
532875	4341543	130	NM	7	7	good	5.0	granitic
532862	4341517	185	NM	10	5	good	8.0	Twm
532857	4341558	158	NM	5	6	good	0.5	qtz
532994	4341522	75	NM	8	5	good	0.5	qtz
532970	4341518	100	NM	8	5	good	0.5	qtz
532865	4341661	68	NM	8	5	good	2.5	qtz
532831	4341672	201	NM	6	5	good	8.0	Twm

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Paleocurrent Measurements

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532836	4341662	110	NM	8	5	good	0.5	granitic
532795	4341694	155	NM	6	4	good	0.5	qtz
532643	4341671	175	NM	12	11	excellent	0.5	qtz
532666	4341671	95	NM	8	8	excellent	0.3	qtz
532666	4341783	195	NM	15	7	excellent	0.5	red sandstone
532672	4341792	225	NM	15	5	excellent	0.5	qtz
532692	4341816	203	NM	10	5	excellent	0.5	qtz
532667	4341838	190	NM	7	4	good	0.5	qtz
532642	4341866	130	NM	12	5	excellent	0.5	qtz
532624	4341890	200	NM	14	12	good	0.5	qtz
532715	4341917	160	NM	10	6	good	0.5	qtz
532673	4341924	210	NM	36	6	excellent	5.0	granitic
532633	4341979	235	NM	12	6	excellent	5.0	Twm
532628	4341963	220	NM	24	11	excellent	2.5	Twm
532688	4342064	192	NM	4	5	poor	2.5	Twm
532673	4342078	225	NM	11	4	good	2.0	granitic
532657	4342072	217	NM	6	4	poor	0.5	qtz
532649	4342098	248	NM	25	5	excellent	2.5	granitic
532620	4342081	220	NM	13	12	excellent	1.0	granitic
532629	4342097	265	NM	10	9	good	0.5	qtz
532624	4342098	192	NM	4	4	poor	0.5	qtz
532593	4342100	213	NM	9	6	good	10.0	Twm
532605	4342095	282	NM	5	6	good	2.5	qtz
532603	4342079	235	NM	5	5	good	10.0	Twm
532563	4342078	237	NM	13	10	excellent	1.0	qtz
532567	4342070	255	NM	8	7	good	1.0	qtz
532567	4342067	260	NM	10	7	excellent	5.0	granitic
532546	4342046	222	NM	17	6	excellent	0.5	qtz
532509	4342058	181	NM	12	10	good	5.0	granitic
532541	4342080	235	NM	12	14	excellent	1.0	qtz
532562	4342100	295	NM	15	9	good	0.5	granitic
532547	4342145	295	NM	11	7	poor	1.0	qtz
532523	4342168	160	NM	23	14	excellent	8.0	Twm
532533	4342205	165	NM	28	10	good	15.0	Twm
532582	4342203	195	NM	10	6	good	2.5	gran
532592	4342173	234	NM	16	8	good	5.0	Twm
532576	4342226	173	NM	10	3	good	8.0	Twm
532589	4342231	145	NM	8	5	good	8.0	Twm
532688	4342271	130	NM	5	5	good	2.5	granitic
532707	4342220	250	NM	6	3	good	2.5	qtz

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Paleocurrent Measurements

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533029	4342233	270	NM	5	2	poor	0.5	granitic
532885	4342454	270	NM	5	4	poor	0.3	qtz
532838	4342442	215	NM	26	17	good	0.2	qtz
532794	4342371	308	NM	9	3	good	0.2	qtz
532794	4342371	234	NM	29	7	good	5.0	Twm
532745	4342346	209	NM	6	3	good	0.2	qtz
532759	4342341	236	NM	8	2	good	8.0	Twm
532784	4342343	210	NM	6	4	good	8.0	Twm
532780	4342324	258	NM	8	3	good	15.0	Twm
532787	4342334	232	NM	6	3	good	5.0	granitic
532799	4342333	230	NM	9	5	good	8.0	blue qtzite
532827	4342353	234	NM	22	4	good	2.5	Twm
532883	4342319	290	NM	8	3	poor	0.5	qtz
532923	4342298	256	NM	18	6	good	10.0	granitic
532955	4342305	270	NM	14	3	good	2.5	granitic
533026	4342288	246	NM	2	3	poor	0.3	qtz
532646	4342163	218	NM	3	2	poor	0.3	qtz
532669	4342136	245	NM	5	3	poor	2.5	qtz
532702	4342121	240	NM	2	11	excellent	0.5	granitic
532773	4342379	233	NM	6	3	good	0.3	qtz
532716	4342454	209	NM	6	6	good	2.5	qtz
532748	4342464	165	NM	8	5	good	8.0	granitic
532740	4342472	30	NM	5	3	good	20.0	Twm
532752	4342472	150	NM	5	5	good	5.0	granitic
532722	4342432	155	NM	11	4	good	8.0	granitic
532709	4342436	95	NM	15	9	excellent	13.0	twm
532712	4342412	151	NM	23	8	excellent	0.5	qtz
532717	4342411	70	NM	7	8	good	30.0	Twm
532656	4342484	185	NM	8	5	good	5.0	Twm
532651	4342452	188	NM	10	5	good	1.3	granitic
532678	4342447	153	NM	20	6	good	5.0	Twm
532633	4342452	215	NM	10	2	good	2.5	granitic
532663	4342434	145	NM	10	6	good	5.0	granitic
532656	4342402	30	NM	7	4	good	8.0	Twm
532643	4342396	83	NM	4	9	good	8.0	granitic
532649	4342409	70	NM	15	9	good	30.0	Twm
532655	4342404	60	NM	8	6	excellent	10.0	Twm
532660	4342404	60	NM	9	6	excellent	25.0	Twm
532649	4342398	125	NM	11	6	good	8.0	Twm
532687	4342409	85	NM	13	4	good	1.3	qtz

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532646	4342387	80	NM	17	5	excellent	2.5	granitic
532655	4342367	142	NM	10	5	good	5.0	granitic
532684	4342377	74	NM	14	8	excellent	1.3	qtz
532699	4342368	95	NM	16	5	good	1.3	qtz
532711	4342377	80	NM	6	7	good	5.0	granitic
532684	4342350	71	NM	10	6	good	8.0	granitic
532668	4342345	82	NM	11	7	excellent	30.0	Twm
532663	4342361	78	NM	15	6	good	15.0	Twm
532634	4342374	135	NM	10	7	poor	2.5	granitic
532651	4342365	246	NM	15	3	good	2.5	granitic
532641	4342348	170	NM	26	8	good	15.0	Twm
532622	4342310	150	NM	8	5	poor	2.5	granitic
532602	4342303	164	NM	12	6	good	25.0	Twm
532616	4342270	175	NM	10	8	poor	1.3	granitic
532598	4342269	105	NM	6	4	poor	2.5	Twm
533222	4340566	150	NM	6	8	good	5.0	granitic
533207	4340551	149	NM	9	8	poor	8.0	gneiss
533178	4340558	133	NM	5	3	poor	0.5	qtz
533174	4340551	130	NM	5	4	poor	5.0	granitic
533165	4340548	175	NM	7	5	good	2.5	granitic
533160	4340544	165	NM	7	4	good	8.0	granitic
533153	4340516	222	NM	7	5	excellent	1.3	qtz
533149	4340539	155	NM	12	8	good	8.0	granitic
533147	4340583	159	NM	6	6	poor	0.7	granitic
533136	4340541	205	NM	8	6	good	5.0	granitic
533132	4340569	210	NM	16	10	excellent	5.0	Twm
533130	4340588	185	NM	18	7	good	8.0	Twm
533107	4340562	195	NM	18	6	excellent	5.0	granitic
533127	4340604	179	NM	6	5	poor	0.5	qtz
533091	4340603	168	NM	8	6	good	8.0	granitic
533101	4340629	145	NM	8	6	poor	0.5	granitic
533095	4340629	125	NM	9	6	good	2.5	granitic
533088	4340699	110	NM	16	8	good	13.0	Twm
533082	4340686	135	NM	8	6	good	5.0	granitic
533082	4340701	87	NM	28	7	excellent	15.0	Twm
533088	4340689	104	NM	19	8	excellent	8.0	Twm
533052	4340650	145	NM	12	6	good	5.0	granitic
533039	4340662	110	NM	6	4	poor	5.0	granitic
533019	4340690	146	NM	8	4	good	0.5	qtz
533043	4340713	130	NM	10	5	good	8.0	qtz

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533092	4340737	122	NM	14	8	good	2.5	granitic
533078	4340728	75	NM	6	5	good	2.5	qtz
533075	4340716	115	NM	13	5	good	5.0	Twm
533082	4340745	110	NM	6	3	poor	0.5	qtz
533093	4340749	106	NM	9	5	good	2.5	blue qtzite
533061	4340736	95	NM	14	7	good	8.0	Twm
533063	4340724	110	NM	11	8	excellent	0.7	qtz
533029	4340730	147	NM	12	8	good	8.0	granitic
533030	4340721	115	NM	6	6	poor	2.5	granitic
533044	4340735	168	NM	7	3	good	2.5	qtz
533032	4340751	99	NM	26	7	good	2.5	granitic
533040	4340753	75	NM	11	10	good	8.0	blue qtzite
533046	4340776	115	NM	26	10	good	10.0	Twm
533039	4340790	118	NM	24	8	good	8.0	qtz
532996	4340765	70	NM	15	5	good	5.0	granitic
533000	4340771	62	NM	17	13	good	2.5	Twm
532989	4340736	220	NM	13	13	good	10.0	gneiss
532989	4340762	200	NM	14	8	good	5.0	qtz
532982	4340778	103	NM	17	5	good	5.0	granitic
532997	4340783	104	NM	20	13	good	8.0	granitic
532995	4340793	93	NM	13	6	poor	5.0	Twm
532985	4340781	120	NM	15	8	good	1.3	qtz
532951	4340798	155	NM	10	6	good	8.0	gran
532949	4340807	163	NM	10	8	good	5.0	qtz
532935	4340809	200	NM	12	8	poor	2.5	qtz
532943	4340811	103	NM	3	2	poor	8.0	Twm
532926	4340813	165	NM	7	4	poor	8.0	granitic
532935	4340821	80	NM	3	5	poor	10.0	granitic
532927	4340836	128	NM	5	4	good	1.3	qtz
532913	4340849	204	NM	4	8	poor	2.5	granitic
532932	4340852	122	NM	4	3	good	5.0	granitic
532968	4340859	182	NM	9	9	good	2.5	granitic
532946	4340855	170	NM	10	7	good	5.0	Twm
532920	4340857	197	NM	17	7	excellent	5.0	granitic
532897	4340853	90	NM	8	9	good	5.0	Twm
532888	4340887	105	NM	9	5	good	8.0	granitic
532906	4340889	90	NM	24	11	good	8.0	Twm
532892	4340908	55	NM	9	8	poor	8.0	granitic
532869	4340908	182	NM	6	8	poor	5.0	granitic
532910	4340931	155	NM	11	12	excellent	8.0	granitic

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EB248, Elbert quad, 534888E/4341290N, T9S, R64W, sec. 31, SE, 2010 (Matt's Eldringhoff property data, near SMK EB191)								
535050	4341260	150	NM	8	4	excellent	1.3	granitic
535031	4341269	161	NM	8	5	excellent	2.5	qtz
534990	4341248	164	NM	10	8	poor	0.7	qtz
535036	4341271	160	NM	6	4	excellent	0.5	qtz
535011	4341298	190	NM	8	4	poor	4.0	Twm
535007	4341301	149	NM	15	5	good	1.3	granitic
535006	4341289	160	NM	12	6	good	1.3	qtz
535019	4341303	180	NM	5	3	poor	0.5	granitic
535008	4341302	160	NM	8	6	good	1.3	granitic
535001	4341316	168	NM	10	5	good	5.0	granitic
535013	4341314	175	NM	11	5	excellent	0.5	qtz
534994	4341312	154	NM	8	3	good	0.5	granitic
534987	4341334	180	NM	10	5	good	4.0	granitic
534998	4341336	165	NM	9	6	good	5.0	Twm
534996	4341340	168	NM	14	5	gran	5.0	granitic
535014	4341332	172	NM	7	5	good	1.3	granitic
535018	4341347	172	NM	14	7	good	2.5	granitic
535024	4341352	160	NM	15	7	good	5.0	granitic
535002	4341355	166	NM	13	6	excellent	8.0	granitic
535006	4341371	172	NM	12	9	poor	2.5	granitic
534987	4341373	172	NM	9	5	good	8.0	granitic
535001	4341402	186	NM	6	5	good	0.5	qtz
534987	4341370	155	NM	5	4	poor	1.3	granitic
534980	4341362	125	NM	6	5	good	5.0	Twm
534979	4341359	175	NM	6	4	good	0.5	qtz
534770	4341264	30	NM	2	2	good	2.5	granitic
534767	4341263	5	NM	2	2	good	0.5	qtz
534746	4341212	20	NM	5	4	good	0.5	qtz
EB249, Elbert quad, 533654E/4342319N, T9S, R64W, sec. 25, SE, 2010 (Matt's Brown property data, near SMK EB192)								
533923	4342173	52	NM	5	3	poor	5.0	blue qtzite
533702	4342432	110	NM	6	2	good	2.5	qtz
533690	4342443	80	NM	9	3	good	5.0	granitic
533702	4342447	30	NM	11	6	good	15.0	twm
533669	4342437	82	NM	18	5	good	2.5	granitic
533655	4342452	60	NM	16	7	good	5.0	granitic
533655	4342456	51	NM	12	6	good	5.0	granitic
533651	4342435	98	NM	6	5	good	1.3	granitic

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533633	4342469	99	NM	13	5	good	8.0	Twm
533354	4342459	235	NM	5	5	good	2.5	granitic
533121	4342387	236	NM	5	5	good	2.5	granitic
533238	4342310	181	NM	12	6	poor	0.5	granitic
533255	4342325	126	NM	7	4	good	1.3	Twm
533256	4342325	115	NM	8	5	good	0.5	qtz
533404	4342253	60	NM	4	3	poor	0.5	granitic
533412	4342242	118	NM	4	3	poor	0.5	granitic
533722	4342169	170	NM	6	1	poor	0.5	qtz
533728	4342148	172	NM	7	2	good	1.3	granitic
533727	4342150	178	NM	7	3	good	0.5	granitic
533785	4342214	165	NM	4	1	poor	20.0	Twm
533789	4342211	190	NM	6	4	good	1.3	granitic
533887	4342354	170	NM	5	2	poor	5.0	twm
533922	4342385	195	NM	3	2	poor	0.5	qtz
533957	4342382	165	NM	4	3	poor	2.5	granitic
533965	4342336	135	NM	6	3	good	2.5	granitic
533981	4342347	155	NM	7	3	good	2.5	granitic
533989	4342371	163	NM	4	2	poor	8.0	Twm
534017	4342379	200	NM	6	6	good	10.0	Twm
534029	4342373	160	NM	9	6	good	8.0	Twm
534031	4342372	155	NM	6	4	good	8.0	granitic
534034	4342374	119	NM	4	3	good	2.5	Twm
534021	4342464	159	NM	7	1	poor	0.5	granitic
534017	4342471	160	NM	13	6	good	5.0	granitic
534017	4342471	165	NM	9	4	good	2.5	granitic
534003	4342467	144	NM	12	4	excellent	2.5	granitic
533997	4342485	126	NM	18	11	excellent	5.0	granitic
534021	4342496	168	NM	6	3	good	5.0	granitic
534098	4342388	135	NM	11	3	good	2.5	granitic
534066	4342372	150	NM	12	10	good	8.0	Twm
534071	4342347	170	NM	17	8	excellent	5.0	Twm
534010	4342351	160	NM	12	5	good	20.0	granitic
534021	4342298	160	NM	5	4	poor	2.5	granitic
534011	4342297	165	NM	9	2	good	0.3	granitic
534025	4342271	166	NM	18	5	good	2.5	Twm
534051	4342252	200	NM	10	3	good	1.3	granitic
534116	4342269	178	NM	10	8	poor	3.0	granitic
534100	4342248	128	NM	5	5	good	0.3	granitic
534089	4342231	127	NM	7	5	excellent	5.0	granitic

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
534083	4342225	170	NM	10	6	good	2.5	
EB250, Elbert quad, 534074E/4338320N, T10S, R64W, sec. 7, NW, 2010 (Matt's Pniak property data)								
533977	4338312	221		12	8	excellent	2.5	granitic
533998	4338309	205		20	10	excellent	2.5	granitic
534169	4338238	180		6	3	good	0.3	granitic
534184	4338228	206		8	3	good	0.3	qtz
534084	4338225	186		10	3	poor	0.3	granitic
534129	4338184	185		10	5	good	0.3	qtz
534116	4338180	205		9	8	good	2.5	granitic
534247	4338179	205		12	4	good	5.0	granitic
534144	4338162	185		17	7	excellent	1.3	granitic
534174	4338127	180		20	8	excellent	5.0	Twm
534205	4338091	180		20	11	poor	0.3	qtz
534168	4338081	182		6	3	poor	0.3	qtz
CRS251, Castle Rock South quad, 518721E/4355760N, T8S, R66W, sec. 16, SE (Matt's Lost Canyon Ranch data, south side)								
518721	4355760	120	NM	5	3	good	7.6	granitic
518673	4355732	115	NM	17	5	good	1.3	granitic
518635	4355736	70	NM	8	5	good	15.2	Twm
518572	4355791	135	NM	8	4	good	5.1	granitic
518570	4355804	130	NM	12	12	good	25.4	twm
518640	4355799	101	NM	7	5	good	7.6	granitic
518639	4355808	150	NM	26	9	excellent	5.1	granitic
518633	4355834	125	NM	7	7	good	5.1	granitic
518624	4355848	105	NM	8	5	good	35.6	Twm
518625	4355863	120	NM	8	6	good	5.1	Twm
518610	4355895	80	NM	9	7	good	25.4	Twm
518594	4355938	182	NM	19	10	excellent	25.4	Twm
518620	4356044	84	NM	15	6	good	15.2	red sandstone
518654	4356047	130	NM	15	11	good	20.3	Twm
518667	4356060	100	NM	14	8	good	30.5	Twm
518688	4356072	40	NM	15	12	good	5.1	granitic
518767	4356074	85	NM	7	5	good	10.2	qtz
518763	4356074	94	NM	6	5	poor	NA	NA
518744	4356065	68	NM	14	6	poor	45.7	Twm
518897	4356047	157	NM	11	9	poor	25.4	Twm
518998	4355978	140	NM	10	6	good	10.2	Twm
519007	4355966	185	NM	10	5	good	7.6	granitic
519036	4355938	102	NM	15	5	excellent	30.5	Twm

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
519078	4355975	160	NM	7	4	good	10.2	granitic
519099	4355978	190	NM	13	10	excellent	12.7	granitic
519088	4355888	60	NM	10	6	poor	7.6	blue qtzt
519121	4355920	80	NM	14	7	good	15.2	Twm
519129	4355875	117	NM	13	8	excellent	7.6	granitic
519127	4355853	80	NM	6	6	good	2.5	granitic
519068	4355891	63	NM	59	11	excellent	35.6	Twm
519026	4355876	106	NM	15	24	excellent	10.2	granitic
519347	4356088	100	NM	5	4	poor	NA	NA
519432	4356234	138	NM	30	10	excellent	25.4	Twm
519435	4356218	162	NM	12	20	good	15.2	granitic
519361	4356333	120	NM	10	6	good	25.4	Twm
519393	4356337	120	NM	9	9	good	10.2	granitic
519490	4356544	139	NM	13	8	poor	25.4	blue qtzt
519541	4356582	178	NM	13	5	poor	10.2	granitic
519672	4356618	153	NM	70	25	excellent	10.2	qtz
519619	4356777	179	NM	17	10	good	7.6	granitic
519520	4356874	145	NM	15	7	good	15.2	granitic
519449	4356950	176	NM	18	8	good	25.4	granitic
519463	4356914	152	NM	13	9	good	2.5	granitic
519327	4356605	169	NM	10	5	good	20.3	Twm
519323	4356541	180	NM	35	22	good	20.3	Twm
519301	4356343	125	NM	12	8	good	30.5	Twm
519292	4356324	180	NM	10	6	poor	7.6	granitic
519283	4356272	175	NM	20	15	good	15.2	blue qtzt
519334	4356160	170	NM	12	5	poor	5.1	granitic
CRS252, Castle Rock South quad, 518318E/4356599N, T8S, R66W, sec. 16, NE (Matt's Lost Canyon Ranch data, north side)								
518318	4356599	55	NM	14	10	poor	91.4	Twm
518297	4356601	65	NM	15	10	poor	12.7	granitic
518318	4356666	50	NM	8	10	poor	15.2	Twm
518348	4356674	70	NM	6	10	poor	10.2	granitic
518415	4356632	57	NM	8	5	good	5.1	granitic
518239	4356577	55	NM	6	5	good	7.6	Twm
518230	4356547	55	NM	10	6	good	61.0	Twm
518284	4356491	125	NM	14	12	good	15.2	Twm
518182	4356470	73	NM	7	10	poor	15.2	Twm
518153	4356496	60	NM	25	10	excellent	12.7	granitic
518154	4356463	60	NM	9	9	excellent	15.2	granitic
518115	4356505	75	NM	17	10	good	5.1	red sandstone

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
517931	4356426	70	NM	50	10	good	15.2	granitic
517908	4356420	34	NM	10	10	good	5.1	granitic
517880	4356414	22	NM	13	14	excellent	10.2	granitic
517924	4356513	98	NM	16	8	excellent	30.5	Twm
517958	4356564	102	NM	18	11	good	7.6	granitic
517968	4356575	62	NM	12	10	good	61.0	Twm
518080	4356628	41	NM	20	12	poor	20.3	Twm
517966	4356324	58	NM	11	10	excellent	30.5	Twm
RG253, Castle Rock South quad, 523000E/4352715N, T8S, R66W, sec. 25, NW (Matt's Colorado Land Board data, near CCSP)								
523000	4352715	179	NM	10	10	excellent	61.0	Twm
522997	4352726	188	NM	7	7	good	5.1	Twm
523051	4352699	176	NM	18	10	excellent	61.0	Twm
523057	4352708	125	NM	8	6	good	7.6	granitic
523064	4352719	124	NM	6	5	good	7.6	Twm
523184	4352696	146	NM	26	9	excellent	30.5	qtz
523159	4352651	104	NM	5	3	good	3.8	qtz
523234	4352616	150	NM	10	7	good	30.5	Twm
523176	4352611	175	NM	11	4	good	10.2	Twm
523212	4352553	155	NM	8	5	poor	2.5	granitic
523182	4352527	121	NM	7	6	good	15.2	Twm
523068	4352536	110	NM	7	6	good	5.1	red sandstone
523156	4352501	119	NM	8	5	good	2.5	granitic
523221	4352454	145	NM	12	8	excellent	12.7	Twm
523101	4352446	114	NM	23	19	excellent	30.5	Twm
523121	4352438	174	NM	29	12	excellent	15.2	Twm
523061	4352380	166	NM	18	5	good	10.2	granitic
523100	4352364	140	NM	21	15	excellent	7.6	Twm
523048	4352231	98	NM	15	6	good	5.1	Twm
523030	4352208	150	NM	11	6	good	30.5	Twm
523146	4352172	111	NM	32	7	good	10.2	granitic
523188	4352213	190	NM	6	5	good	25.4	Twm
523181	4352242	173	NM	11	8	good	20.3	Twm
523289	4352405	185	NM	10	6	good	1.3	granitic
523295	4352333	158	NM	7	4	poor	0.6	granitic
523342	4352263	132	NM	21	22	excellent	15.2	Twm
523327	4352219	175	NM	6	4	good	15.2	qtz
523401	4352062	140	NM	8	13	good	61.0	Twm
523393	4352024	128	NM	12	25	excellent	30.5	Twm
523346	4352022	190	NM	38	14	excellent	30.5	Twm

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Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
523424	4351920	171	NM	35	12	excellent	12.7	Twm
523605	4351883	220	NM	8	5	good	5.1	granitic
523563	4351910	192	NM	12	7	good	7.6	granitic
523542	4351915	190	NM	10	7	good	2.5	granitic
523453	4351942	200	NM	10	5	good	20.3	granitic
523504	4352014	165	NM	6	5	poor	15.2	granitic
523519	4351106	221	NM	5	4	NM	NM	NM
523519	4351167	220	NM	2	1	NM	NM	NM
523535	4351205	235	NM	3	1	NM	NM	NM
523550	4351204	220	NM	4	2	NM	NM	NM
523602	4351348	192	NM	2	1	NM	NM	NM
523602	4351401	206	NM	2	2	NM	NM	NM
523296	4351695	154	NM	3	3	NM	NM	NM
523286	4351692	122	NM	1	1	NM	NM	NM
523220	4351788	202	NM	8	4	NM	NM	NM
523237	4351858	236	NM	11	4	NM	NM	NM
523297	4351866	150	NM	2	2	NM	NM	NM
523410	4351762	128	NM	2	2	NM	NM	NM
523446	4351777	110	NM	5	1	NM	NM	NM
523546	4351821	230	NM	2	2	NM	NM	NM
523549	4351849	228	NM	2	2	NM	NM	NM
523555	4351844	160	NM	2	3	NM	NM	NM
523566	4351838	210	NM	1	1	NM	NM	NM
523505	4351944	105	NM	2	1	NM	NM	NM
523474	4351970	205	NM	3	2	NM	NM	NM
523471	4351987	140	NM	2	1	NM	NM	NM
523458	4351994	150	NM	2	1	NM	NM	NM
BB254, Bijou Basin quad, 547797E/4338766N, T10S, R63W, sec. 9, NE, 23Nov11								
547797	4338766	163	28	5	4	fair	ms to grans	NM
547810	4338765	160	NA	4	5	poor	cs to grans	NM
547829	4338794	179	12	10	6	fair	cs to grans	NM
547818	4338808	178	NA	2	2	poor	cs to grans	NM
547804	4338783	173	11	1	1	poor	cs to grans	NM
BB255, Bijou Basin quad, 545341E/4337302N, T10S, R63W, sec. 17, NW, 23Nov11								
545341	4337302	149	17	10	4	fair	3	NM
545346	4337299	170	20	2	2	poor	4	NM
545355	4337333	97	18	4	4	poor	9	NM
545375	4337272	100	8	4	5	poor	4	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
545448	4337177	94	10	9	8	fair	4	NM
545467	4337177	130	20	4	3	poor	5	NM
545563	4337171	36	10	2	4	poor	8	NM
545576	4337164	21	NA	3	4	poor	ms to vcs	NM
545579	4337159	52	NA	3	5	poor	ms to granules	NM
545854	4337157	28	18	4	6	fair	5	NM
545604	4337185	107	NA	3	2	poor	4	NM
545628	4337126	153	NA	3	3	poor	5	NM
RG256, Russellville Gulch quad, 528226E/4345765N, T9S, R65W, sec. 16, SW, 15Oct10 (in tandem with S. Keller's RG210)								
528226	4345765	154	NM	11	4	good	8.0	Twm
527978	4345726	150	NM	10	5	excellent	8.0	Twm
527927	4345726	168	NM	10	3	good	10.0	bone
527897	4345721	165	NM	21	4	excellent	10.0	Twm
527917	4345717	156	NM	16	4	excellent	2.5	red sandstone
527908	4345691	170	NM	13	4	excellent	10.0	Twm
527904	4345670	145	NM	7	3	good	2.5	granitic
527904	4345668	140	NM	6	3	good	8.0	Twm
527905	4345661	166	NM	9	5	good	5.0	Twm
527902	4345657	145	NM	7	4	excellent	5.0	granitic
527903	4345645	160	NM	9	6	excellent	8.0	Twm
527894	4345627	148	NM	6	6	good	5.0	granitic
527898	4345619	112	NM	2	3	good	2.5	qtz
527895	4345610	140	NM	4	2	good	5.0	granitic
527903	4345602	107	NM	5	3	good	2.5	granitic
527905	4345598	126	NM	4	3	good	2.5	granitic
527903	4345592	128	NM	9	4	good	10.0	Twm
527906	4345577	135	NM	12	5	good	8.0	granitic
527917	4345570	125	NM	7	5	good	2.5	granitic
527909	4345562	125	NM	5	3	good	2.5	Twm
527899	4345555	127	NM	18	4	good	0.5	granitic
527907	4345553	120	NM	17	6	excellent	5.0	granitic
527903	4345538	143	NM	10	4	excellent	4.0	granitic
527915	4345522	140	NM	14	6	good	2.5	granitic
527906	4345522	141	NM	10	5	excellent	2.5	granitic
527913	4345497	192	NM	5	3	good	2.5	granitic
EB257, Elbert quad, 537025E/4338850N, T10S, R64W, sec. 8, NE, 07Nov2012 (Kathy Welch property, SMK and Matt Morgan as team)								
537025	4338850	90	12	7	7	fair	6	NM
537036	4338851	111	15	8	9	poor	4	NM

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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
537273	4338880	65	NA	7	3	poor	4	NM
537312	4339004	119	NA	8	5	poor	14	NM
537347	4339017	109	13	5	4	poor	7	NM
537399	4339036	40	NA	6	8	poor	19	NM
537641	4339109	211	11	22	11	fair	9	NM
537644	4339104	216	NA	3	2	poor	ms to gran	NM
537641	4339117	236	NA	7	7	fair	ms to 1 cm	NM
537665	4339113	230	13	10	6	fair	4	NM
537680	4339102	220	13	8	8	poor	4	NM
537684	4339099	218	NA	4	4	poor	4	NM
537711	4339101	211	25	9	10	good	6	NM
537576	4339196	241	NA	12	7	poor	ms to gran	NM
537568	4339172	231	5	21	12	good	ms to gran	NM
537547	4339252	84	NA	5	4	poor	6	NM
537547	4339261	79	14	4	5	poor	3	NM
537560	4339317	206	NA	7	5	poor	4	NM
537532	4339318	172	NA	6	3	poor	3	NM
537519	4339334	210	5	12	4	poor	ms to gran	NM
537380	4339229	198	NA	8	10	poor	ms to gran	NM

COMPILATION OF ALL PLANAR CROSS-BED MEASUREMENTS

Station Number	Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Inclination Direction (i.e."downdip") (degrees)	Inclination of Beds (degrees)	Width (parallel to inclination direction) (meters)	Length (transverse to inclination direction) (meters)	Quality	Largest Clast (centimeters)
CRS031	511154	4346949	286	13	5	5		
Planar cross bedding, oriented NW on trend with troughs of JA Ranch paleochannel, JA Ranch								
CRN083	517292	4361172	275	17	8	6		
Possible epsilon cross bedding, oriented SW at right angle to SE troughs of main paleochannel, Hidden Mesa								
CRN085	517373	4361497	281	16	8	3		
Possible epsilon cross bedding, oriented SW at right angle to SE troughs of main paleochannel, Hidden Mesa								
CRN088	517710	4360887	66	14	4	5		
Planar cross bedding, oriented NE on trend with troughs of JA Ranch paleochannel, Hidden Mesa								
CRN097	517524	4360097	115	16	12	3		
Planar cross bedding, oriented ESE approximately on trend with SE troughs of main paleochannel, Gateway Mesa								
CRN098	517836	4360097	154	18	9	3		
Could be either planar cross bedding, oriented SE approximately on trend with SE troughs of main paleochannel; or epsilon cross bedding, at right angles to								

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
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Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
NE troughs of JA Ranch paleochannel, Gateway Mesa								
CV130	529207	4343119	110	16	3	5	fair	1
Planar cross bedding, oriented ESE approximately on trend with one SE trough of main paleochannel, between East Cherry Creek and Private Road 104								
RG132	524580	4350802	57	24	6	11	fair	2
Planar cross bedding, oriented ENE on trend with troughs of JA Ranch paleochannel, Prairie Canyon Ranch								
RG132	524633	4350806	144	22	13	16	fair	2
Planar cross bedding, oriented SE on trend with troughs of main paleochannel, Prairie Canyon Ranch								
RG132	524638	4350774	90	18	6	8		
Planar cross bedding, oriented E approximately on trend with troughs of JA Ranch paleochannel, Prairie Canyon Ranch								
RG132	524859	4350743	117	6	5	11	NM	2
Planar cross bedding, oriented ESE on trend with troughs of main paleochannel, Prairie Canyon Ranch								
RG132	524814	4350760	105	15	3	14	NM	7
Planar cross bedding, oriented ESE on trend with troughs of main paleochannel, Prairie Canyon Ranch								
RG135	524919	4351915	99	8	16	14	good	1
Planar cross bedding, oriented ESE on trend with troughs of main paleochannel, Prairie Canyon Ranch								
RG137	524589	4351225	116	7	4	13	good	
Planar cross bedding, oriented ESE on trend with troughs of main paleochannel, Prairie Canyon Ranch								
RG137	523905	4351961	37	13	5	13	poor	
Isolated; can't tell.								
RG141	524169	4350909	156	24	17	20	good	6
Isolated, but possibly planar cross bedding, oriented SSE on trend with troughs of main paleochannel, Prairie Canyon Ranch								
RG142	524271	4350638	161	23	7	13	fair	
Isolated, but possibly planar cross bedding, oriented SSE on trend with troughs of main paleochannel, Prairie Canyon Ranch								
CV146	528730	4343676	77	17	4	18	good	
Isolated; can't tell								
CV149	531131	4343114	102	18	6	7	fair	
Isolated, but possibly epsilon cross bedding, oriented ESE at approximately right angle to NE troughs of Bucks Mountain trend, Private Road 104								
RG151	522899	4353185	26	9	12	27	good	
Planar cross bedding, oriented NNE on trend with troughs of JA Ranch paleochannel, CCSP								
CRS152	521245	4355736	191	18	18	27	good	
Isolated; can't tell								
CRS153	521358	4355823	221	4	11	7	good	
Possible epsilon cross bedding, oriented SW at approximately right angle to SE troughs of paleochannel, CCSP								
SD168	505474	4366580	232	18	4	9	good	1
Possible planar cross bedding, oriented SW at right angle to main paleochannel (which was not observed here), Cherokee Ranch								
CV173	525241	4332663	101	18	3	10	fair	1
Possible epsilon cross bedding, oriented SE at approximately right angle to NE troughs of Bucks Mountain trend, SE of Bucks Mountain								
EB189	532438	4340940	157	18	5	6	fair	cs to 1 cm
Planar cross bedding, oriented SE on trend with SE troughs main paleochannel, Running Creek								
EB189	532633	4340869	212	14	3	10	fair	cs to 2 cm

CASTLE ROCK CONGLOMERATE PALEOCURRENT PROJECT
Paleocurrent Measurements

Easting (UTM, NAD27 CONUS)	Northing (UTM, NAD27 CONUS)	Azimuth of Trough Axis (degrees)	Inclination of Foreset Beds at Trough Axis (degrees)	Length (meters)	Width (meters)	Quality	Largest Clast (centimeters)	Lithology of Largest Clast
Possible epsilon cross bedding, oriented SW at approximately right angle to SE troughs of main paleochannel, Running Creek								
EB189	532421	4341509	140	22	7	22	fair	cs to 1 cm
Possible epsilon cross bedding, oriented SW at approximately right angle to SSW troughs of main paleochannel, Running Creek								
EB189	532387	4341495	265	12	9	44	good	cs to granules
Planar cross bedding, oriented SW on trend with SSW troughs of main paleochannel, Running Creek								
EB189	532450	4341918	300	23	3	10	poor	cs to granules
Possible epsilon cross bedding, oriented WNW at approximately right angle to SSW troughs of main paleochannel, Running Creek								
EB190	533926	4339675	60	14	11	20	fair	cs to 1 cm
Can't tell; doesn't fit with nearby flow directions								
EB192	534196	4341716	82	17	5	39	very good	cs to 1 cm
Possible epsilon cross bedding, oriented ENE at approximately right angle to N to NNE troughs of Bucks Mountain trend,trib to Running Creek								
EB192	534287	4341711	86	4	4	25	fair	fs to ms
Possible epsilon cross bedding, oriented E at approximately right angle to N to NNE troughs of Bucks Mountain trend,trib to Running Creek								
EB192	534409	4341562	34	21	11	33	good	cs to 2 cm
Possible epsilon cross bedding, oriented E at approximately right angle to N to NNE troughs of Bucks Mountain trend,trib to Running Creek								
EB204	538047	4342213	93	30	18	12	good	cs to 2 cm
Planar cross bedding, oriented E on trend with NE troughs of Bucks Mountain trend, NW of Elbert								
EB204	538072	4341897	143	10	7	15	fair	cs to 1 cm
Possibly planar cross bedding, oriented SE on trend with SE troughs of main paleochannel, NW of Elbert								
EB204	538126	4341878	167	13	8	18	good	cs to 1 cm
Possibly planar cross bedding, oriented SE on trend with SE troughs of main paleochannel, NW of Elbert								
CRN220	513352	4372094	87	4	12	20	fair	cs to granules
Isolated; can't tell								
CRS228	518132	4355087	164	15	14	16	fair	ms to granules
Possible epsilon cross bedding, oriented SSE at approximately right angle to ENE troughs of JA Ranch paleochannel, mesa S of Willow Creek								
RG231	523089	4352493	227	13	8	11	good	ms to granules
Possible epsilon cross bedding, oriented SW at approximately right angle to SE troughs of main paleochannel,CCSP								
EB189 (second measurement)	532424	4341509	130	12	16	7	good	cs to granules
EB189	532374	4341534	280	5	8	8	poor	cs to granules
Possible epsilon cross bedding, oriented WNW at approximately right angle to S to SSW troughs of main paleochannel, Running Creek								
BB236	546898	4334047	5	19	5	20	fair	7
Isolated; can't tell								

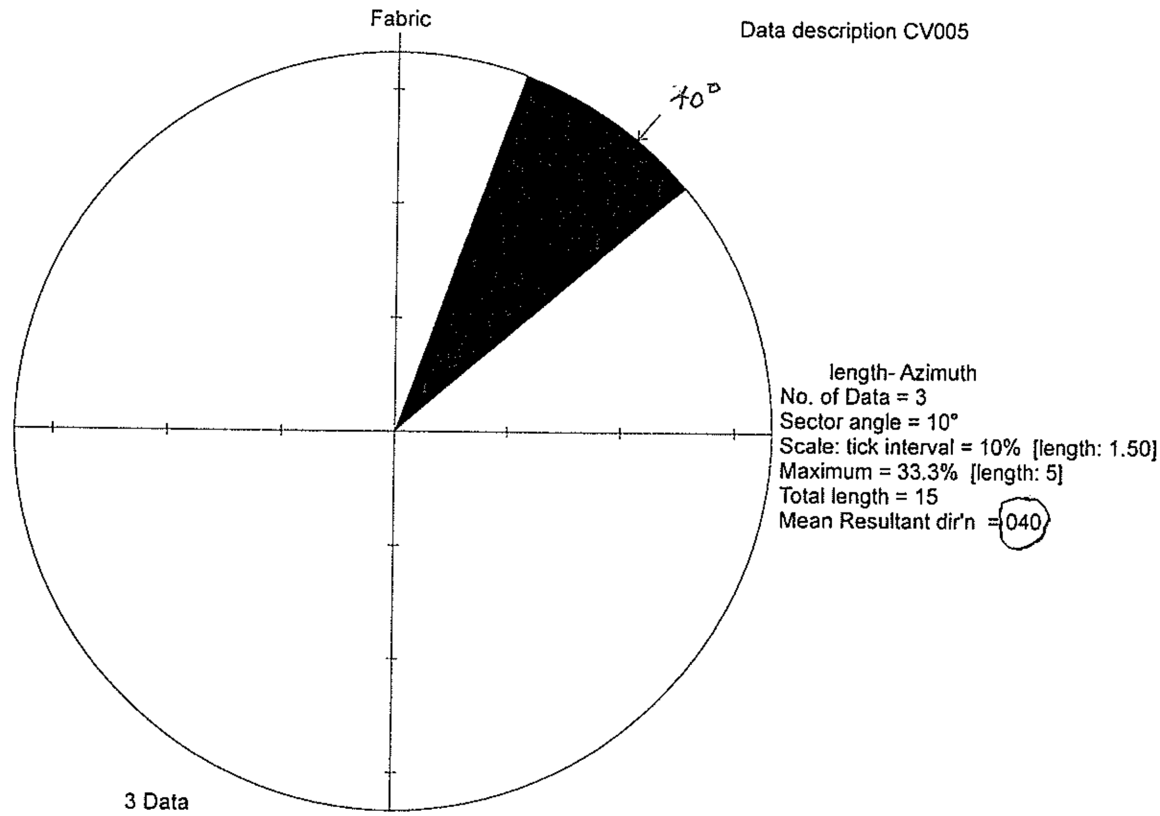
APPENDIX 2

CONSOLIDATED PALEOCURRENT DIRECTION ROSE DIAGRAMS

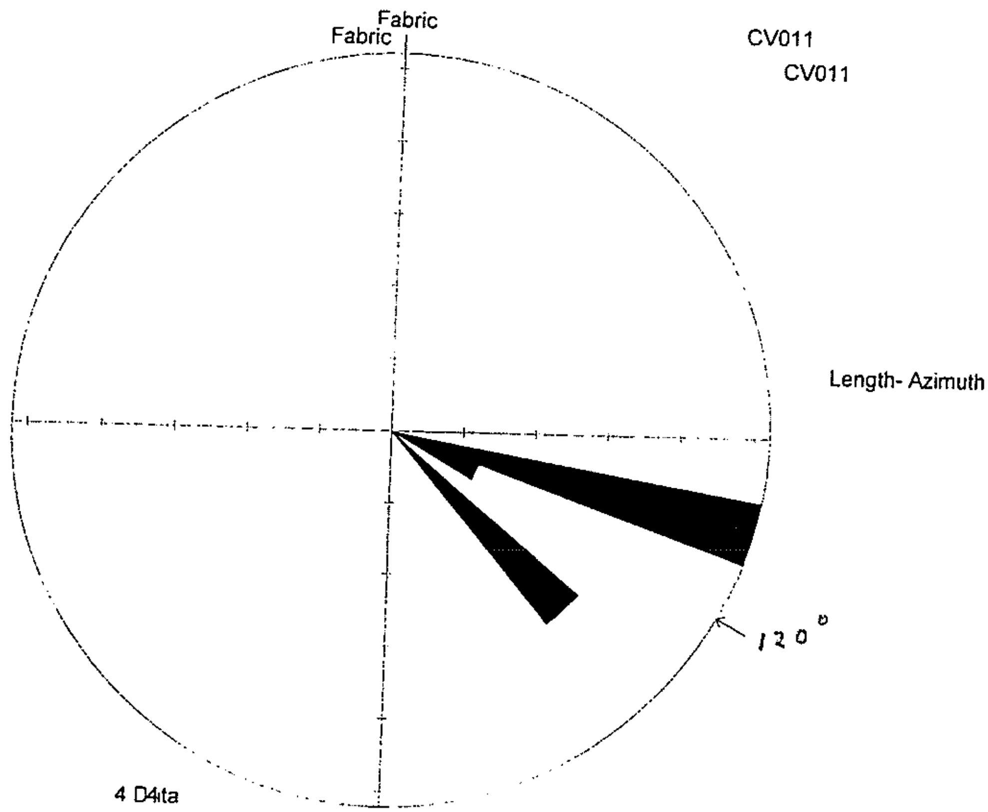
This appendix contains length-azimuth rose diagrams for the consolidated paleocurrent directions of 375 locations tabulated in Appendix 3 (Consolidated paleocurrent directions) and posted on the maps of Plates 3A through 3D (Consolidated paleocurrent directions). The locations in this appendix are in the same order as in Appendix 3. (Appendix 3 also contains the data for 36 locations where there is only one paleocurrent measurement and therefore no rose diagram.)

Each rose diagram is headed in black marker pen with its location number and number of paleocurrent measurements. The number of measurements also appears at the lower left of the each diagram. Each diagram has an arrow indicating the resultant direction, supplemented with the resultant direction in pencil. On many diagrams the resultant direction is also circled in pencil in the printed information on the diagram.

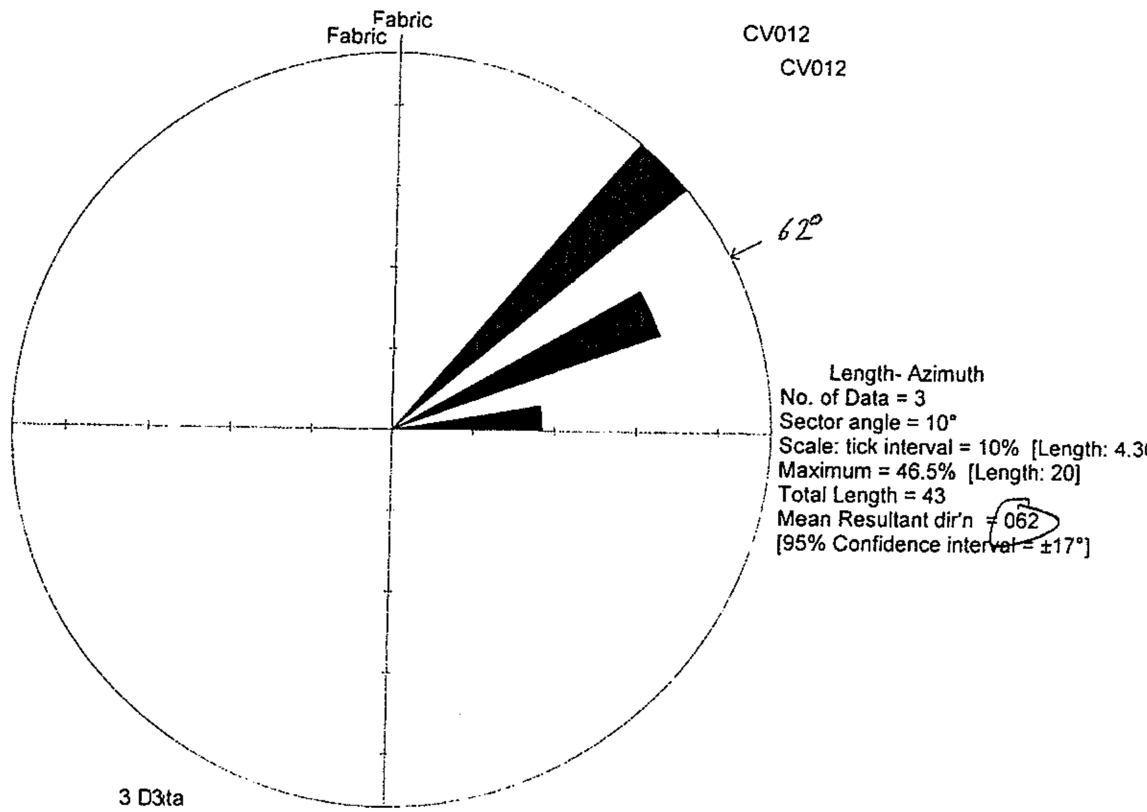
CV005
3


Fabric
Data description CV005
40°
3 Data
length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.50]
Maximum = 33.3% [length: 5]
Total length = 15
Mean Resultant dir'n = 040

CV011
4

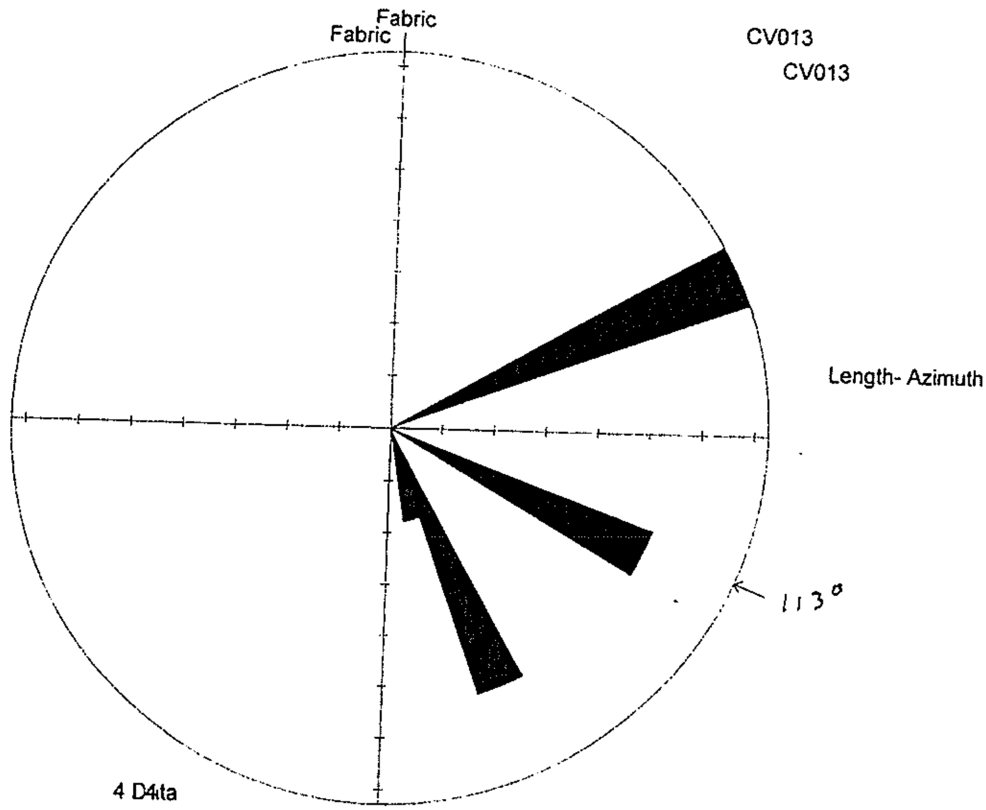


CV012
3



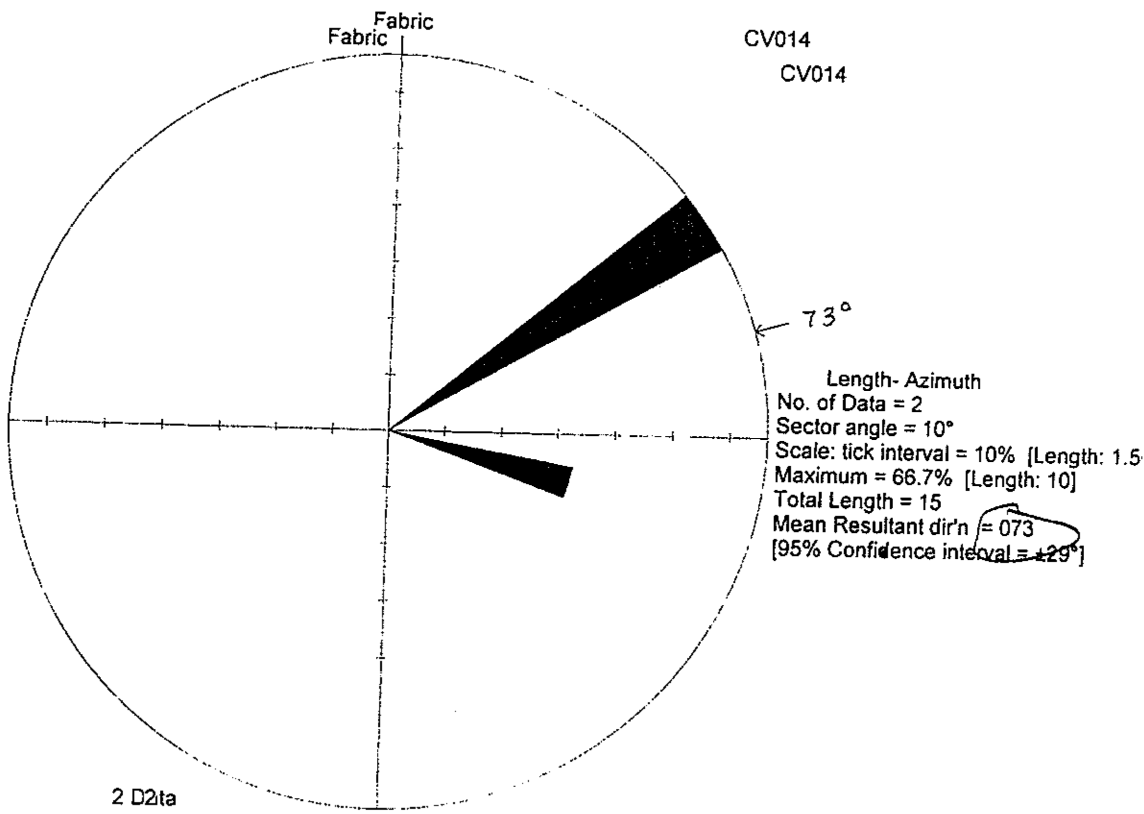
Fabric
Fabric
CV012
CV012
62°
Length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [Length: 4.3
Maximum = 46.5% [Length: 20]
Total Length = 43
Mean Resultant dir'n = 062
[95% Confidence interval = ±17°]
3 D3ta

CV013
4

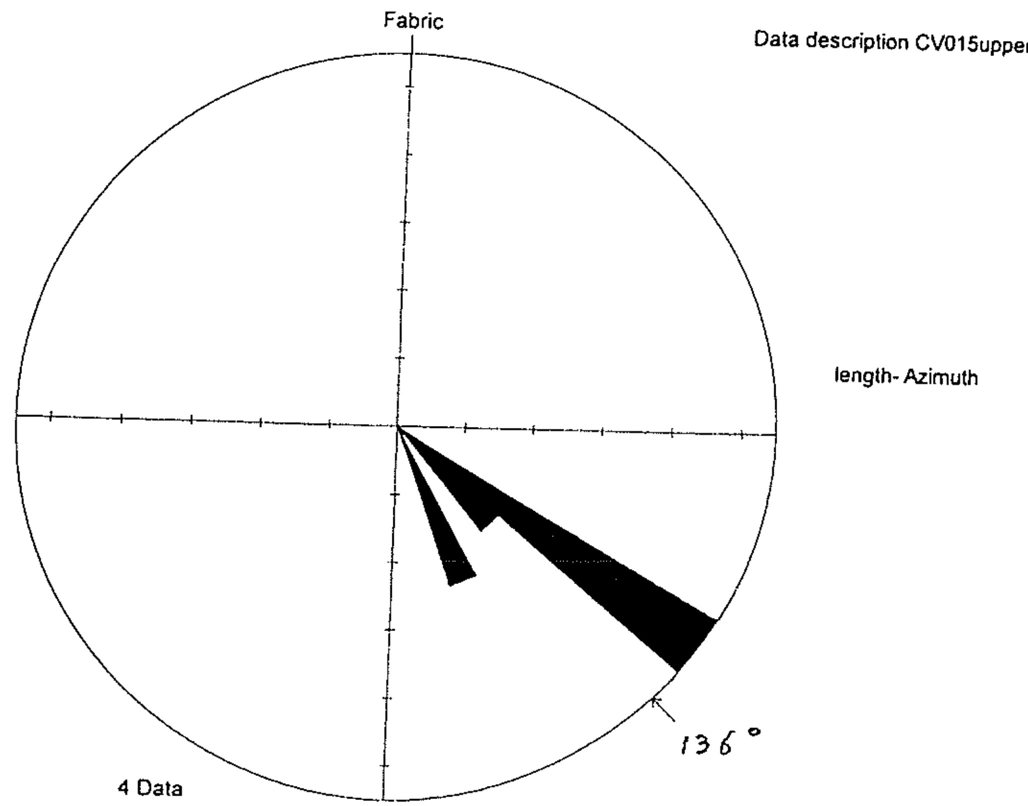


CV014

2

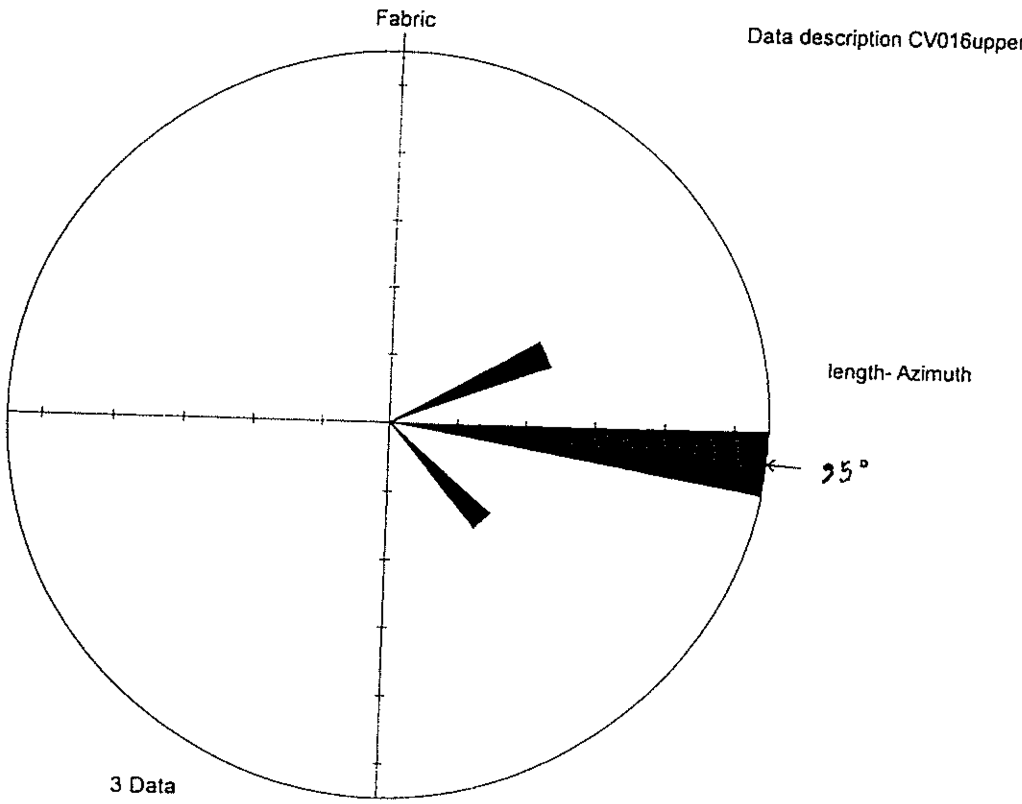

Fabric
Fabric
CV014
CV014
73°
Length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [Length: 1.5
Maximum = 66.7% [Length: 10]
Total Length = 15
Mean Resultant dir'n = 073
[95% Confidence interval = ±29°]
2 D2ta

CV015 A
4


Fabric
Data description CV015upper
length- Azimuth
136°
4 Data

CV016 A

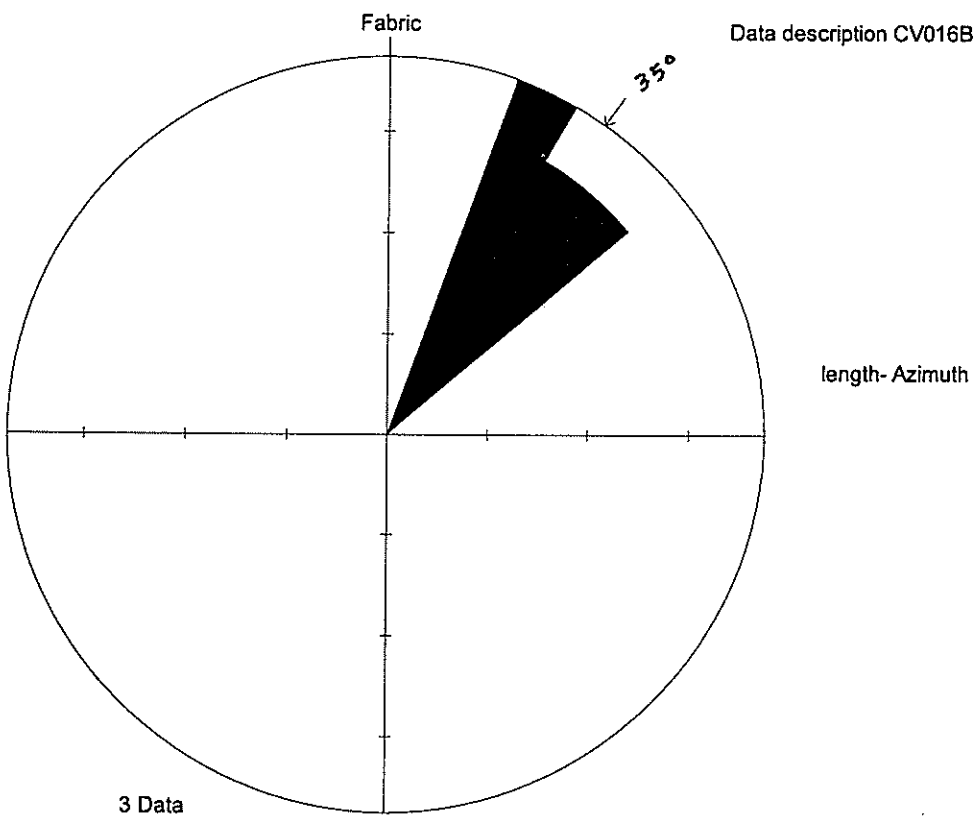
3



Fabric
Data description CV016upper
length- Azimuth
95°
3 Data

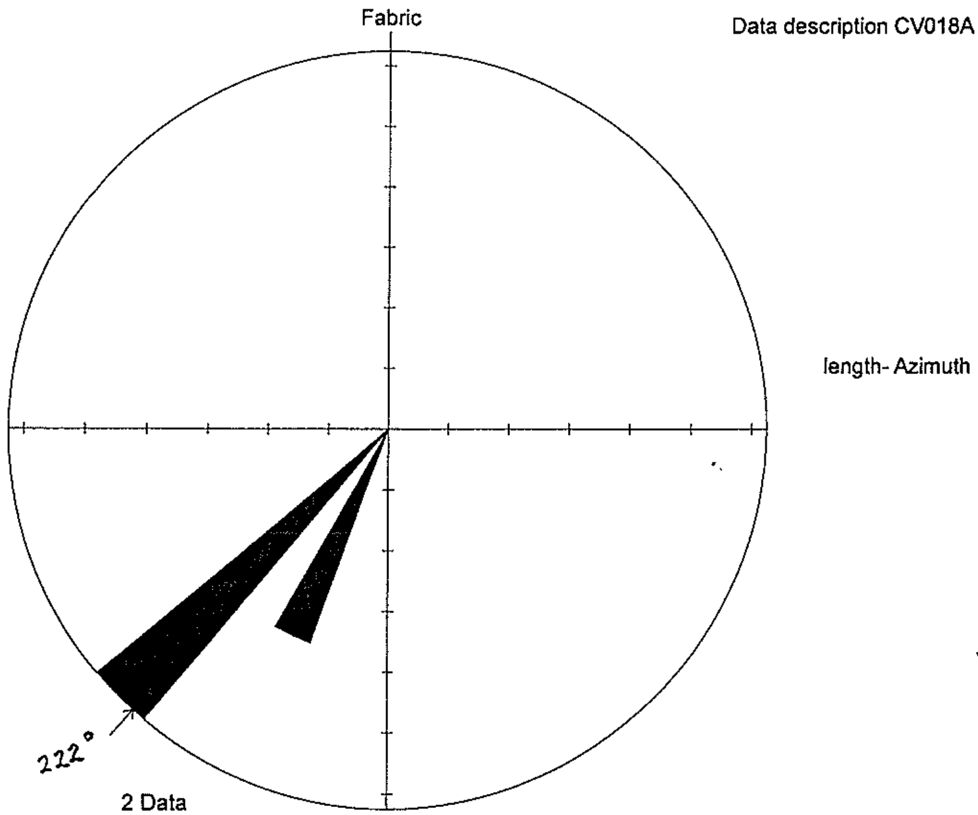
CV016B

3



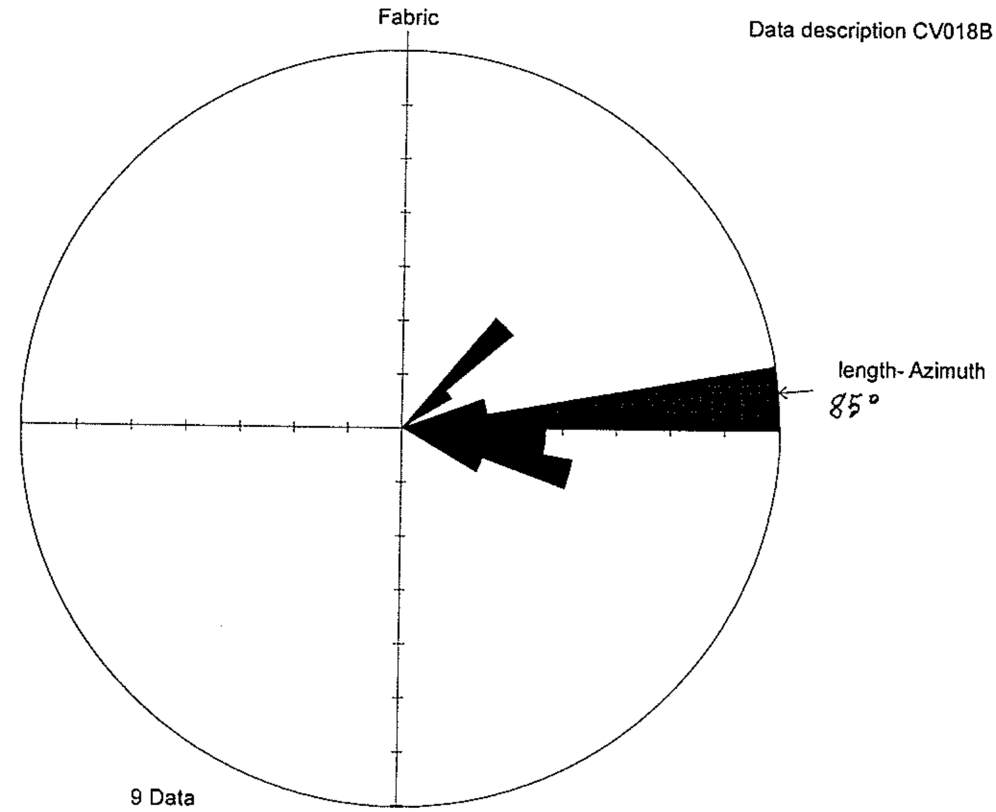
CV018A

2



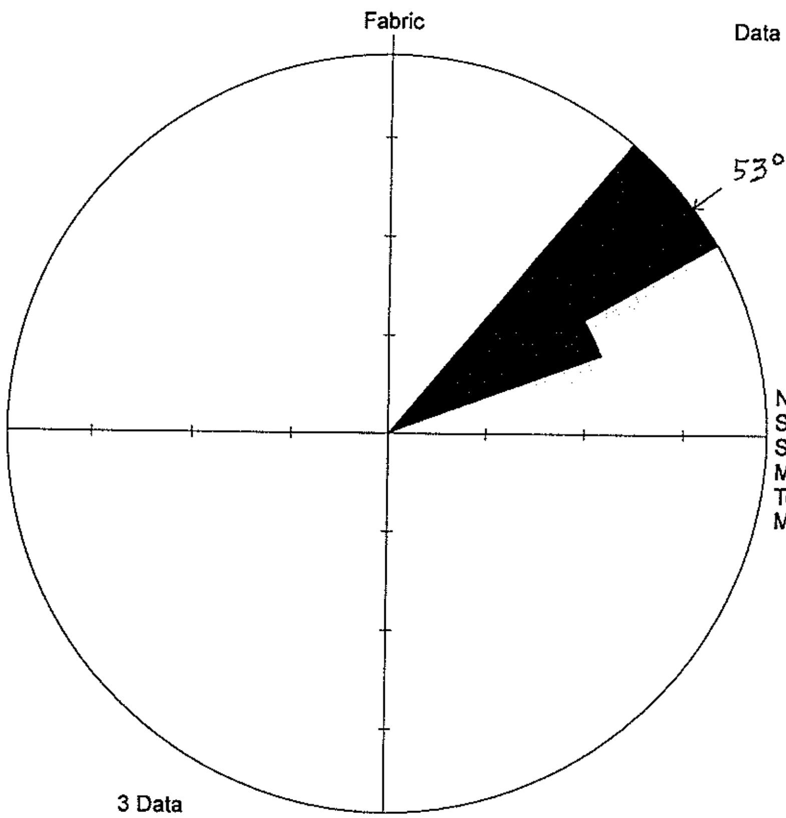
CV018B (rvsd)

9



CV019A (rvsd)

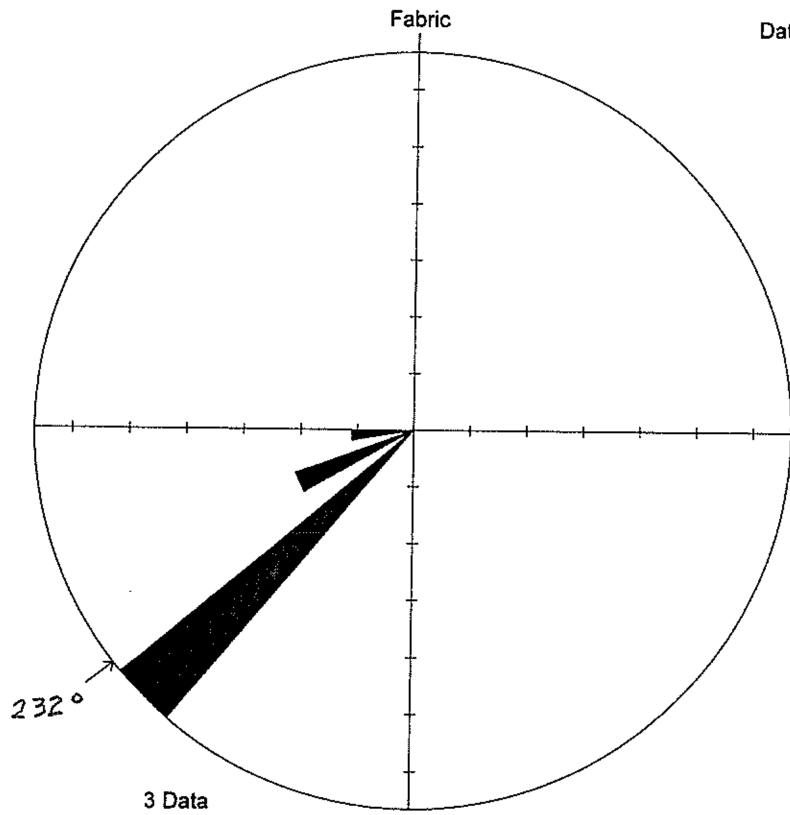
3



Data description CV019A

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.30]
Maximum = 38.5% [length: 5]
Total length = 13
Mean Resultant dir'n = 053

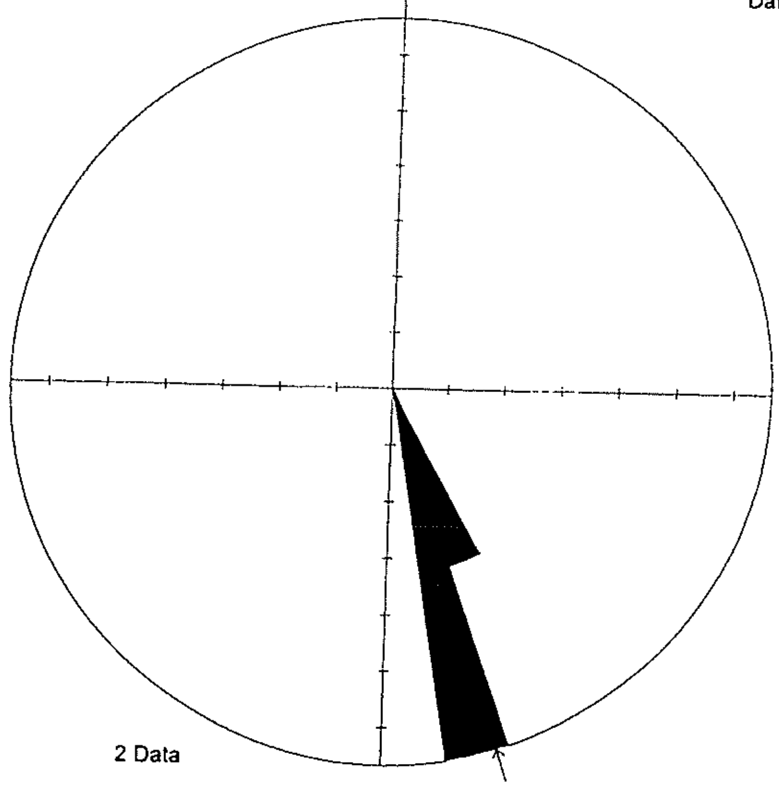
CV019B
3



Data description CV019B

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 0.90]
Maximum = 66.7% [length: 6]
Total length = 9
Mean Resultant dir'n = 232

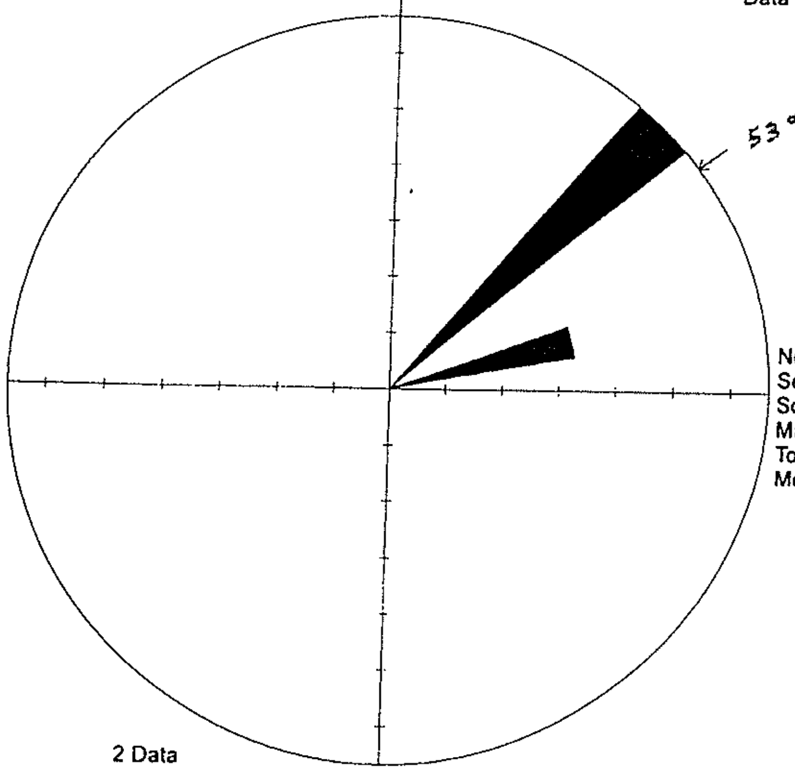
CV020,[A]
2


Fabric
Data description CV020upper
length- Azimuth
2 Data
162°

CVO20X
2

Data description CV020X

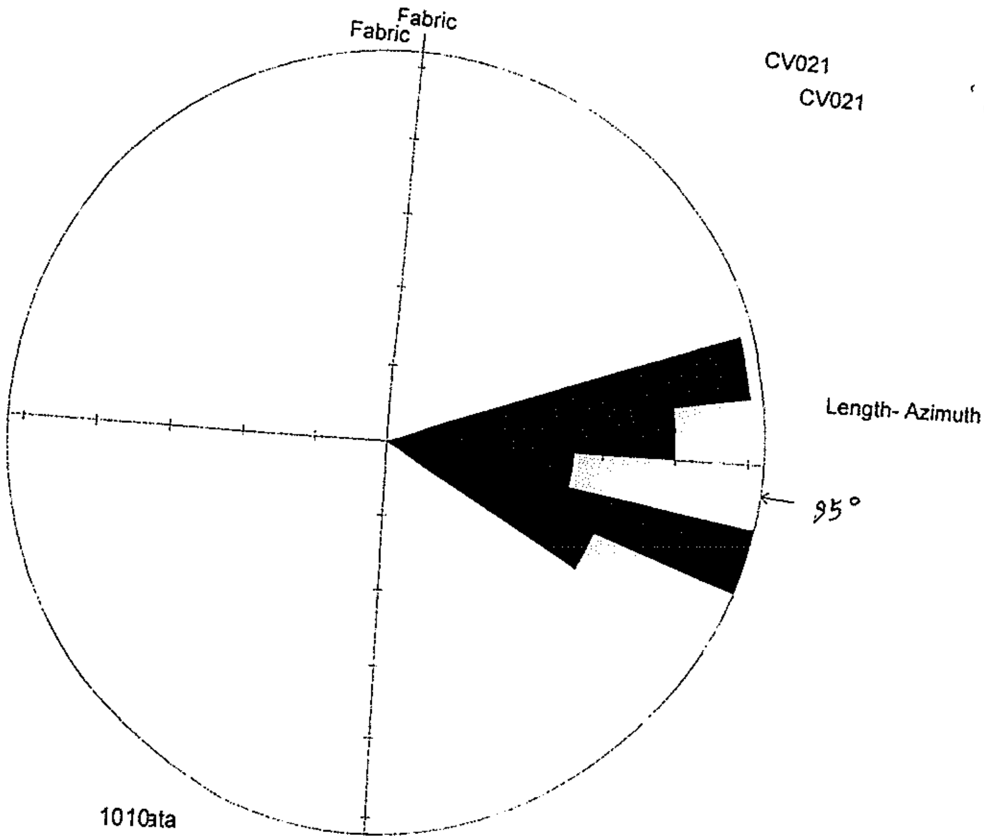
Fabric



length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 0.60
Maximum = 66.7% [length: 4]
Total length = 6
Mean Resultant dir'n = 053

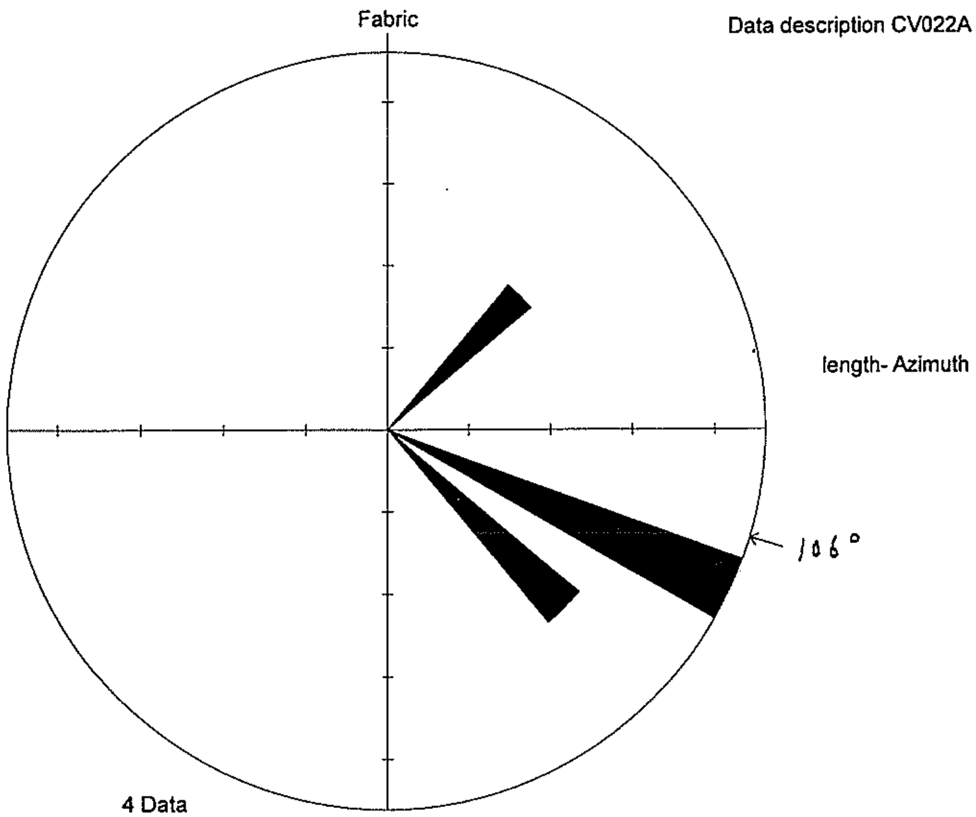
2 Data

CV021
10



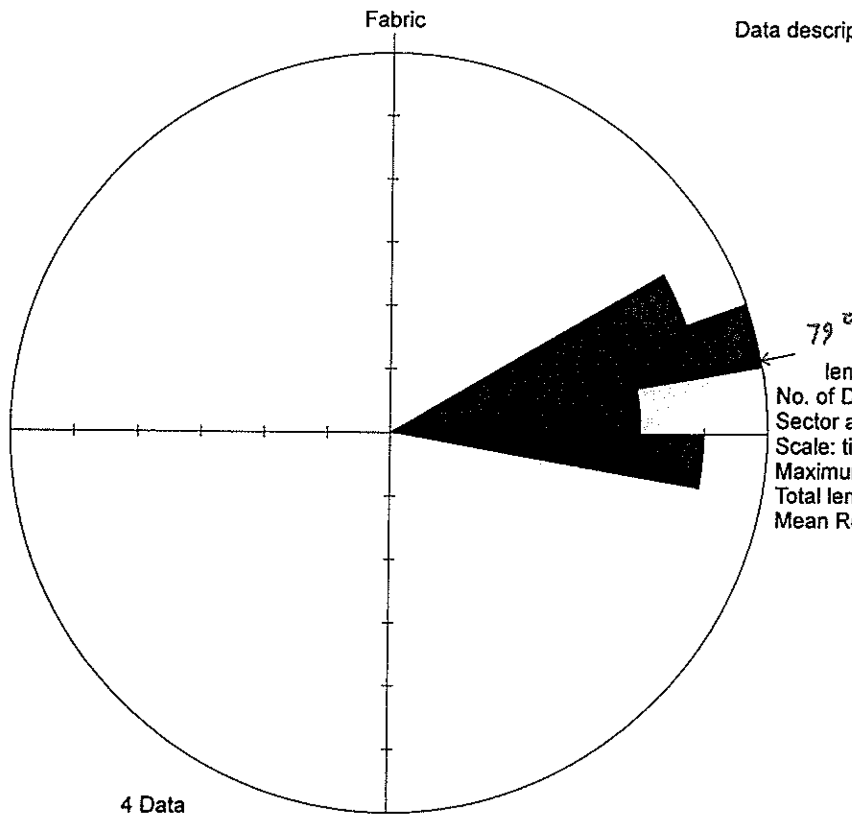
CV022A

4



CV022B

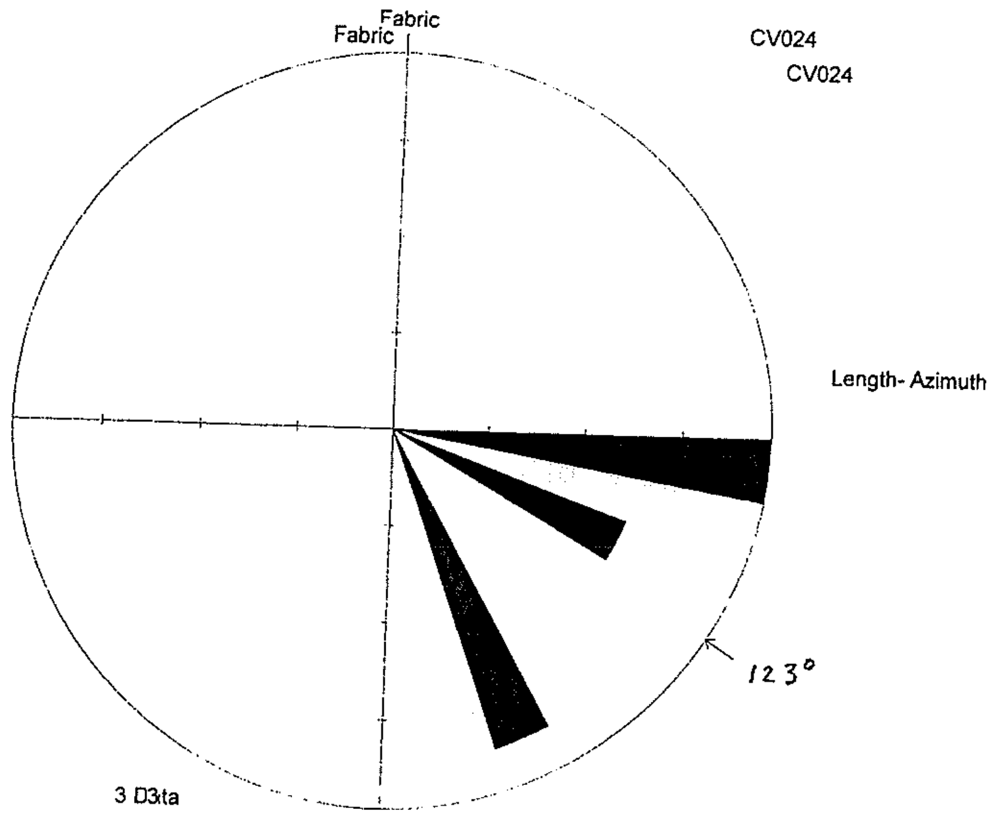
4



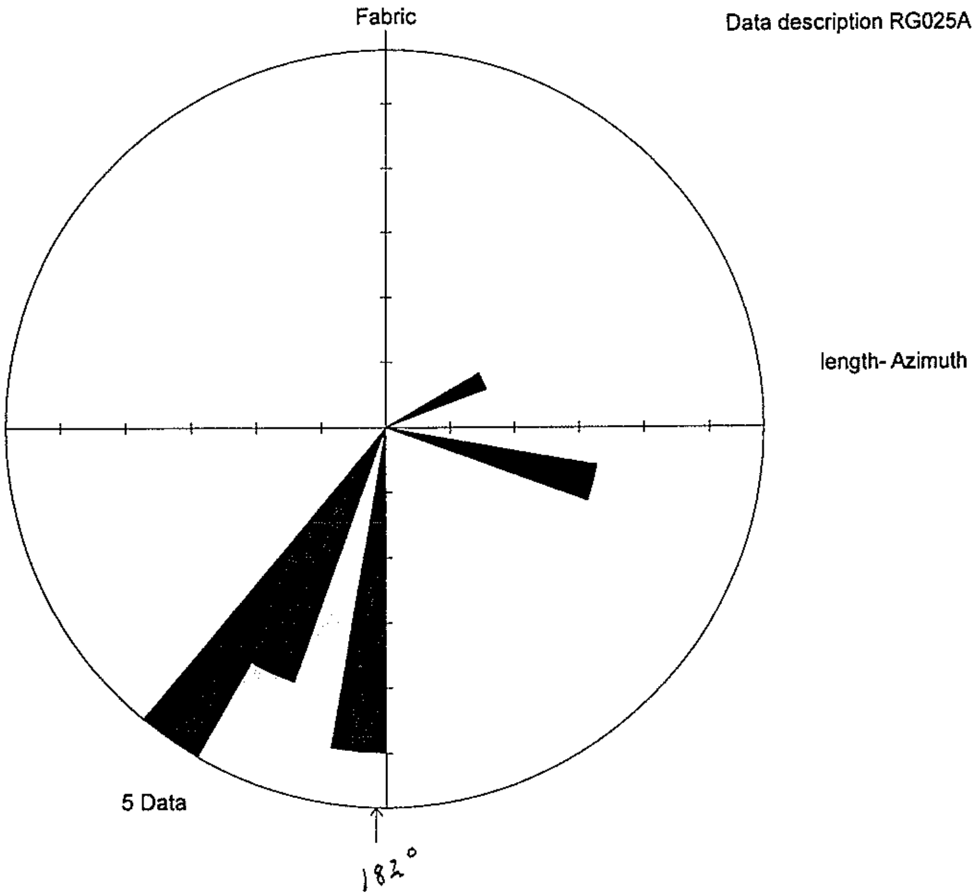
Data description CV022B

length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 1.00]
Maximum = 30% [length: 6]
Total length = 20
Mean Resultant dir'n = 079

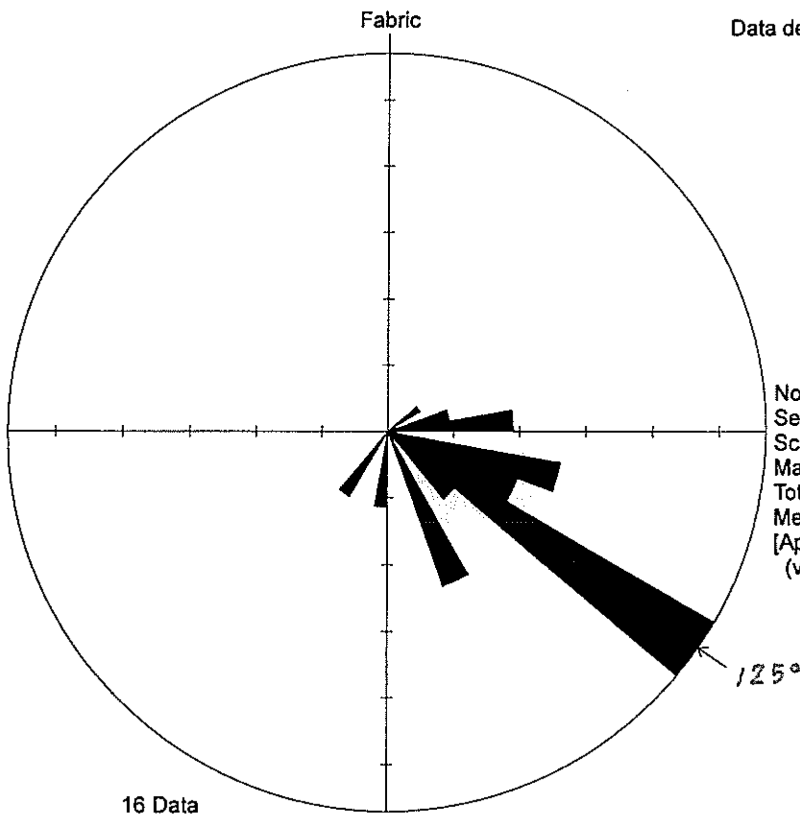
CV024
3



RG025A
5



RG025B
16

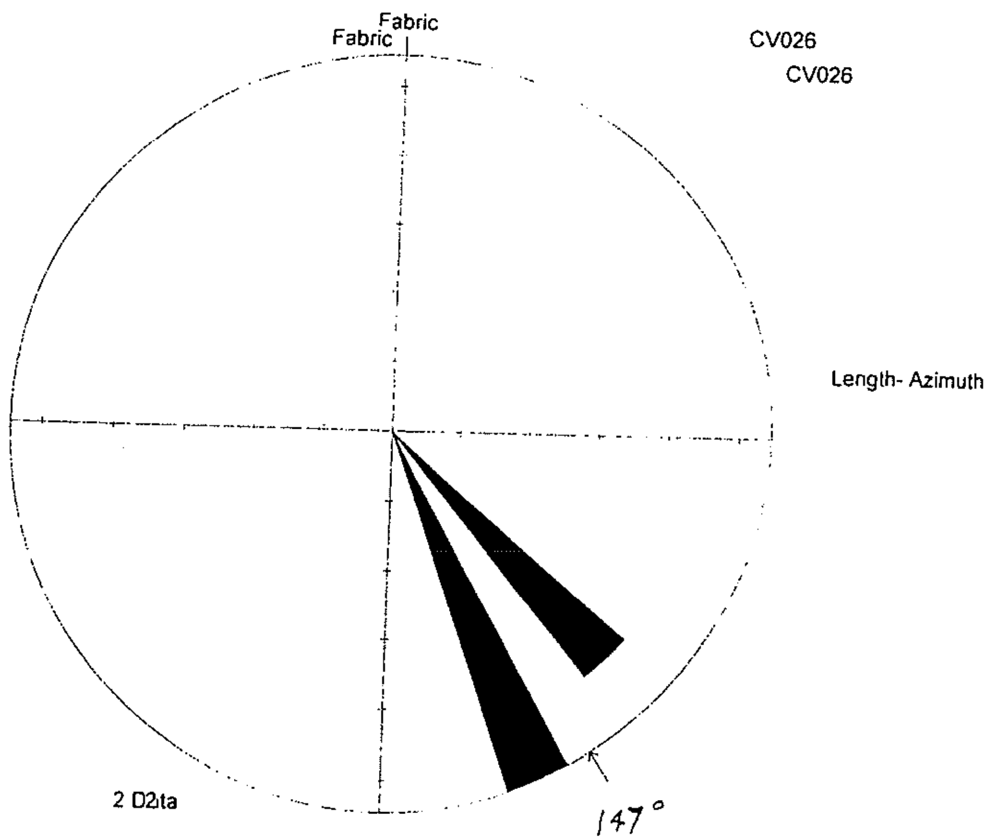


Data description RG025B

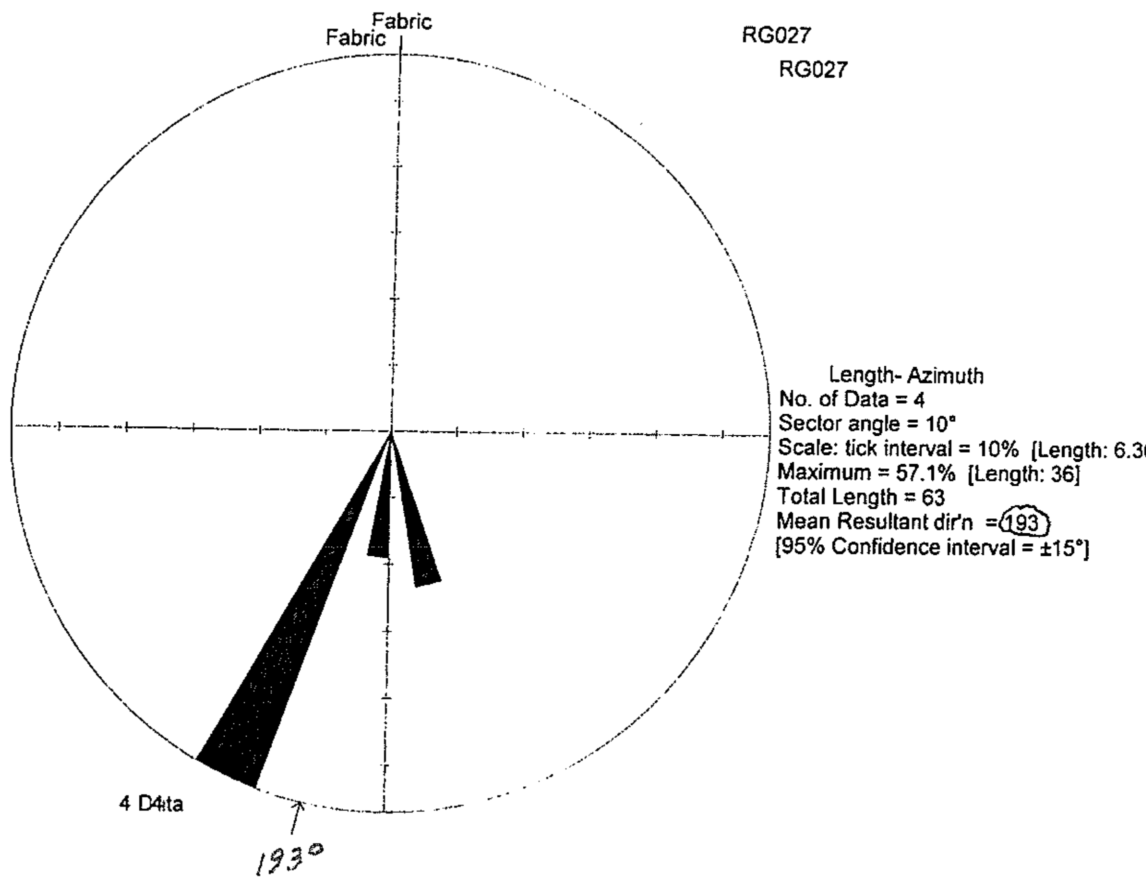
length- Azimuth
No. of Data = 16
Sector angle = 10°
Scale: tick interval = 5% [length: 5.25]
Maximum = 28.6% [length: 30]
Total length = 105
Mean Resultant dir'n = 125
[Approx. 95% Confidence interval = ±17
(valid only for unimodal data)

RG026

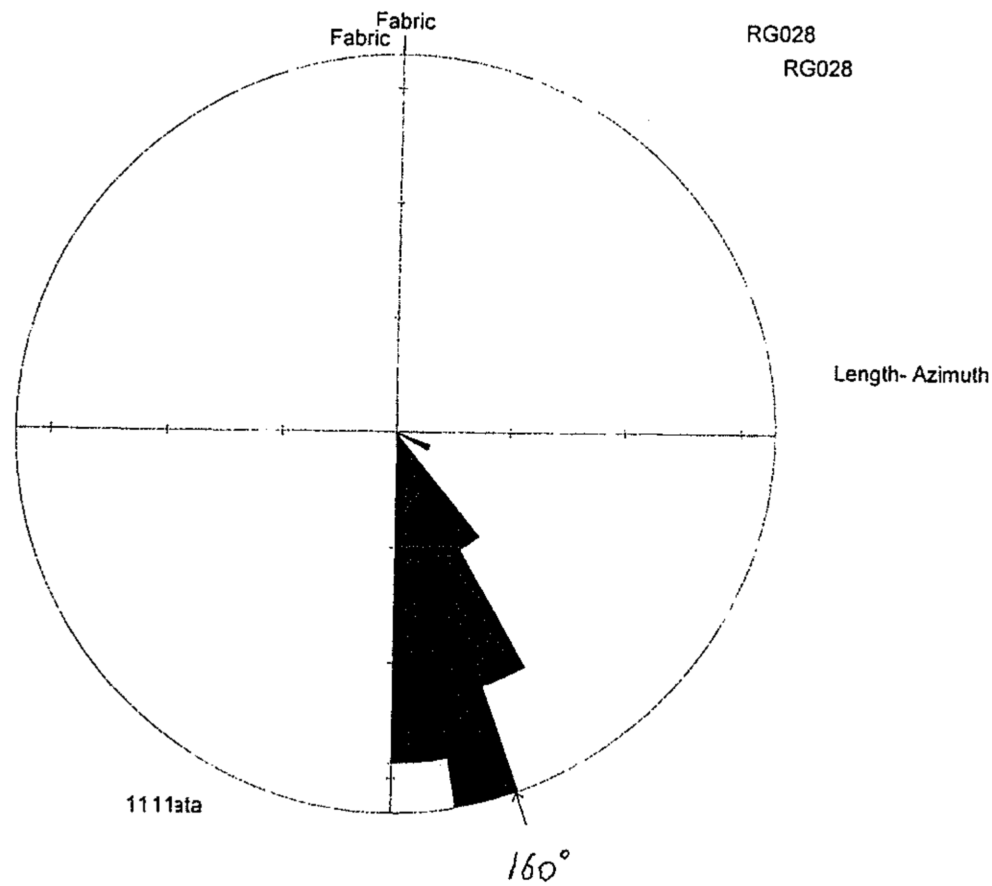
2



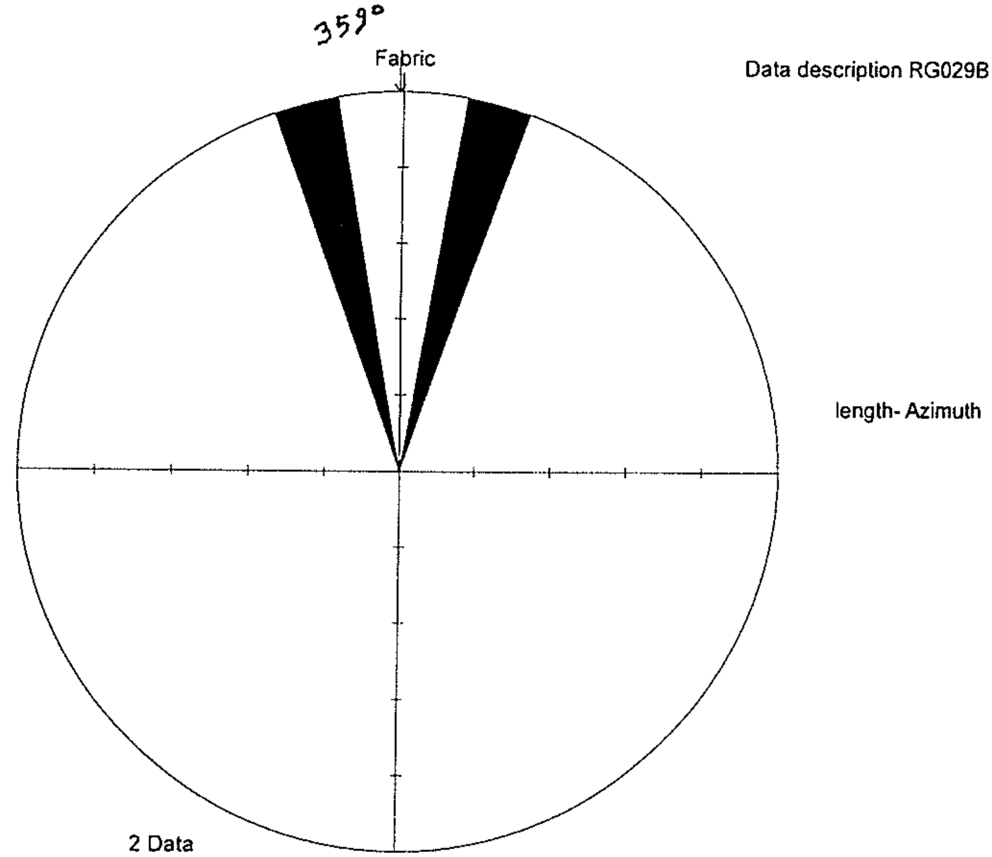
RG027
4


Fabric
Fabric
RG027
RG027
Length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [Length: 6.3(
Maximum = 57.1% [Length: 36]
Total Length = 63
Mean Resultant dir'n = 193
[95% Confidence interval = ±15°]
4 D4ita
193°

RG028
11



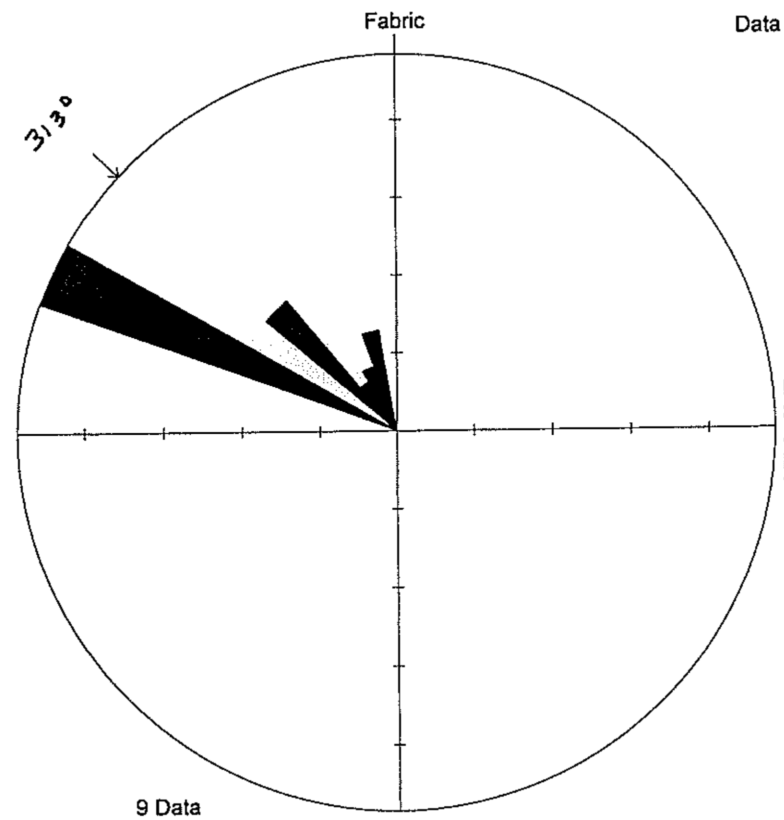
RG029B
2



CRS031A

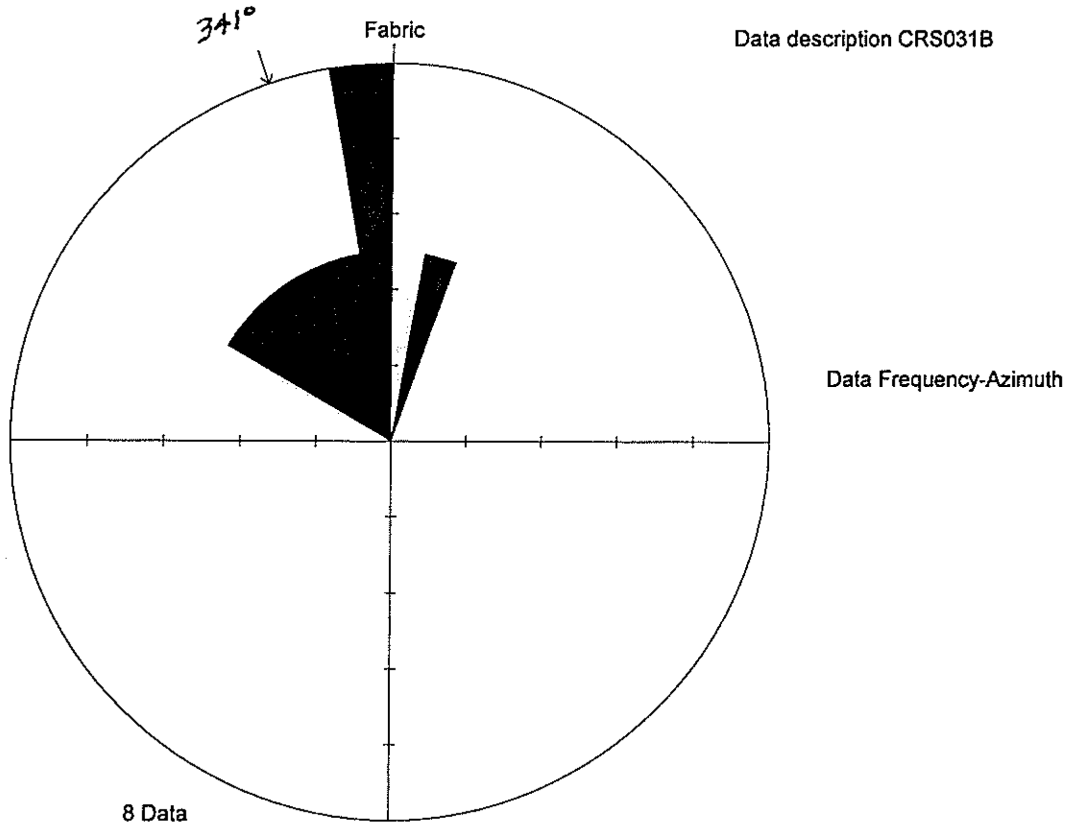
9

Data description CRS031A



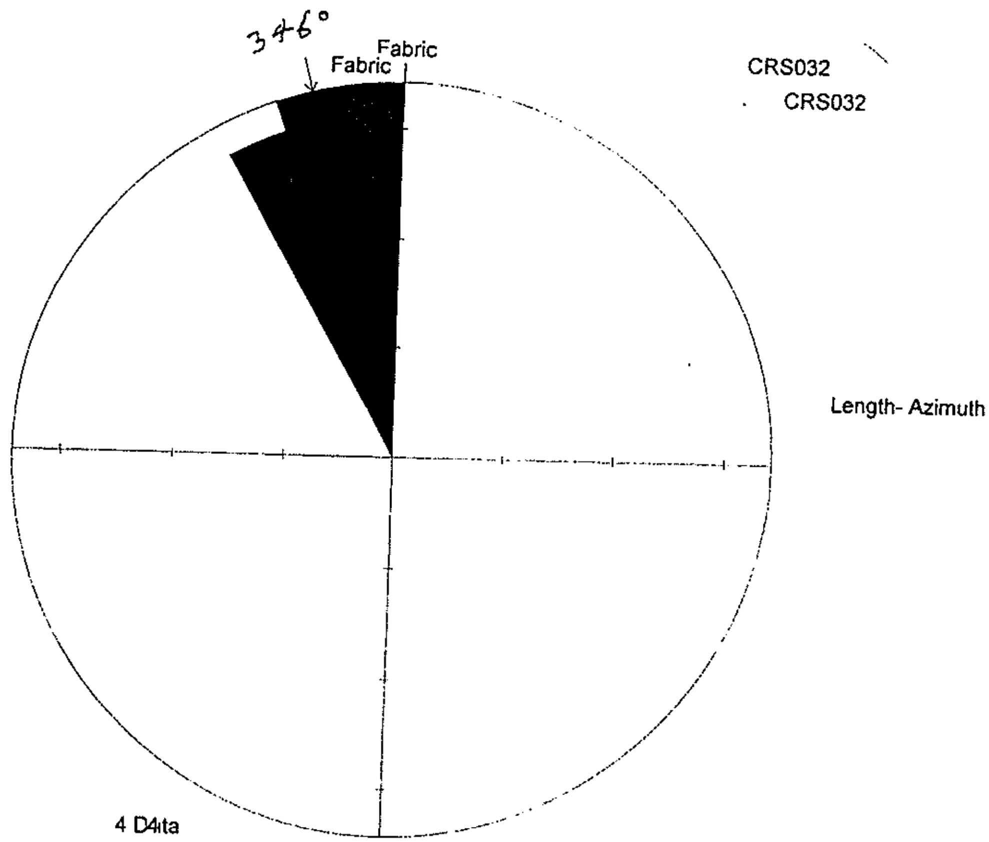
length- Azimuth
No. of Data = 9
Sector angle = 10°
Scale: tick interval = 10% [length: 6.8
Maximum = 48.5% [length: 33]
Total length = 68
Mean Resultant dir'n = 313
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

CRS031B (rvsd)
8

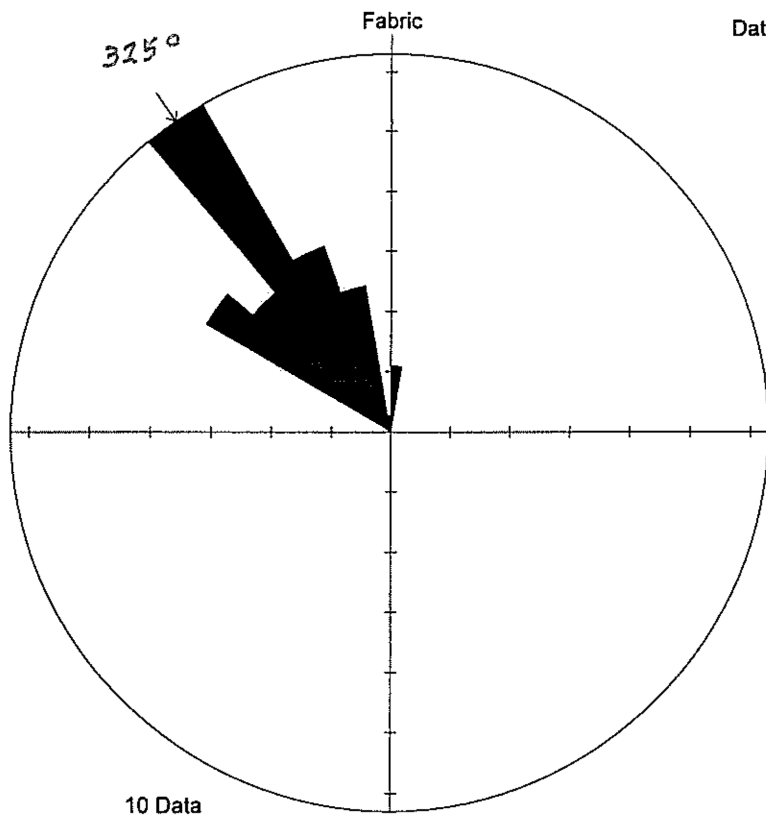


CRS032

4



CRS033 (rvsd)
10

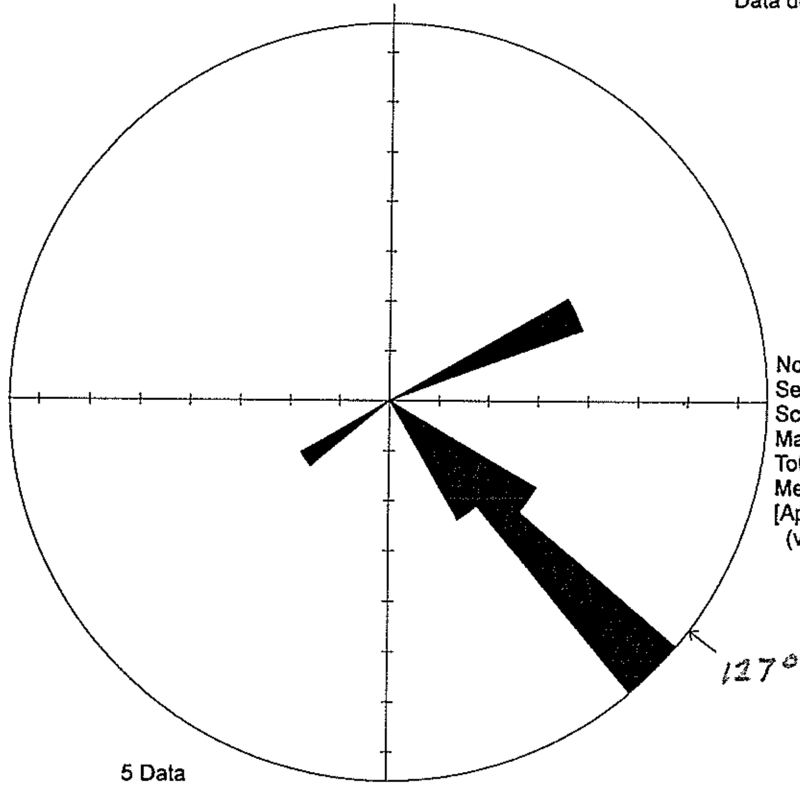


Data description CRS033

length- Azimuth
No. of Data = 10
Sector angle = 10°
Scale: tick interval = 5% [length: 10.95]
Maximum = 31.5% [length: 69]
Total length = 219
Mean Resultant dir'n = 325
[Approx. 95% Confidence interval = ±9.9
(valid only for unimodal data)

CRS035A

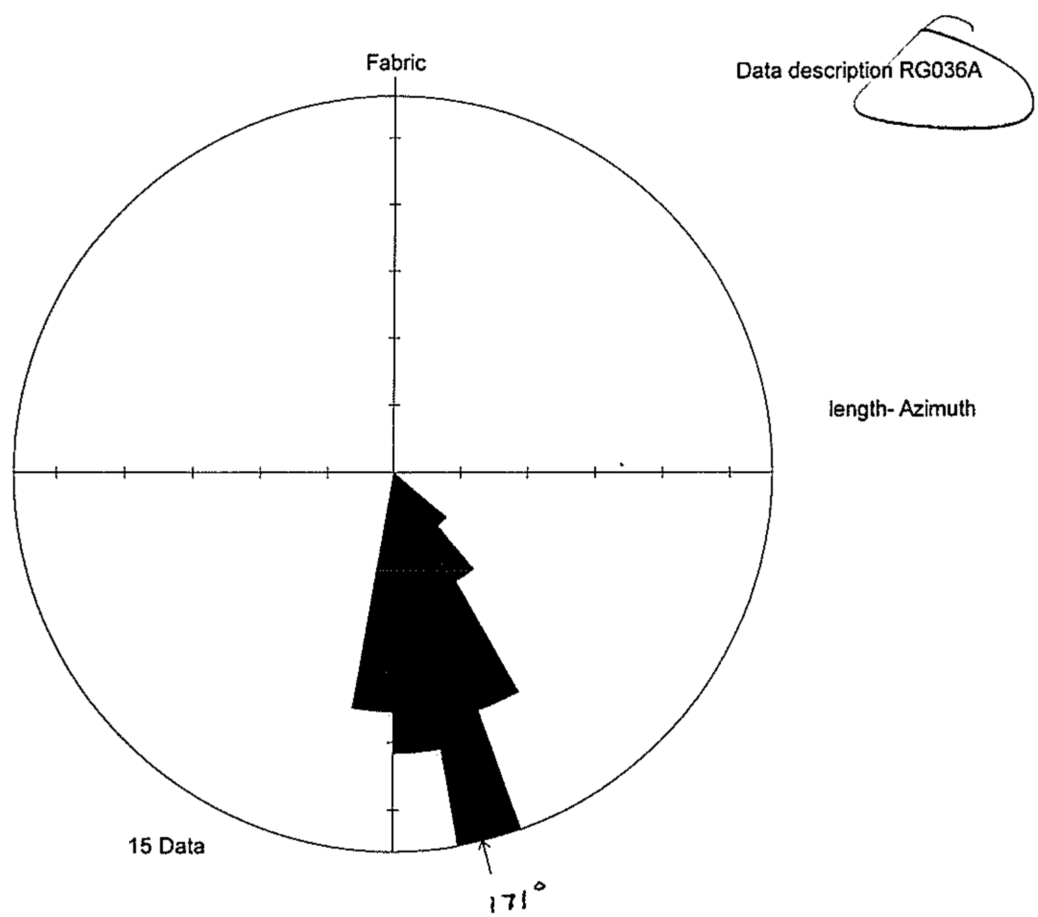
5



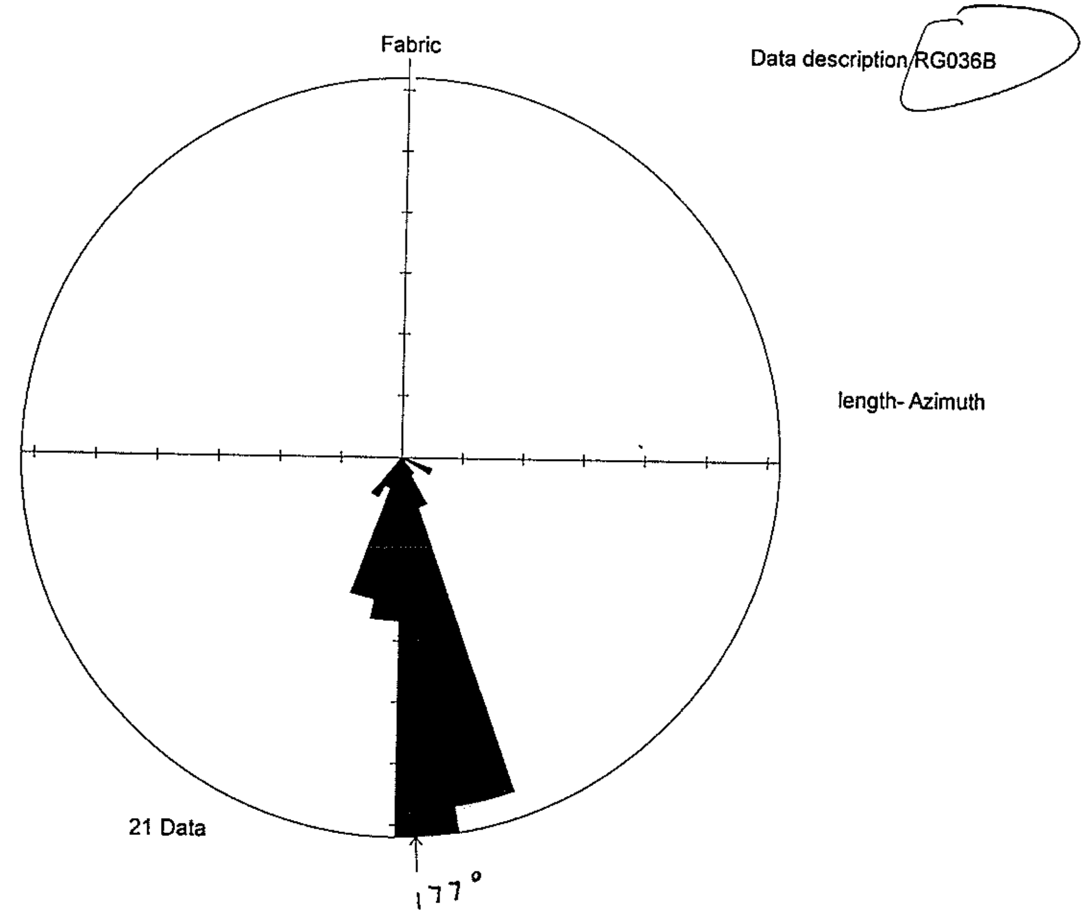
Data description CRS035A

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 5% [length: 1.45]
Maximum = 37.9% [length: 11]
Total length = 29
Mean Resultant dir'n = 127
[Approx. 95% Confidence interval = ±3
(valid only for unimodal data)

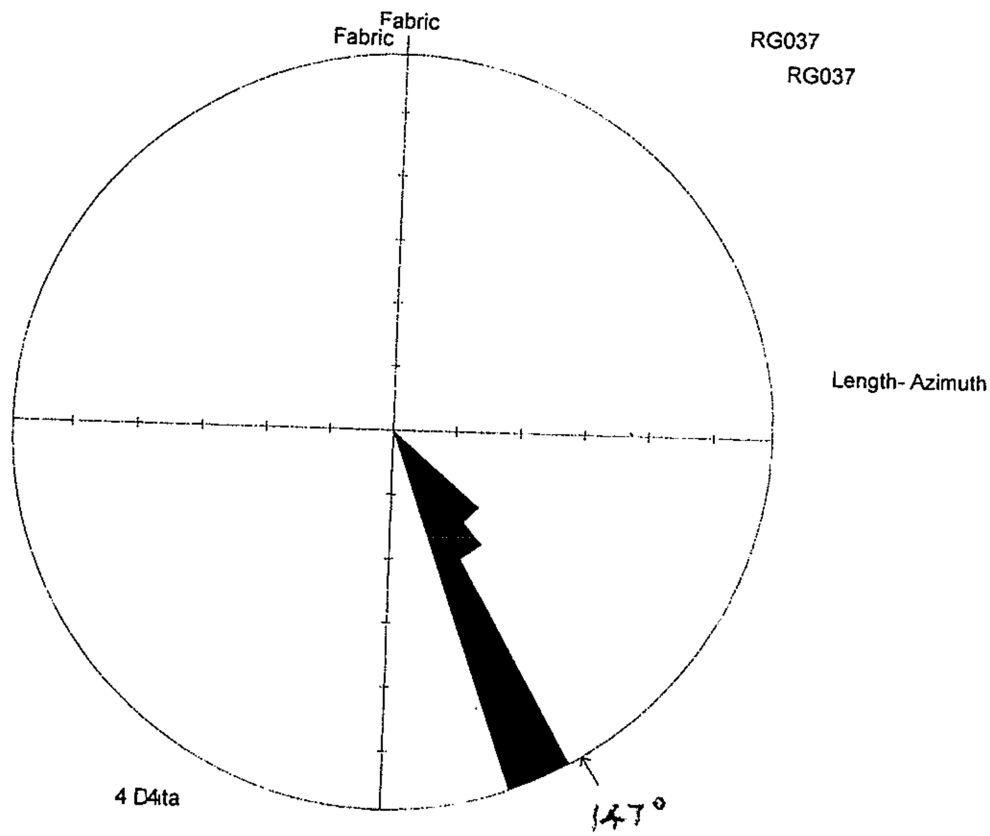
RG036A
15



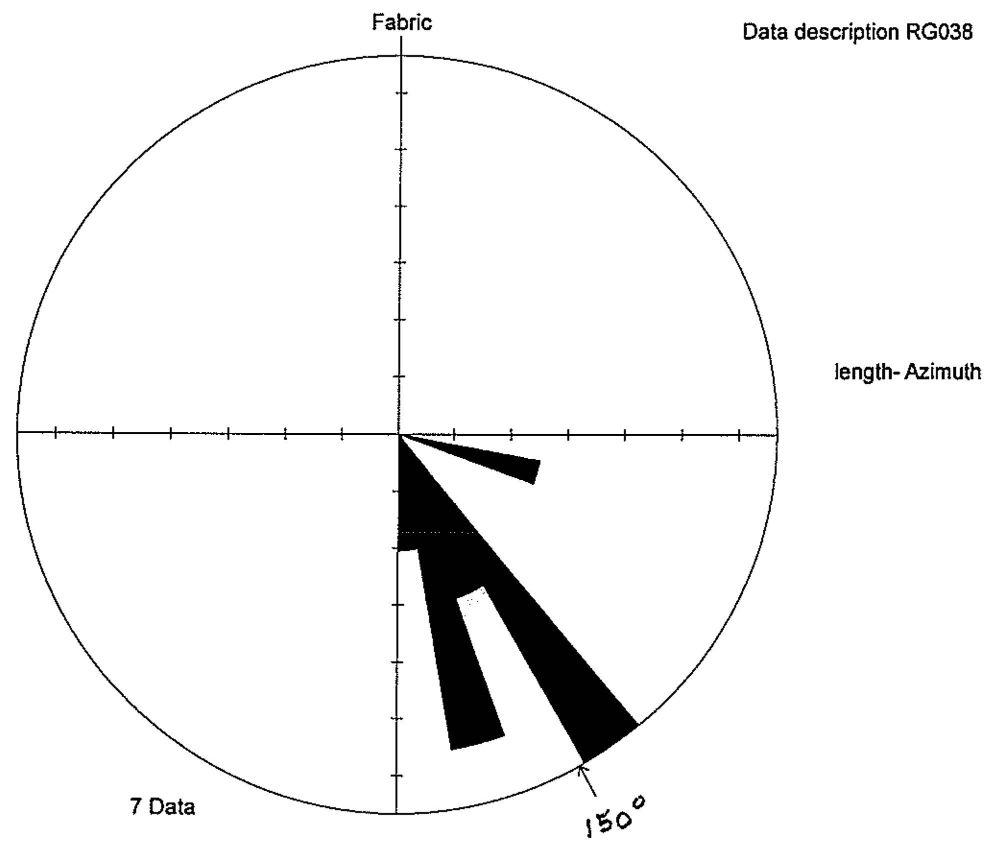
RG036B
21



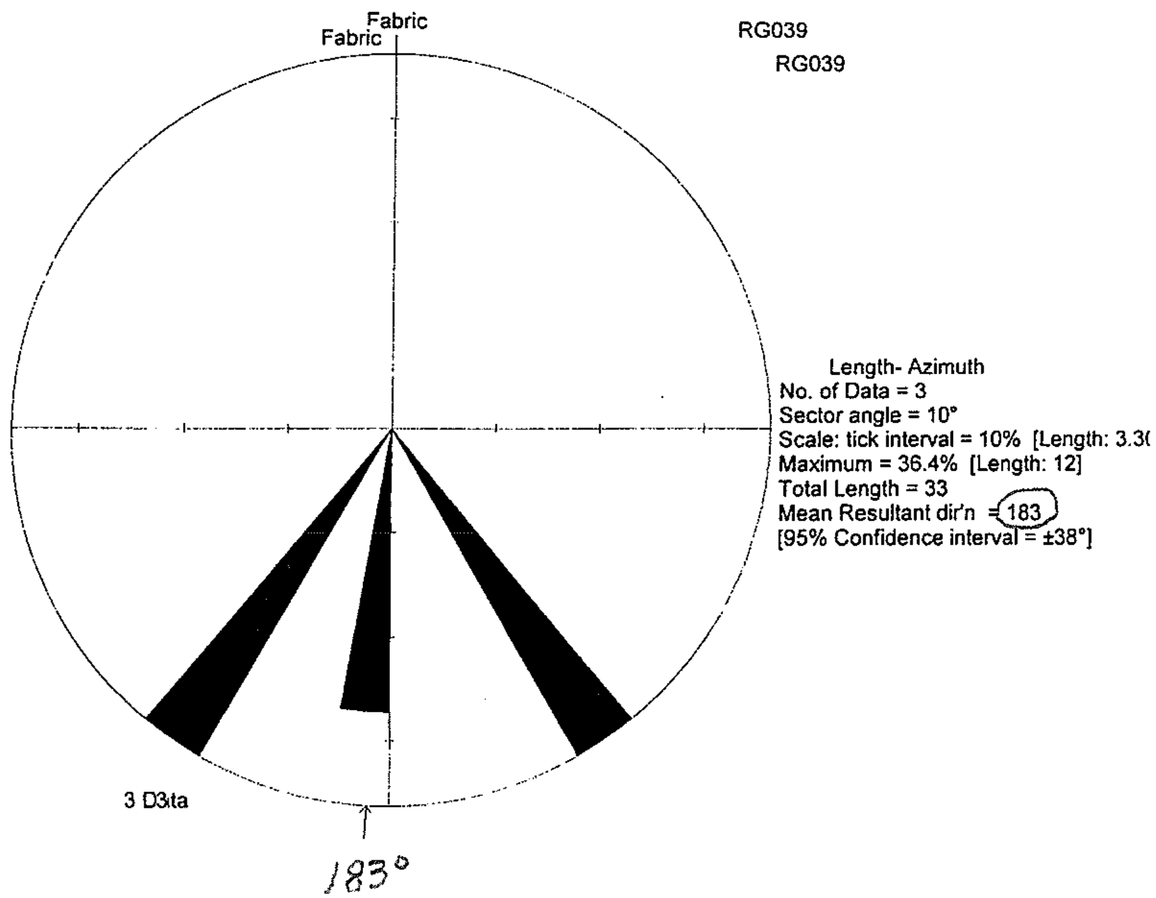
RG037
4



RG038 (rvsd)
7

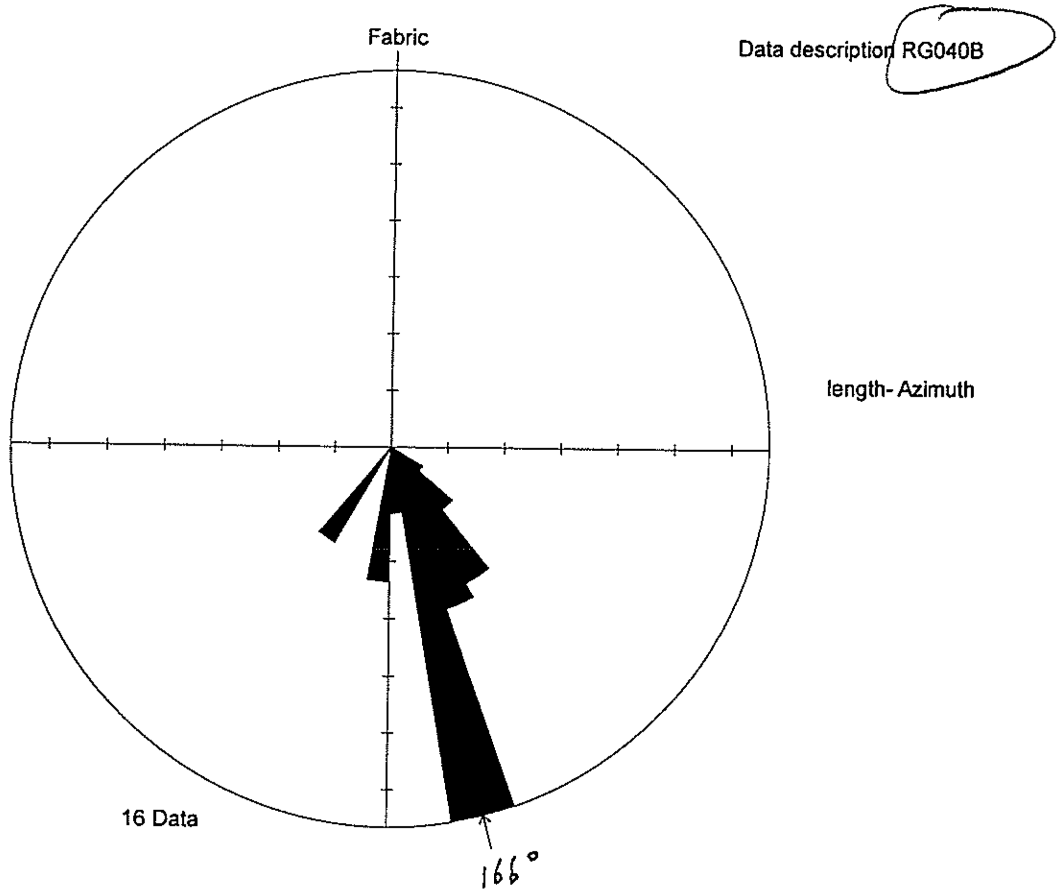


RG039
3

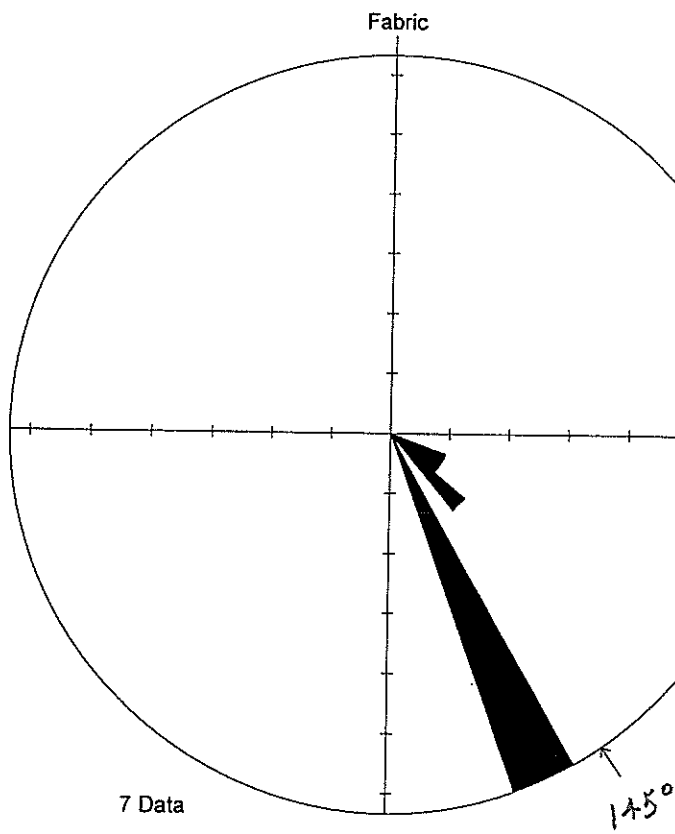

Fabric
Fabric
RG039
RG039
Length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [Length: 3.3(
Maximum = 36.4% [Length: 12]
Total Length = 33
Mean Resultant dir'n = 183
[95% Confidence interval = ±38°]
3 D3ta
183°

RG040B

16



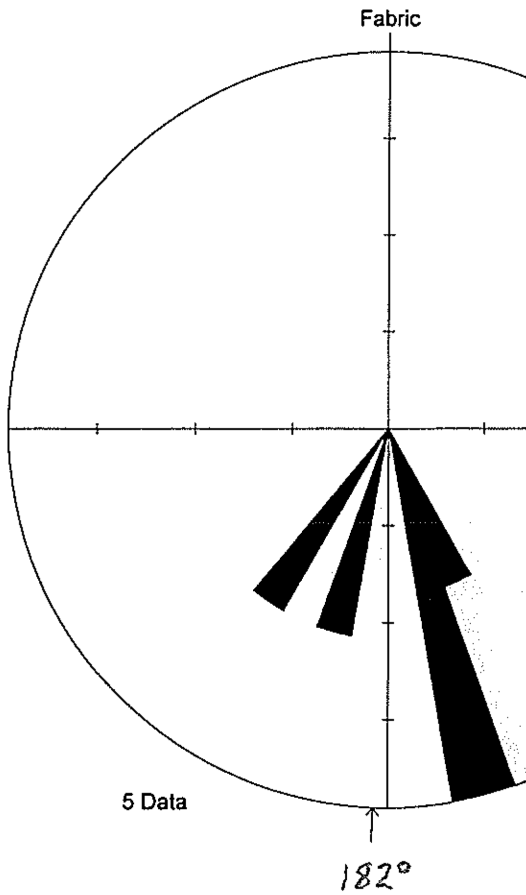
RG040C
7



Data description RG040C

length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 10% [length: 3.00]
Maximum = 63.3% [length: 19]
Total length = 30
Mean Resultant dir'n = 145
[Approx. 95% Confidence interval = ±10.
(valid only for unimodal data)

RG041A (rvsd)
5



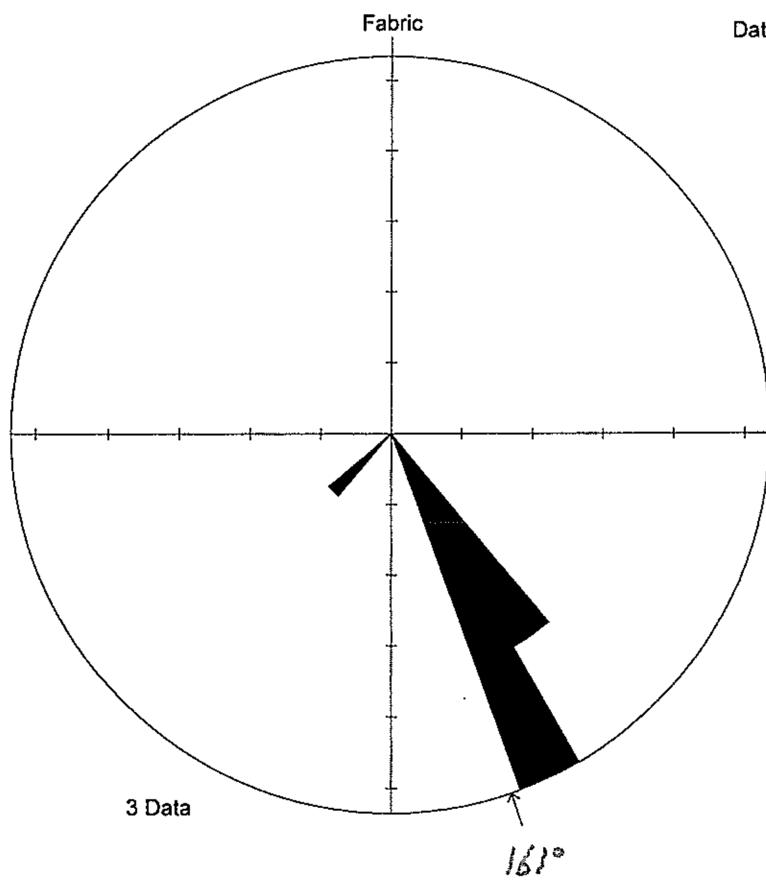
Data description RG041A

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 2.30]
Maximum = 39.1% [length: 9]
Total length = 23
Mean Resultant dir'n = 182

RG041B

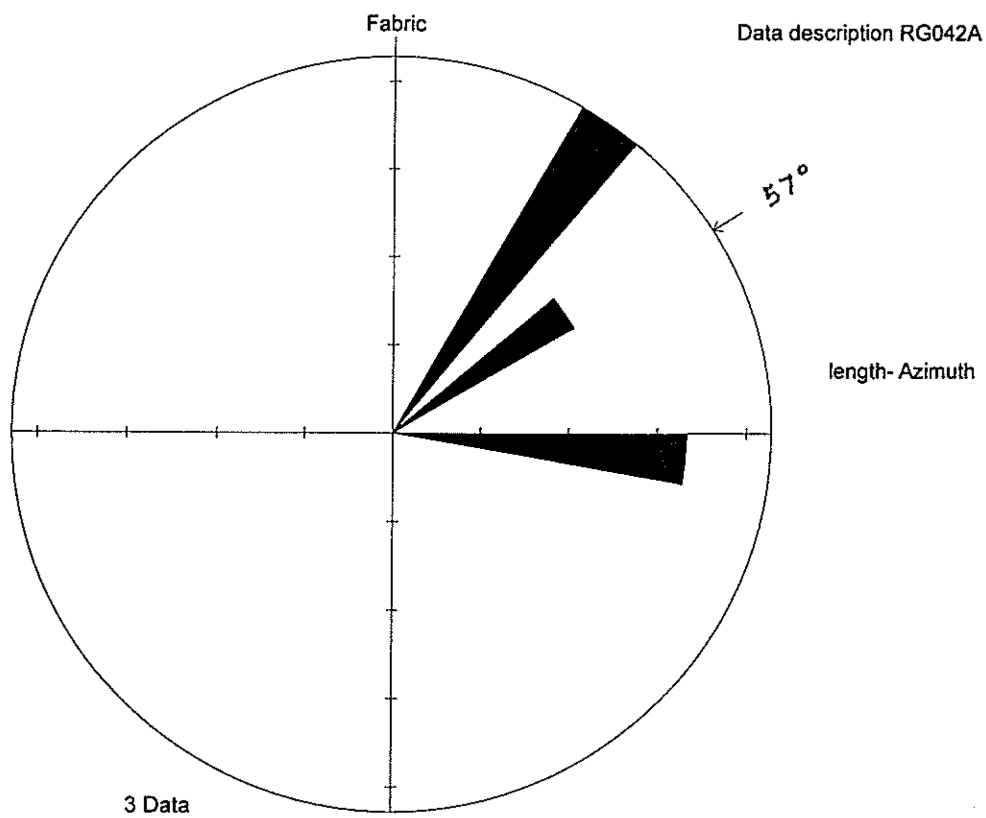
3

Data description RG041B



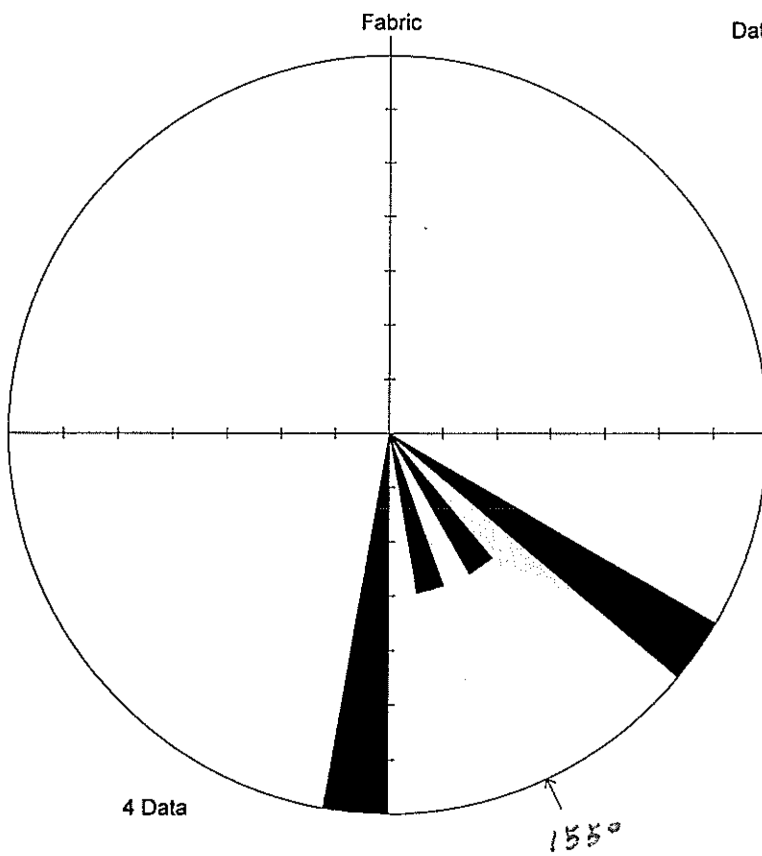
length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 4.30
Maximum = 53.5% [length: 23]
Total length = 43
Mean Resultant dir'n = 161
[Approx. 95% Confidence interval = ±2
(valid only for unimodal data)

RG042A
3



RG042B

4

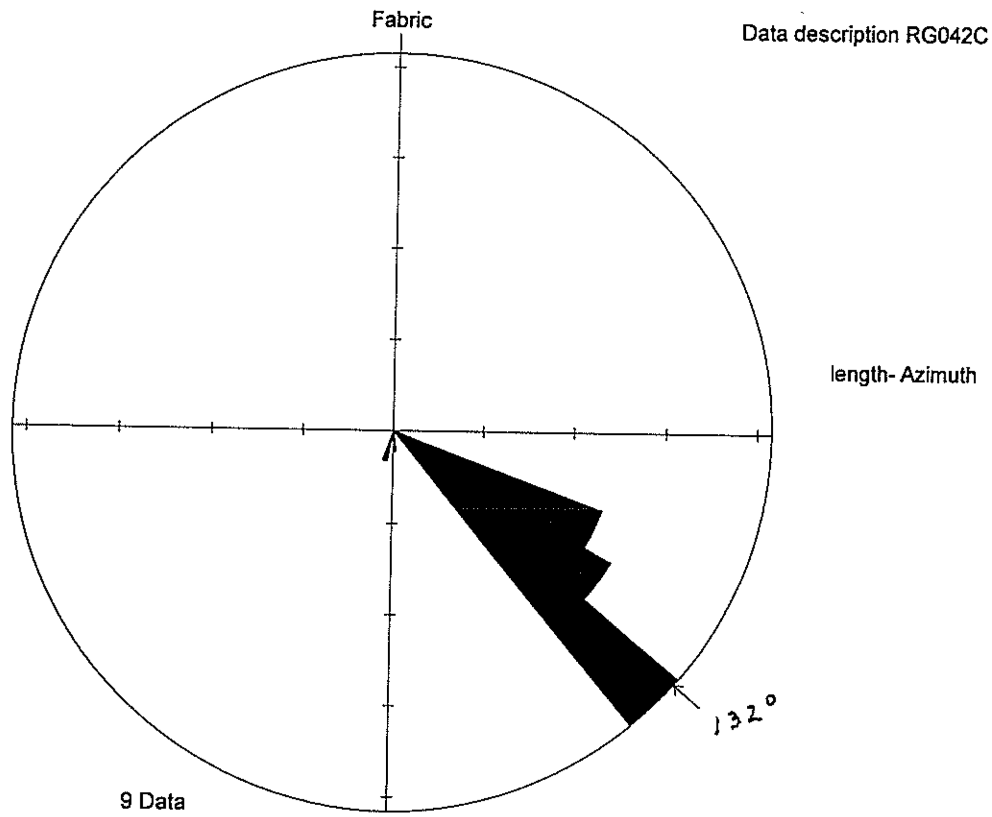


Data description RG042B

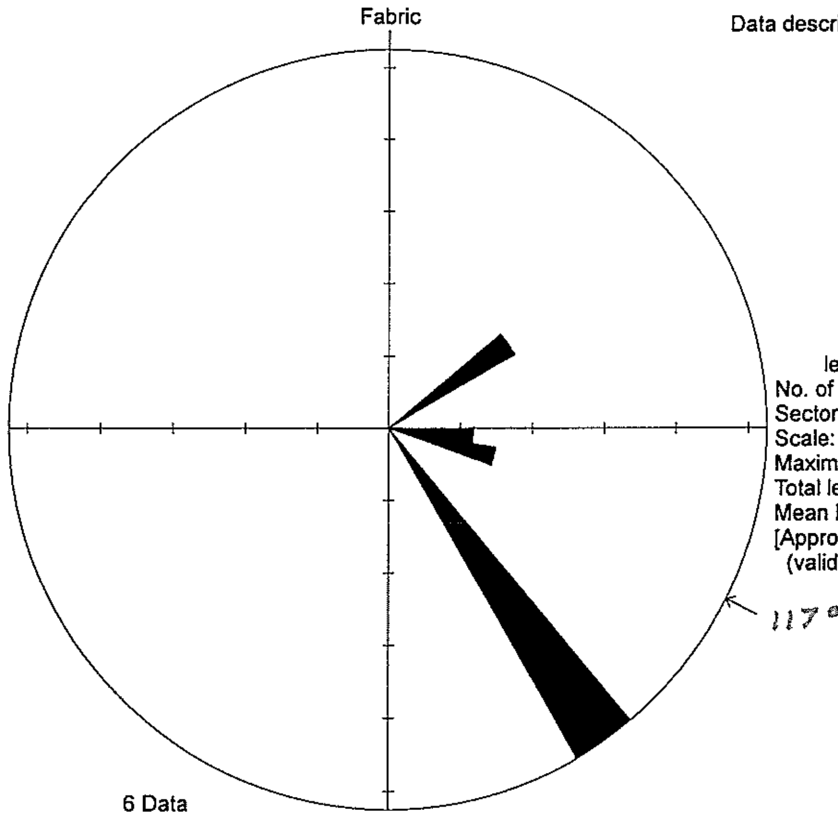
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 1.00]
Maximum = 35% [length: 7]
Total length = 20
Mean Resultant dir'n = 155

RG042C

9



RG043A
6

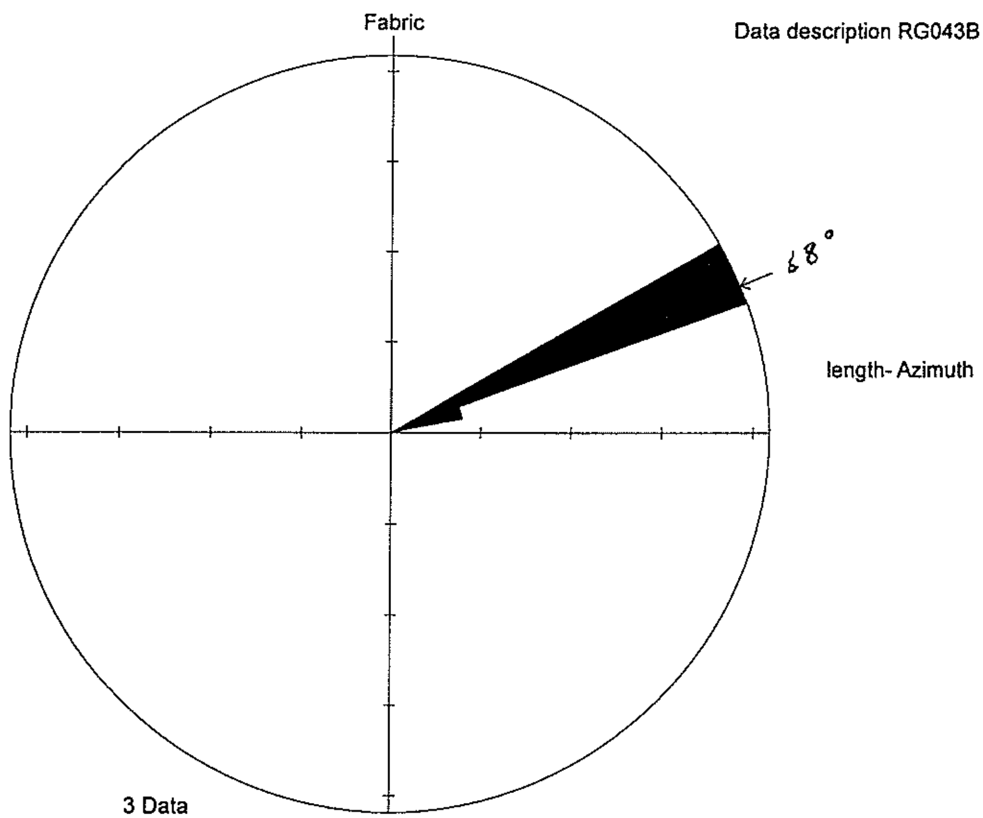


Data description RG043A

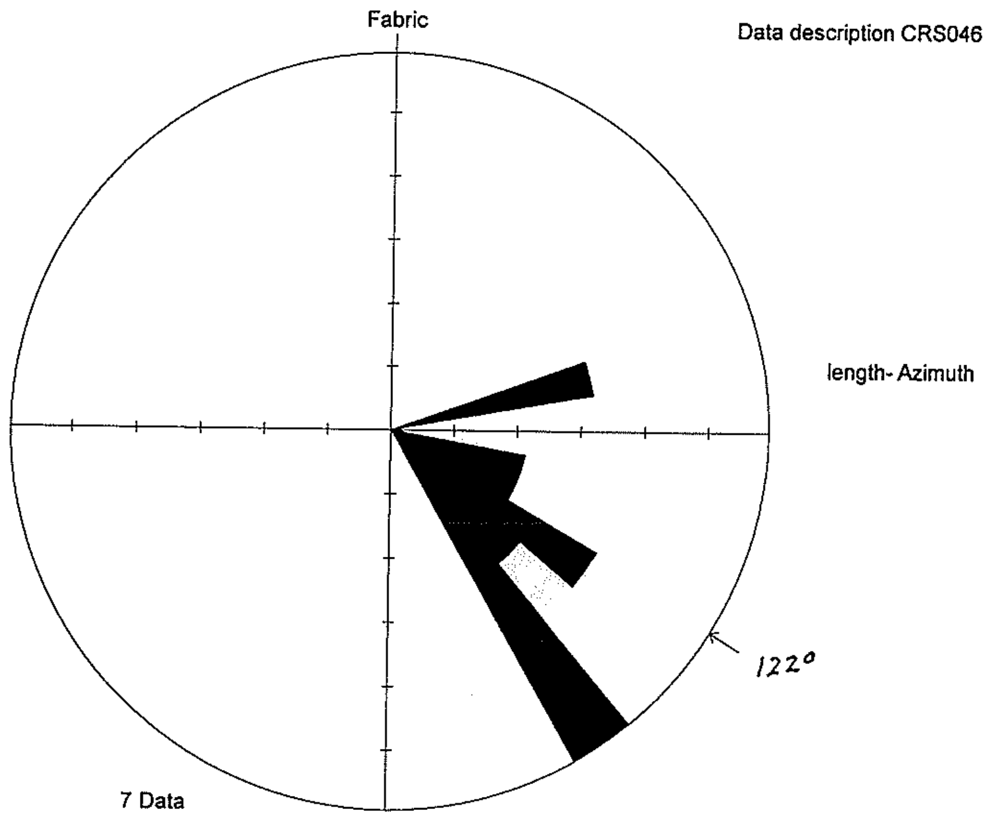
length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 10% [length: 5.9(
Maximum = 52.5% [length: 31]
Total length = 59
Mean Resultant dir'n = 117
[Approx. 95% Confidence interval = ±3
(valid only for unimodal data)

RG043B

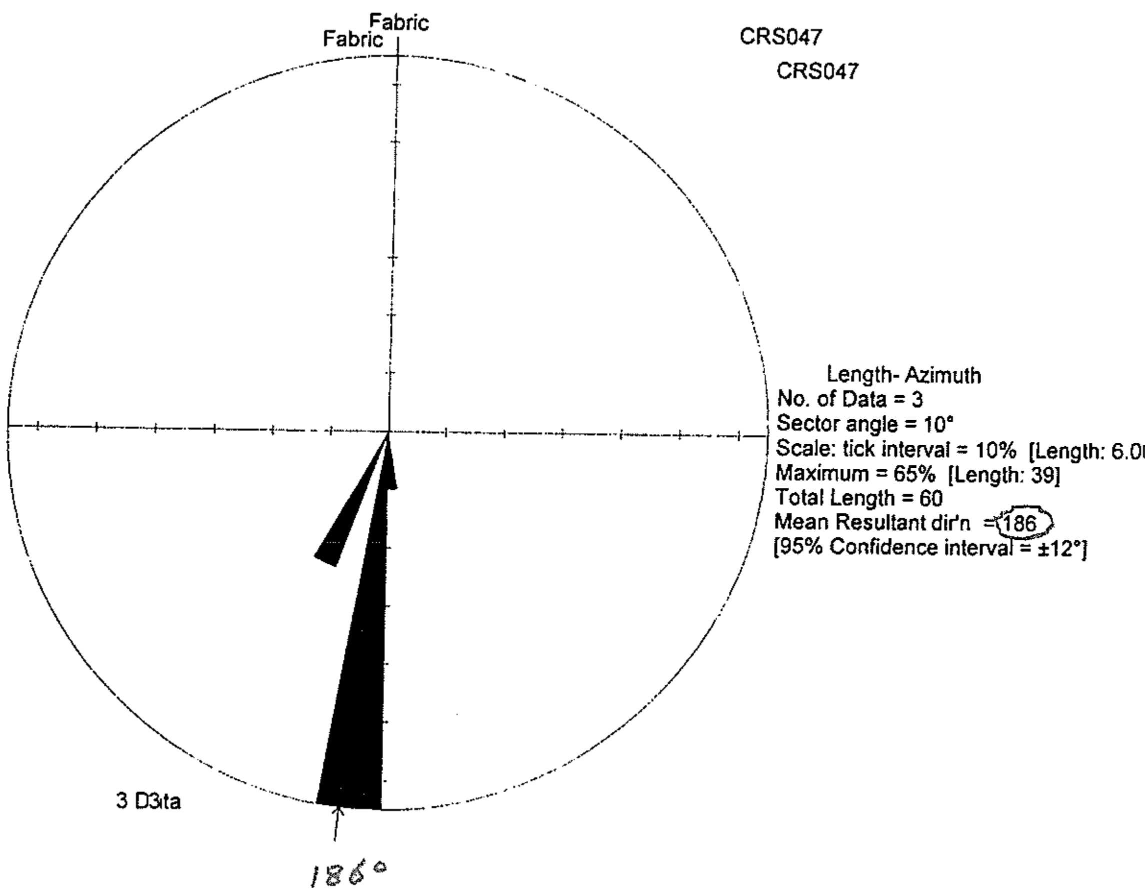
3



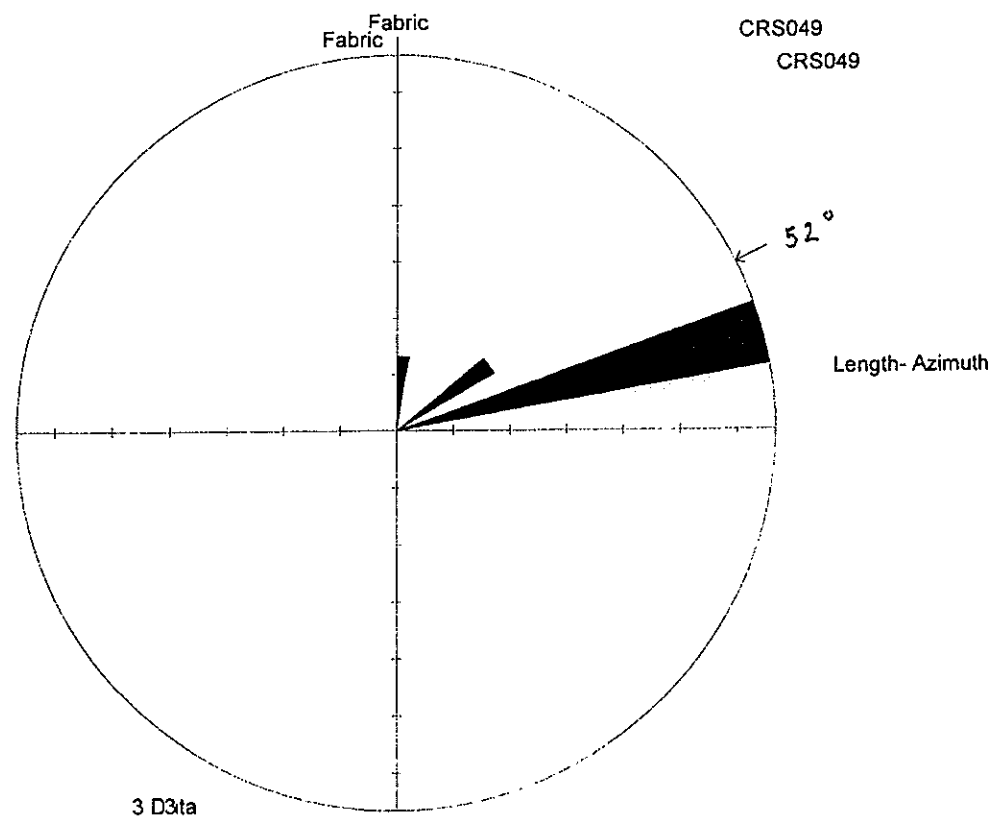
CRS046 (rvsd)
7



CRS047
3


Fabric
Fabric
CRS047
CRS047
Length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [Length: 6.0
Maximum = 65% [Length: 39]
Total Length = 60
Mean Resultant dir'n = 186
[95% Confidence interval = ±12°]
3 D3ta
186°

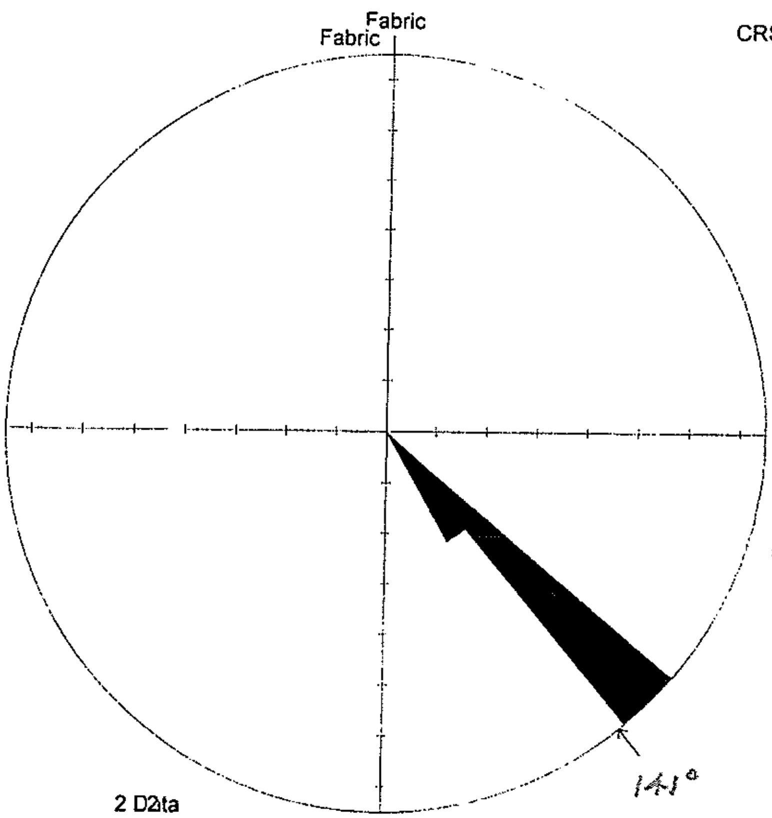
CRS049
3



CRS050
2

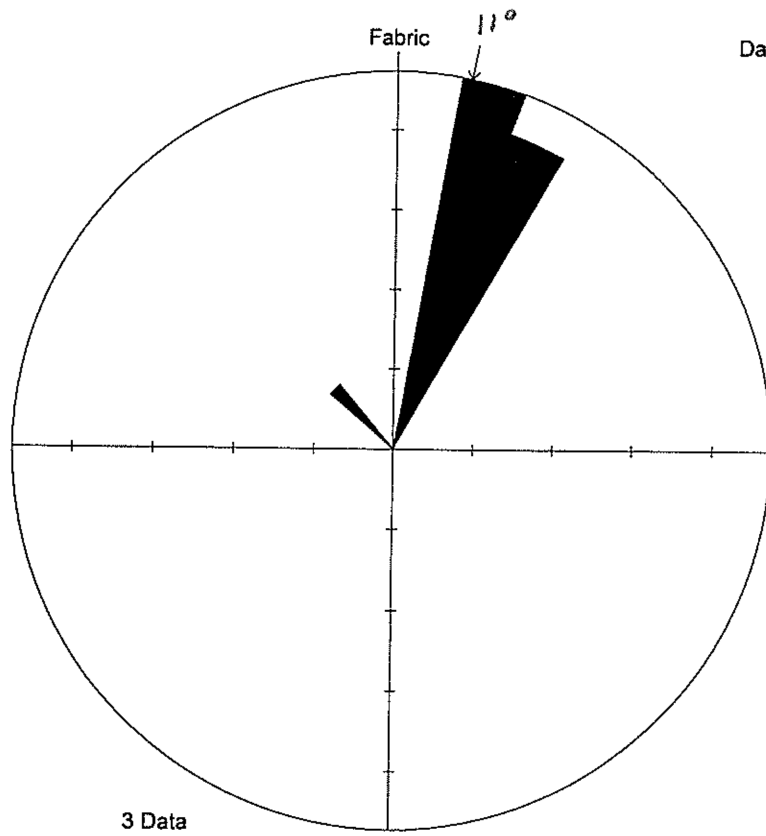
CRS050

CRS050



Length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [Length: 2.4(
Maximum = 75% [Length: 18]
Total Length = 24
Mean Resultant dir'n = 141
[95% Confidence interval = ±5°]

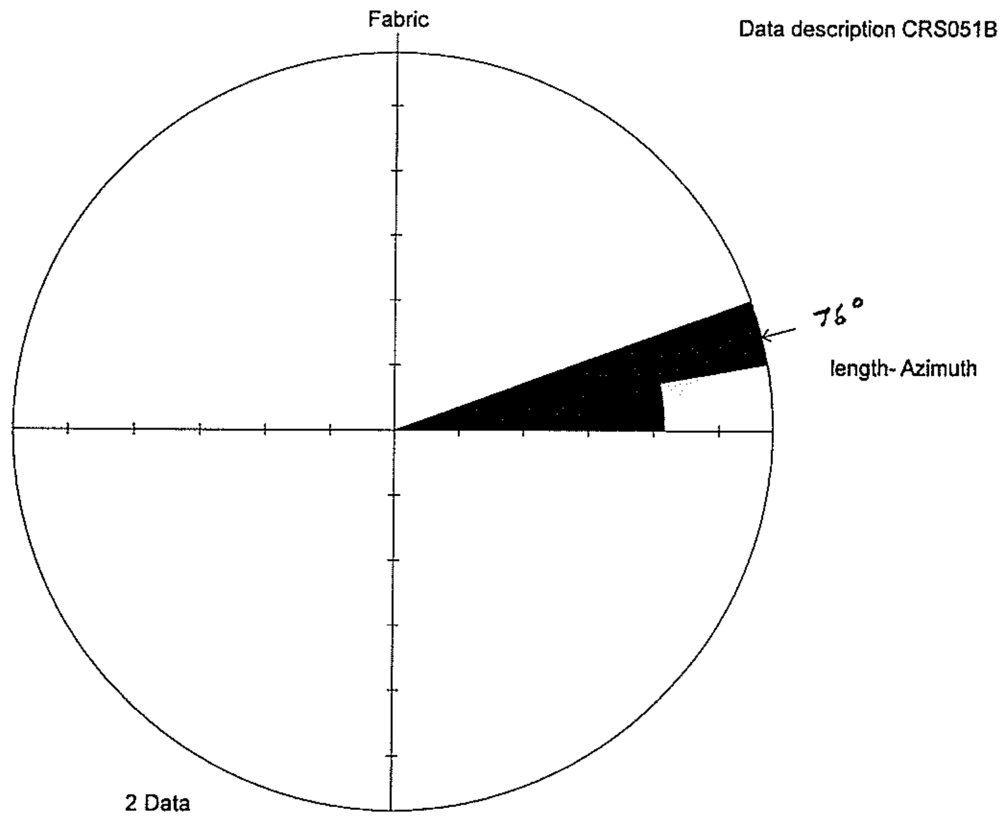
CRS051A
3



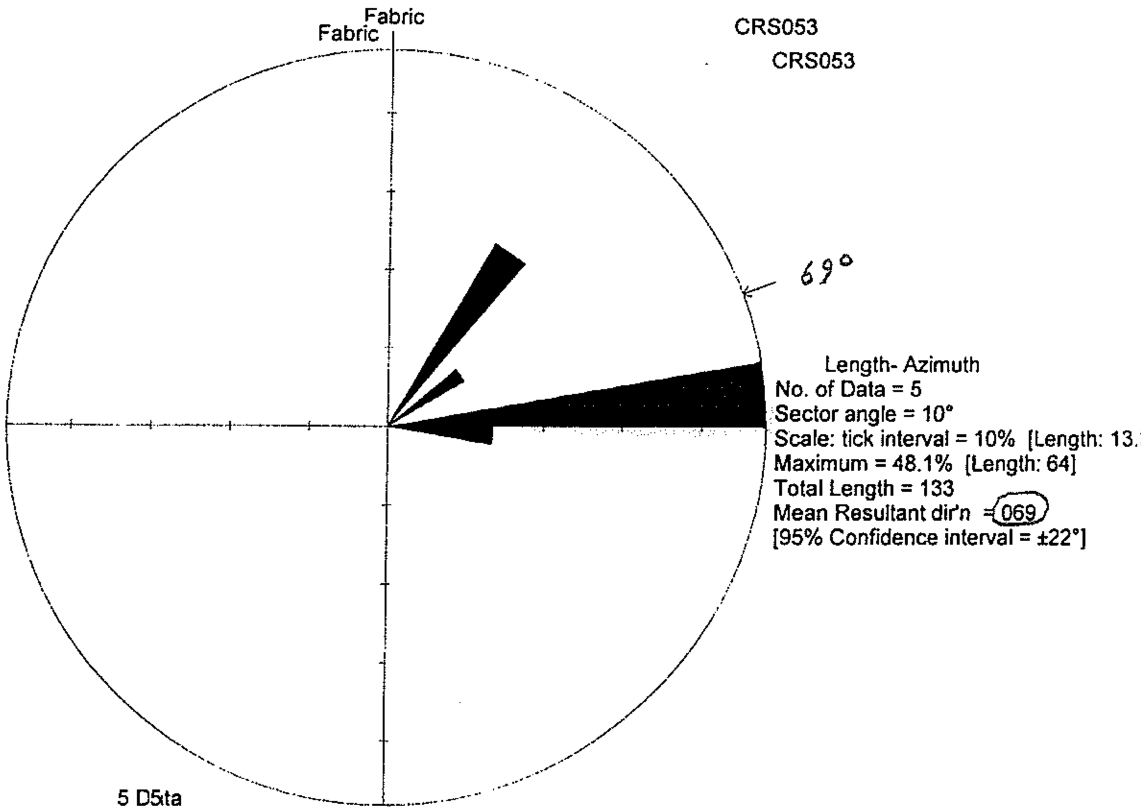
Data description CRS051A

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.90
Maximum = 47.4% [length: 9]
Total length = 19
Mean Resultant dir'n = 011

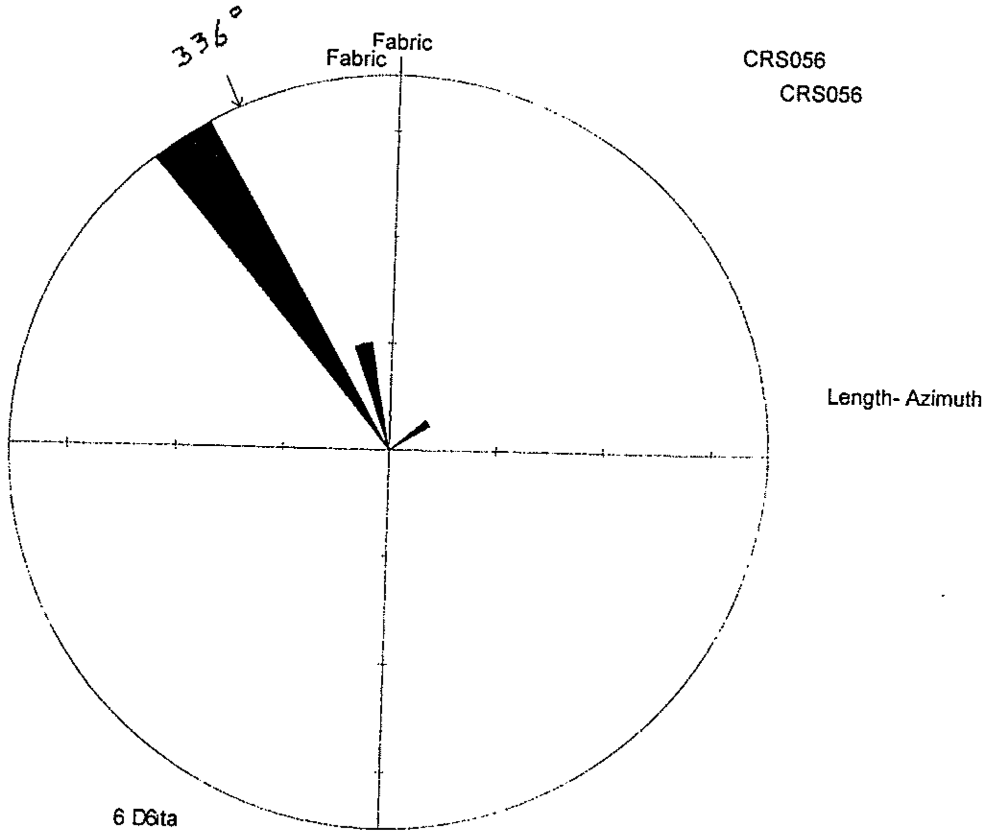
CRS051B
2



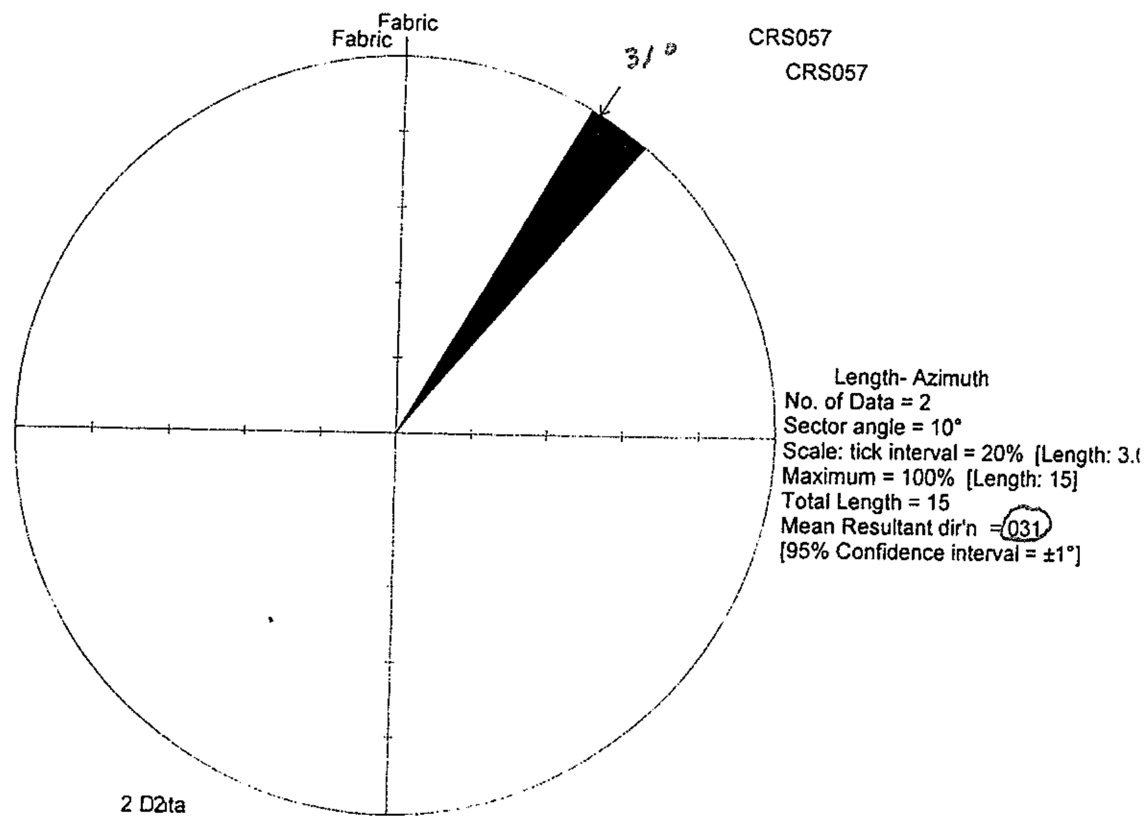
CRS053
5


Fabric
Fabric
CRS053
CRS053
69°
Length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [Length: 13.
Maximum = 48.1% [Length: 64]
Total Length = 133
Mean Resultant dir'n = 069
[95% Confidence interval = ±22°]
5 D5ta

CRS056
6

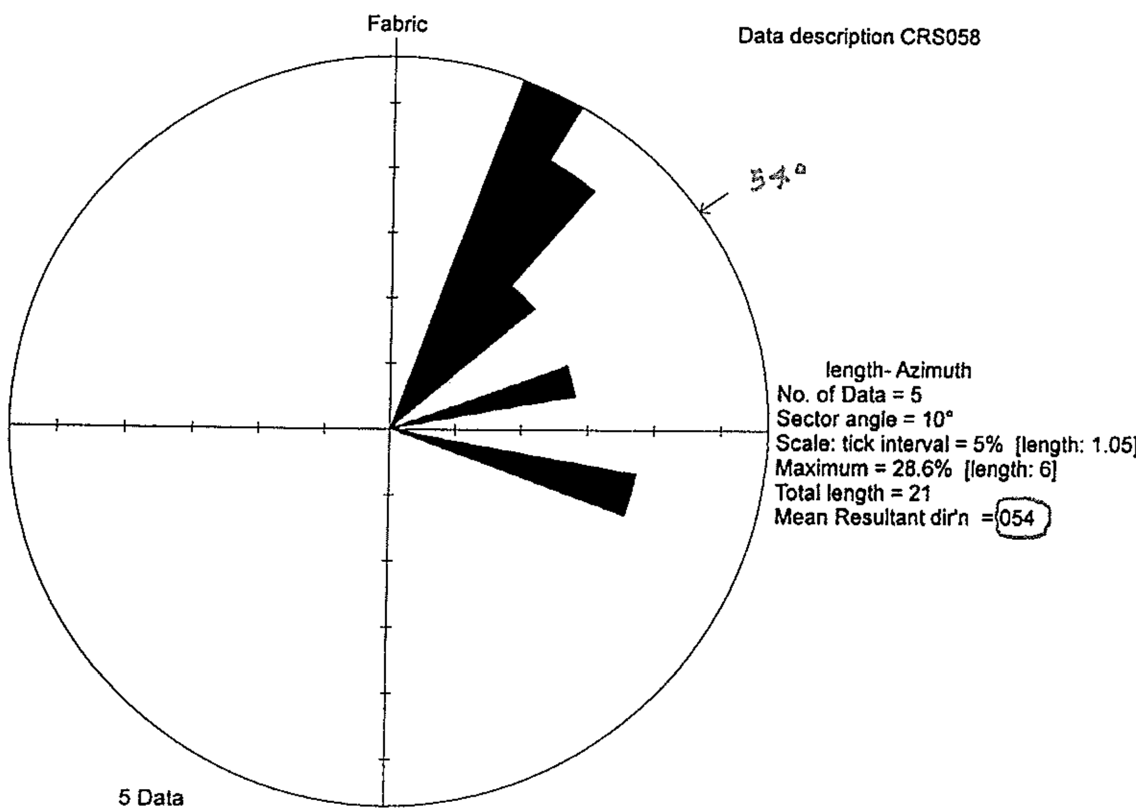


CRS057
2


Fabric
Fabric
31°
CRS057
CRS057
Length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 20% [Length: 3.
Maximum = 100% [Length: 15]
Total Length = 15
Mean Resultant dir'n = 031
[95% Confidence interval = ±1°]
2 D2ta

CRS058

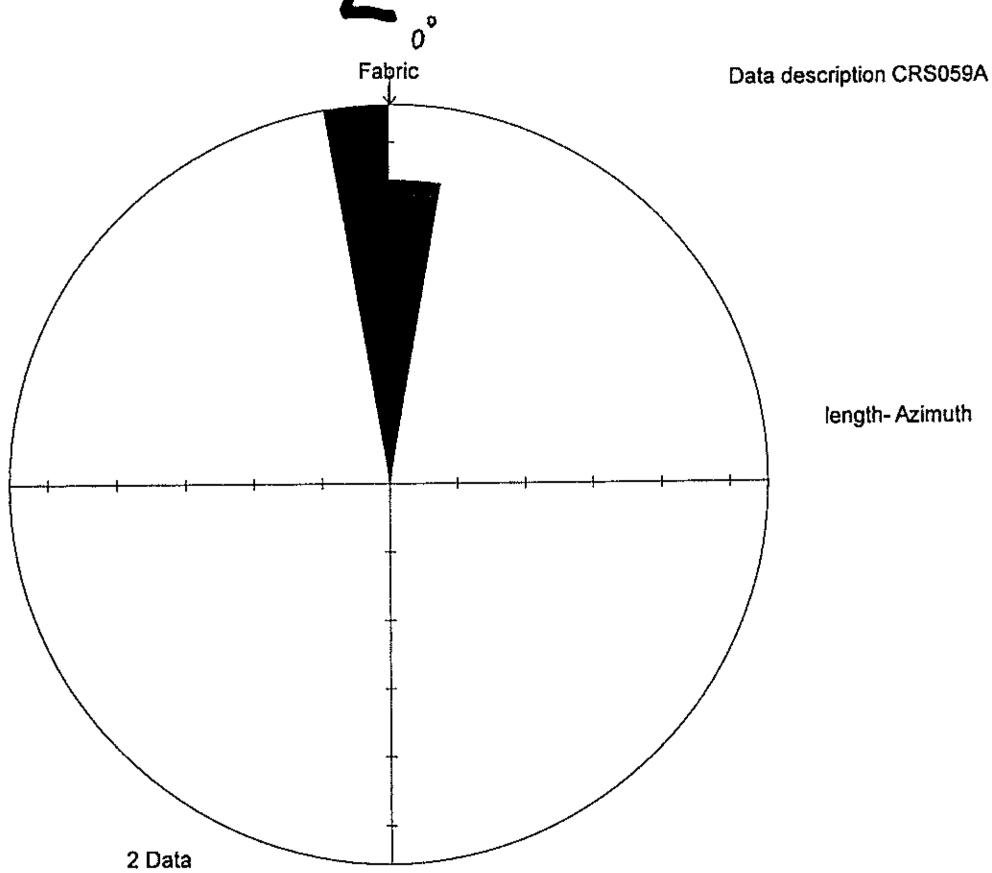
5



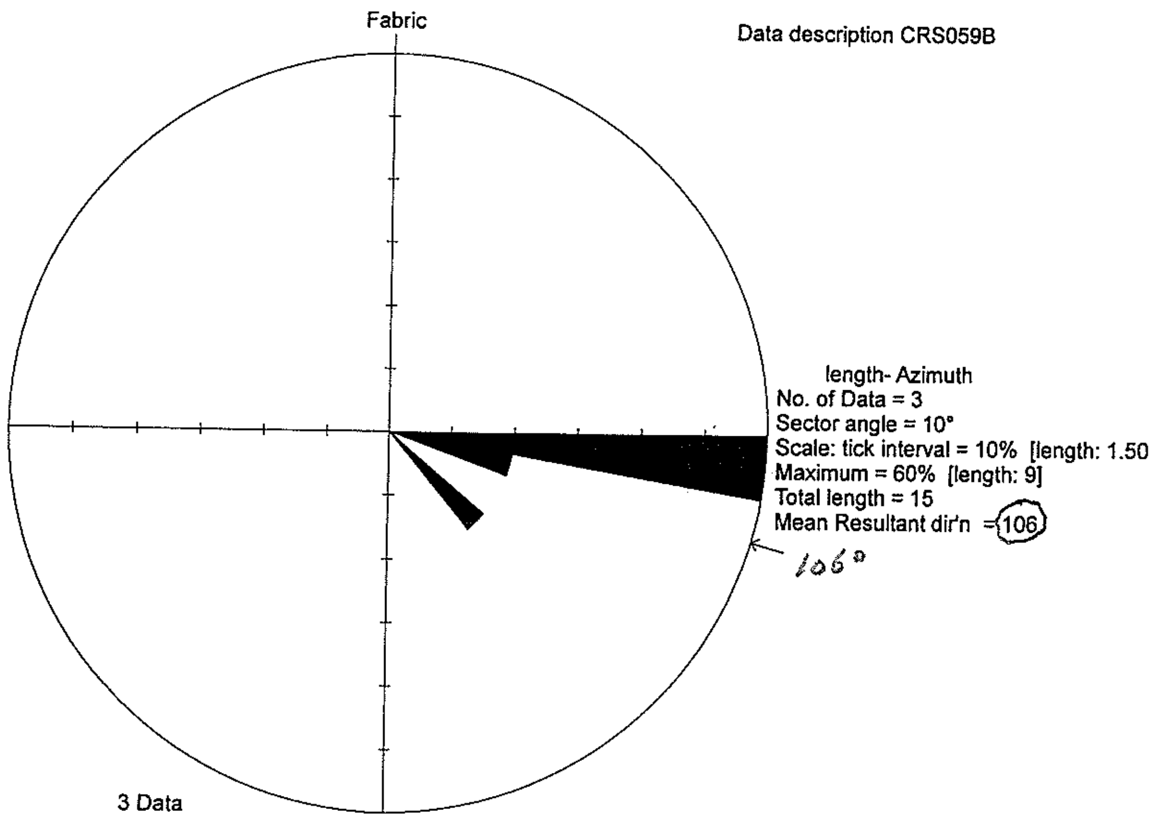
Fabric
Data description CRS058
54°
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 5% [length: 1.05]
Maximum = 28.6% [length: 6]
Total length = 21
Mean Resultant dir'n = 054
5 Data

CRS059A

2

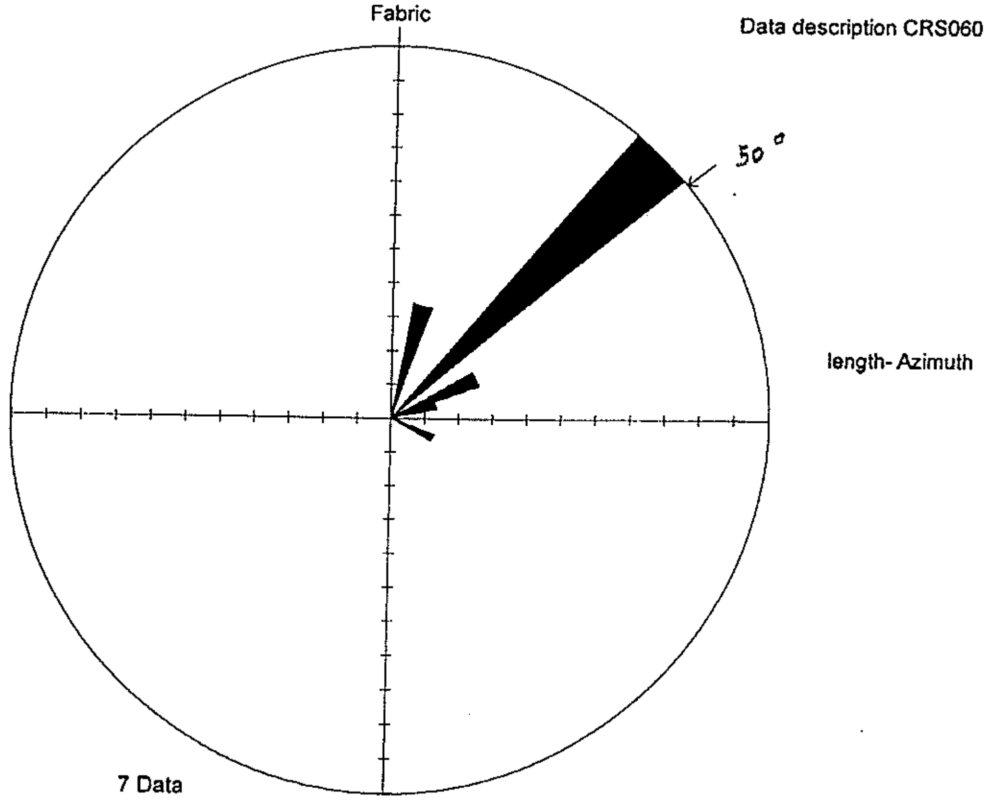


CRS059B
3

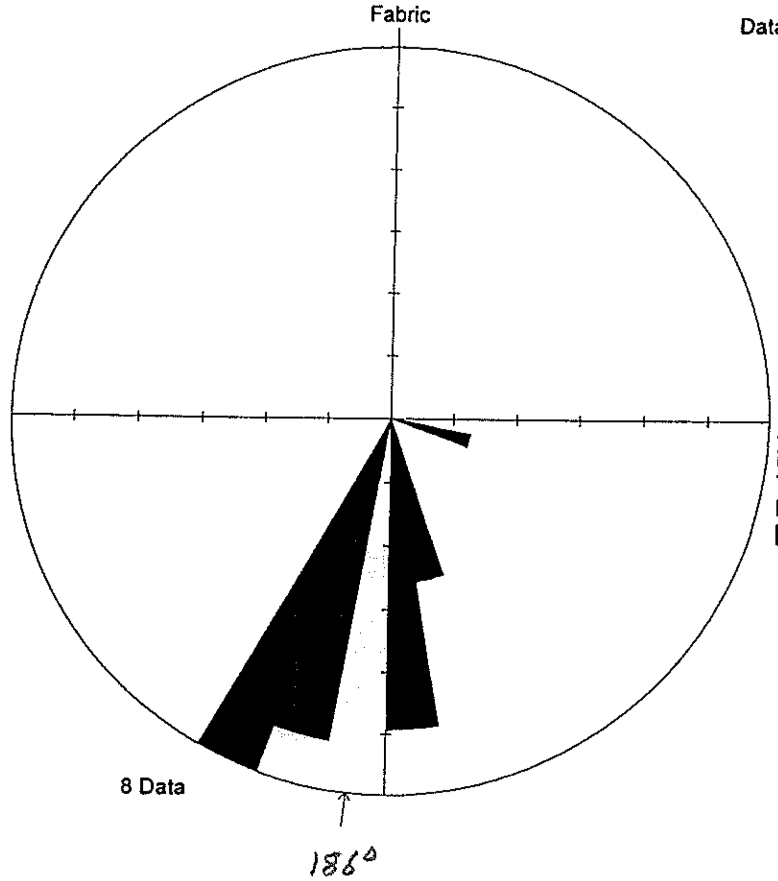


Fabric
Data description CRS059B
length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.50
Maximum = 60% [length: 9]
Total length = 15
Mean Resultant dir'n = 106
106°
3 Data

CRS060
7



CRS061
8

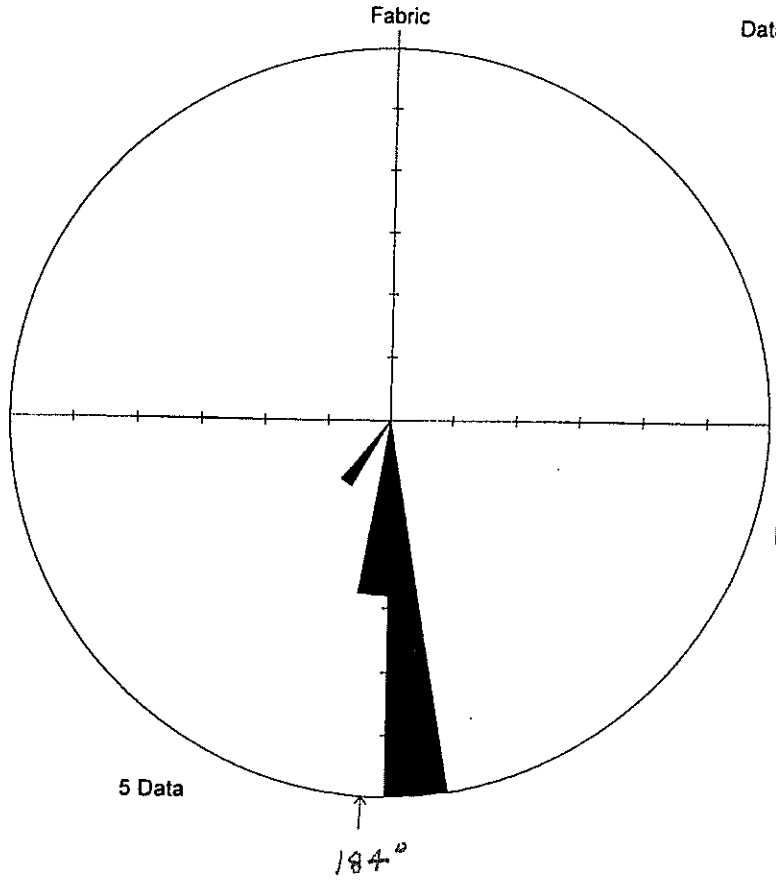


Data description CRS061

length- Azimuth
No. of Data = 8
Sector angle = 10°
Scale: tick interval = 5% [length: 3.85
Maximum = 29.9% [length: 23]
Total length = 77
Mean Resultant dir'n = 186
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

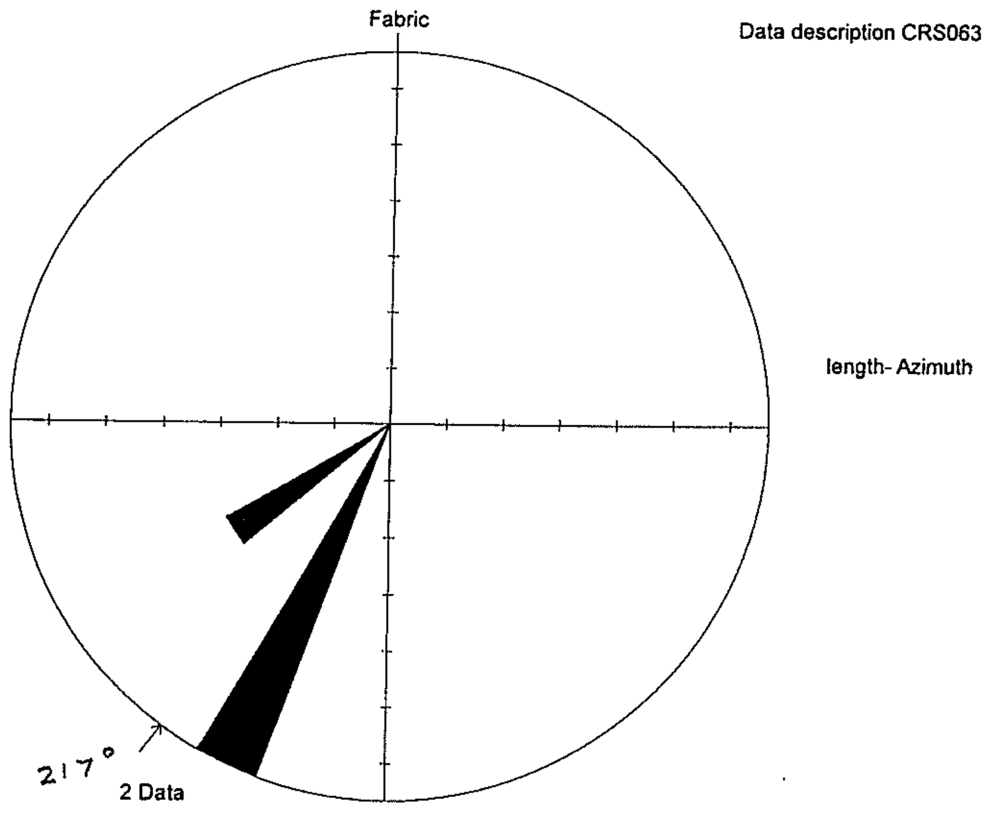
CRS062
5

Data description CRS062

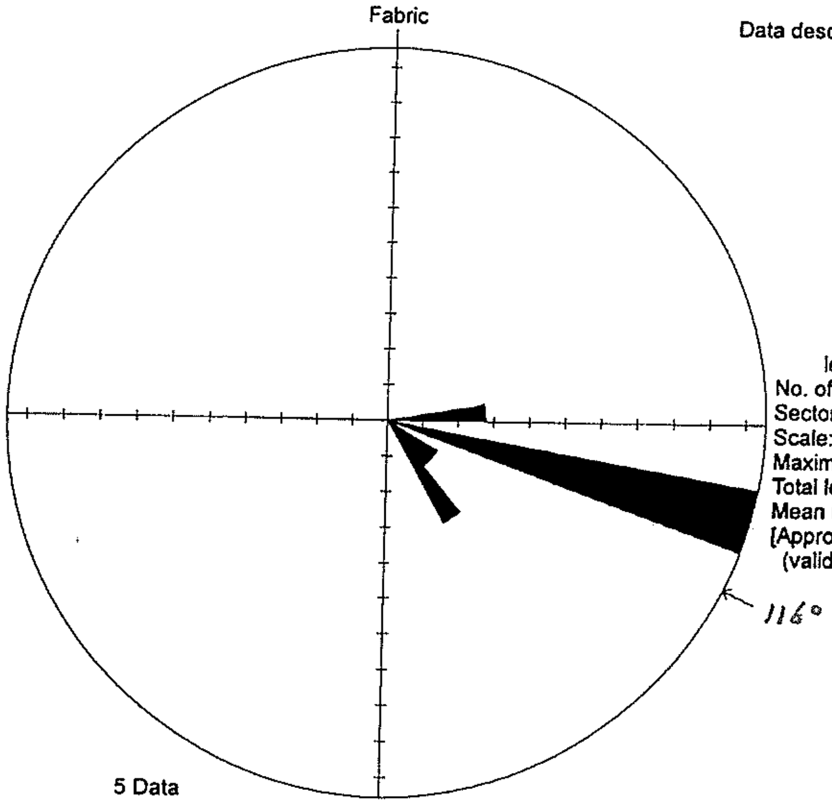


length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 8.2
Maximum = 59.8% [length: 49]
Total length = 82
Mean Resultant dir'n = 184
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

CRS063
2



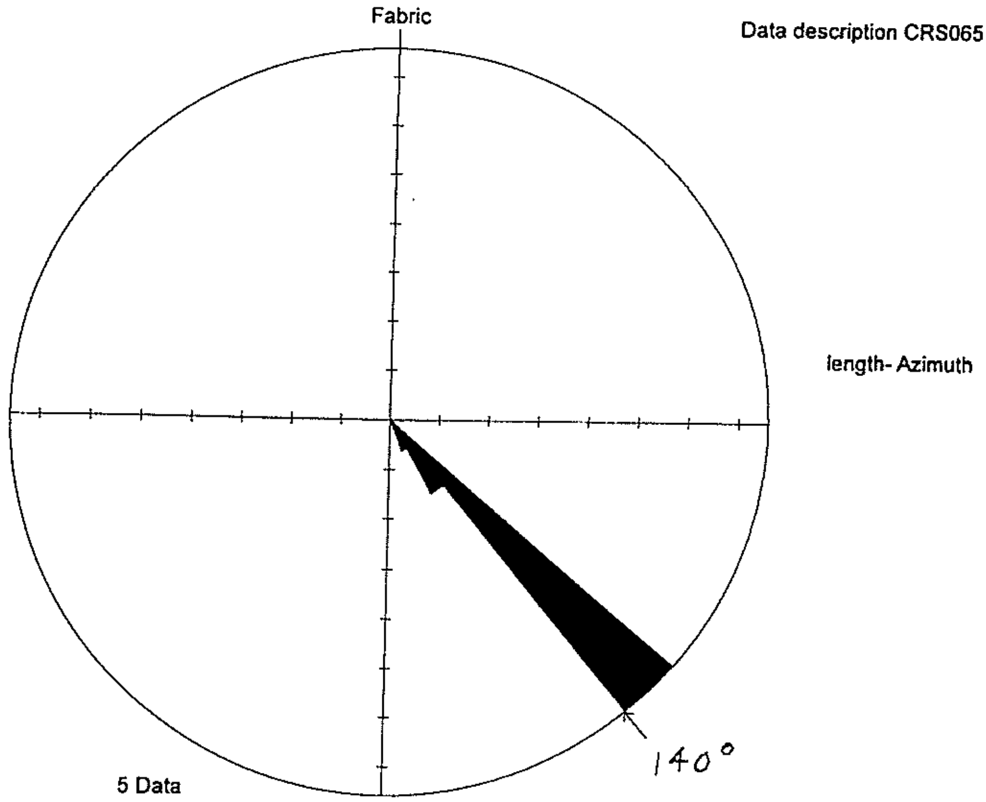
CRS064
5



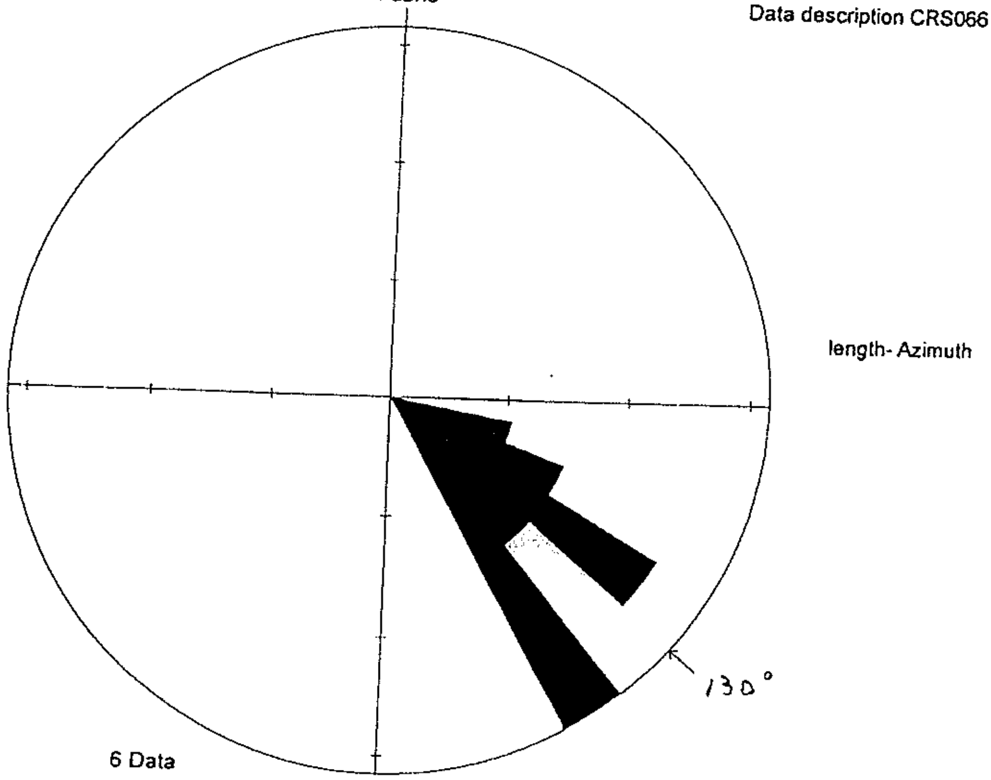
Data description CRS064

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 5% [length: 1.8(
Maximum = 52.8% [length: 19]
Total length = 36
Mean Resultant dir'n = 116
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

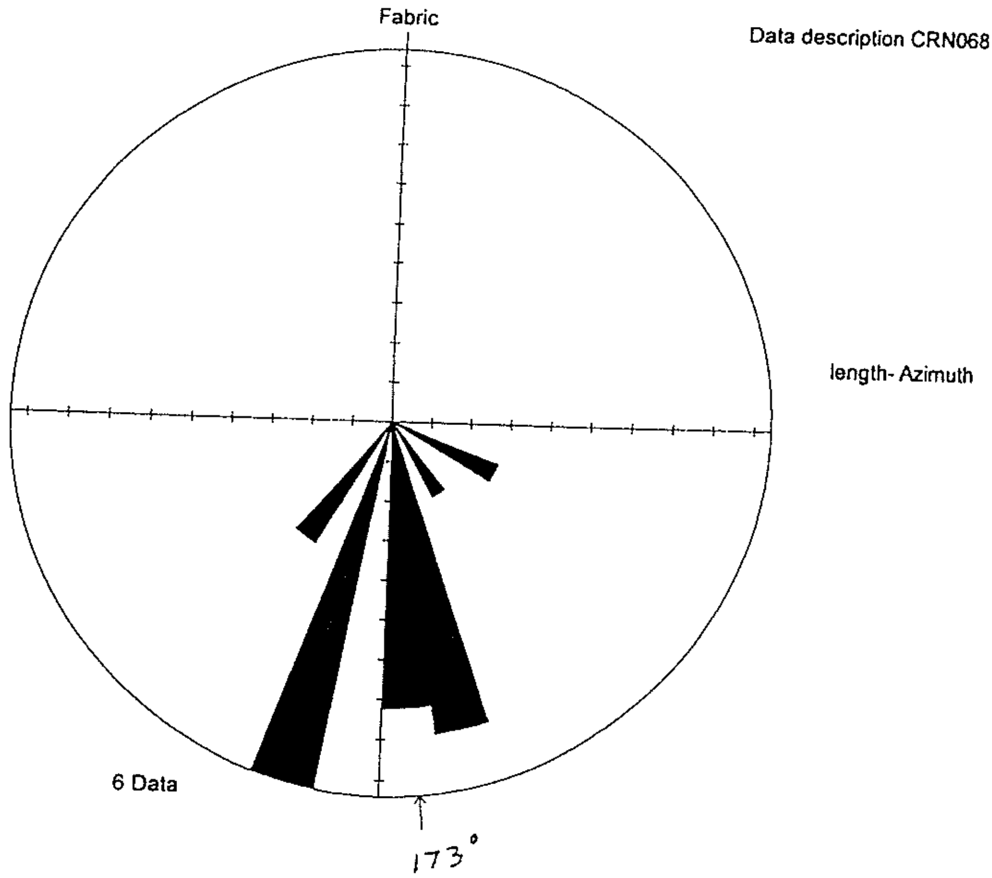
CRS065
5



CRS066
6

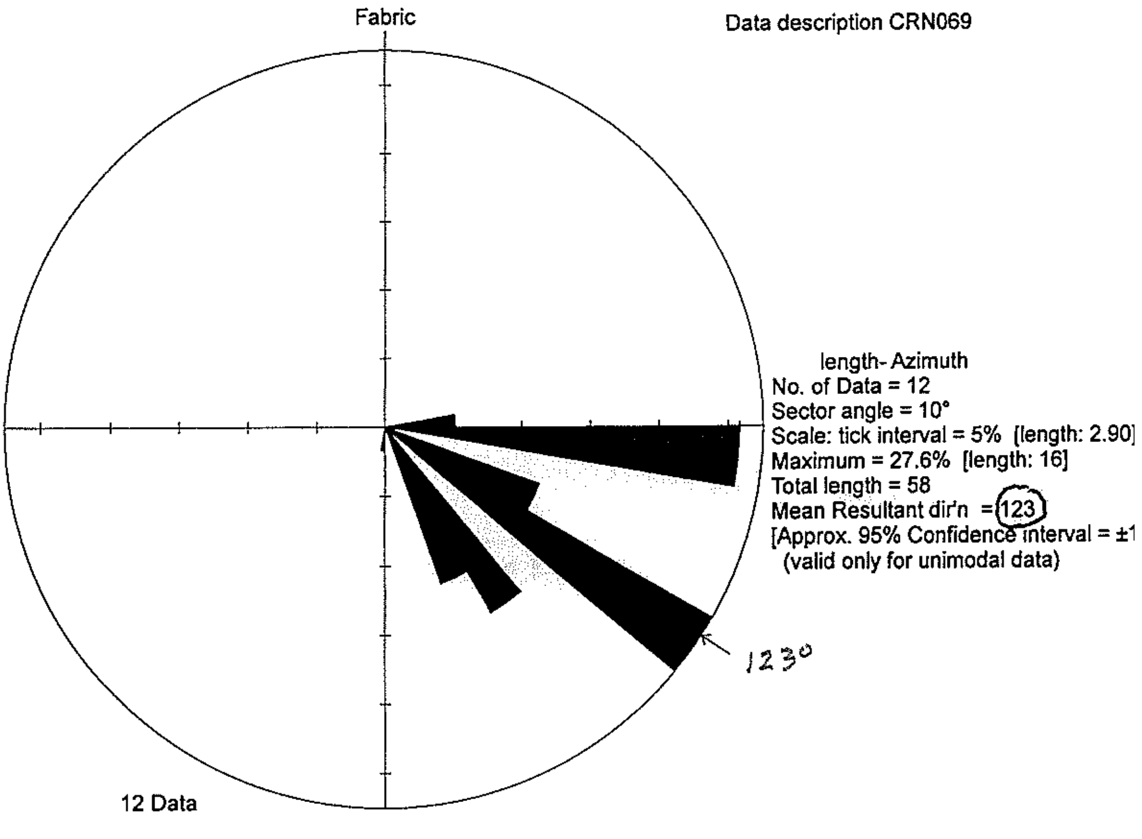


CRN068
6

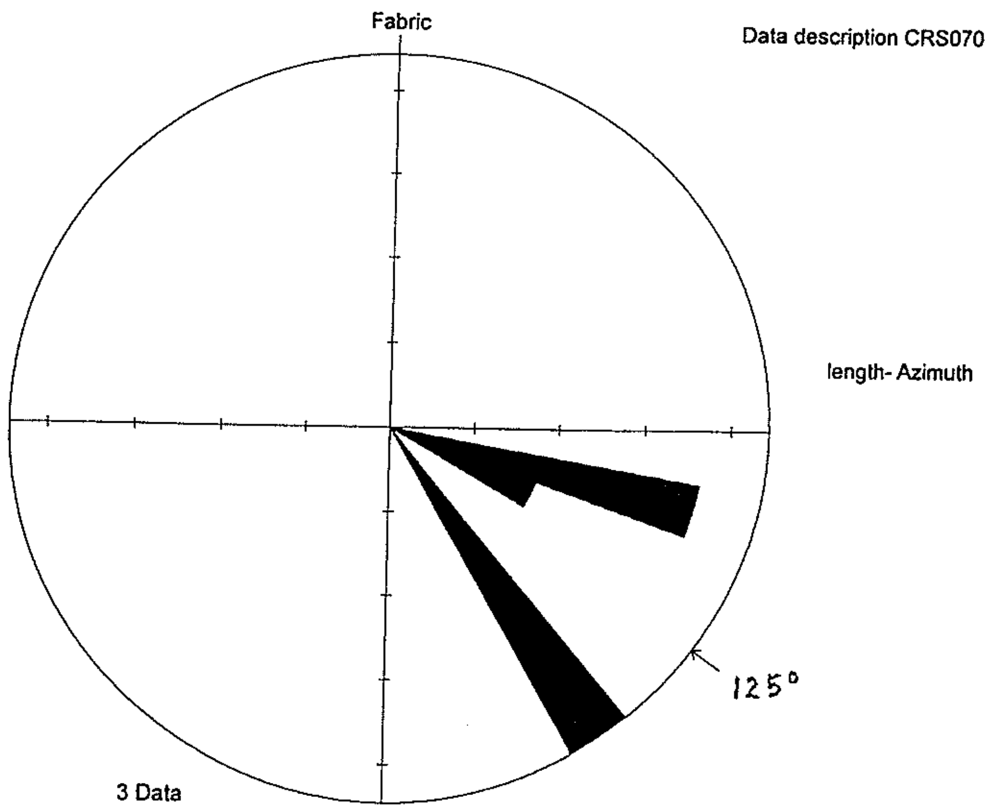


CRN069 (rvsd)

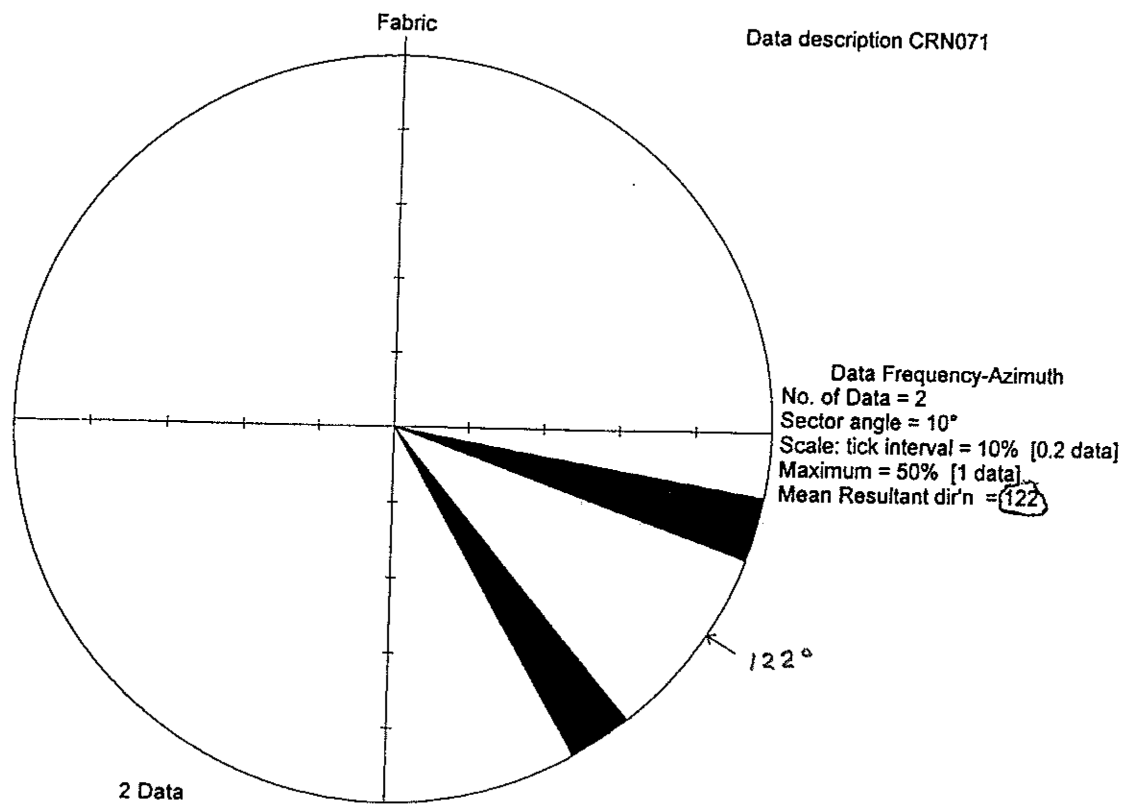
12



CRS070
3

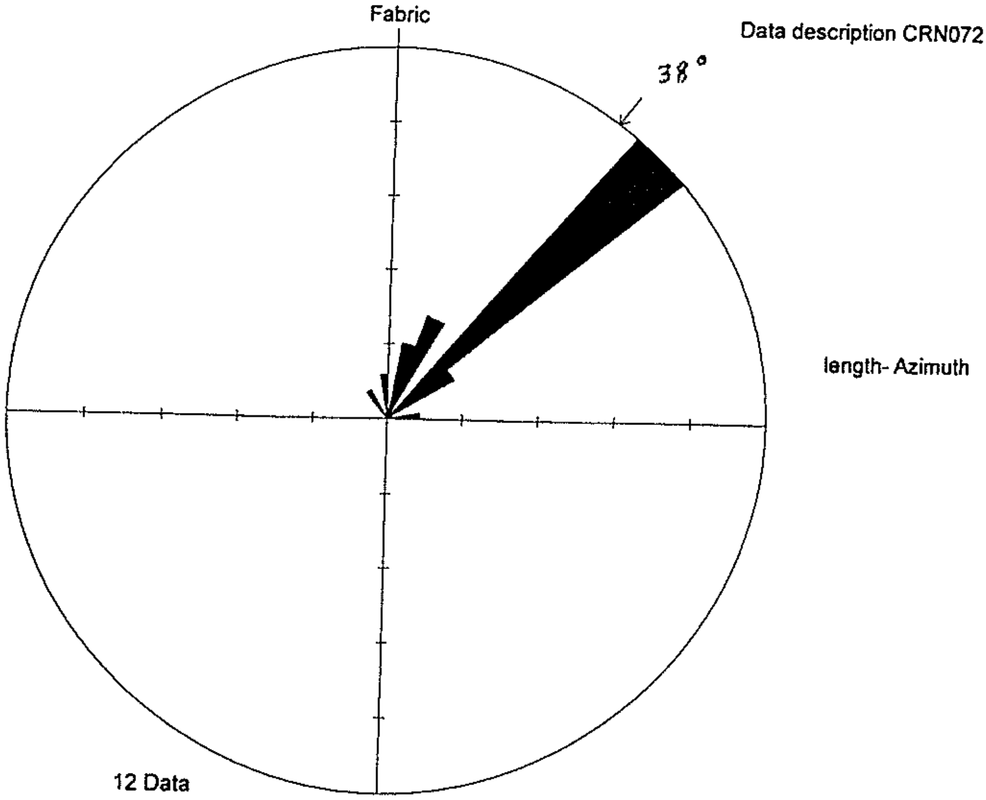


CRN071
2



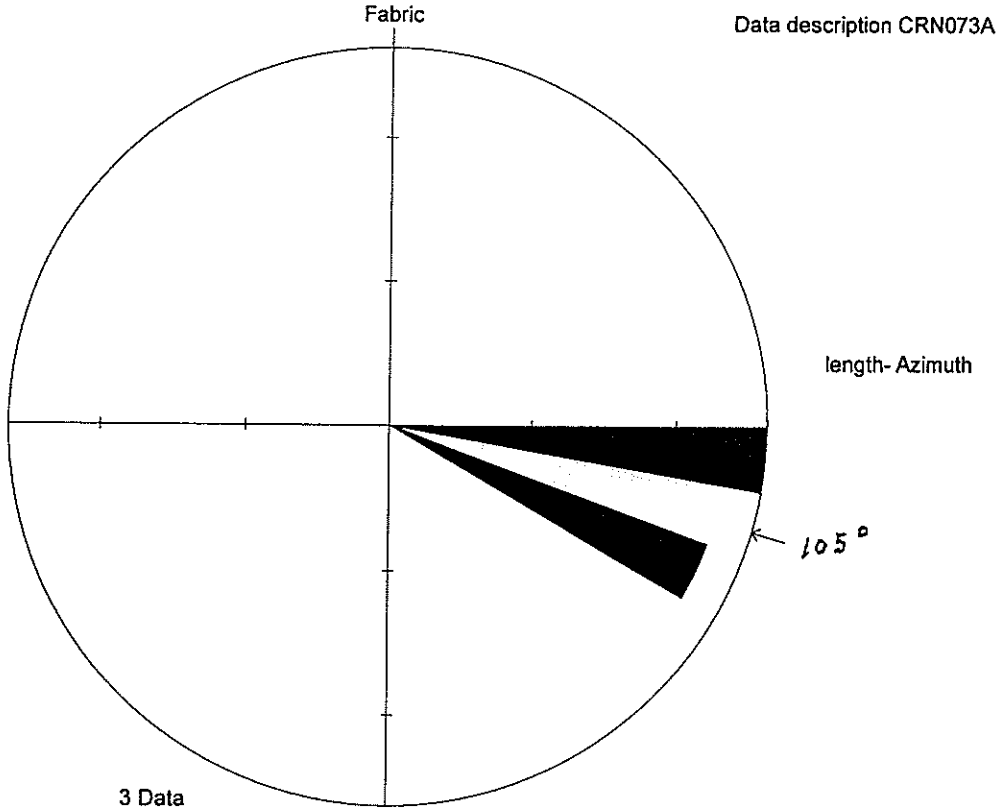
Fabric
Data description CRN071
Data Frequency-Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [0.2 data]
Maximum = 50% [1 data]
Mean Resultant dir'n = 122
122°
2 Data

CRN072
12



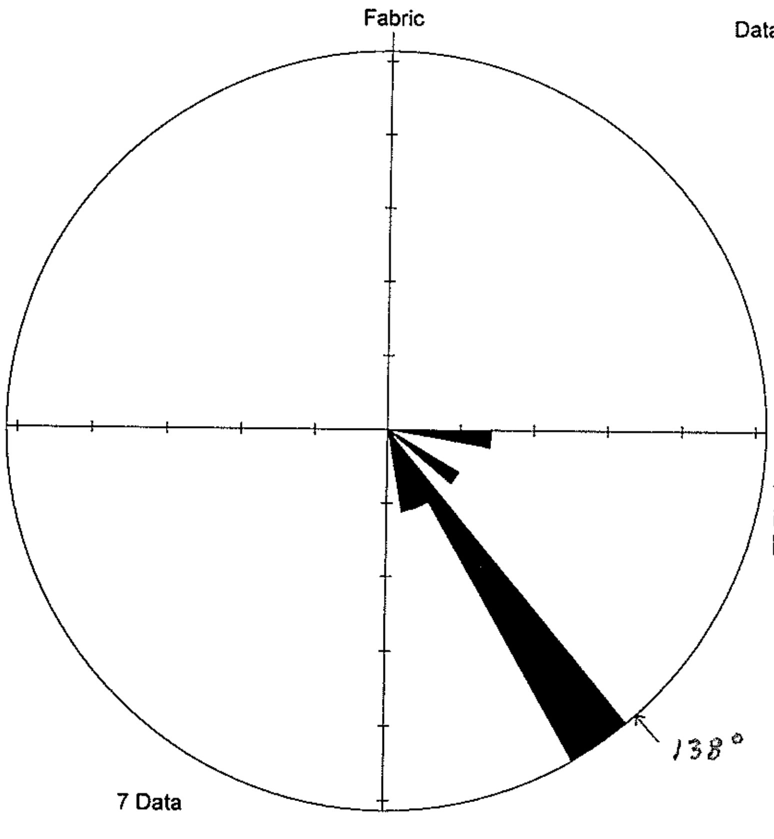
CRN073A

3



CRN073B

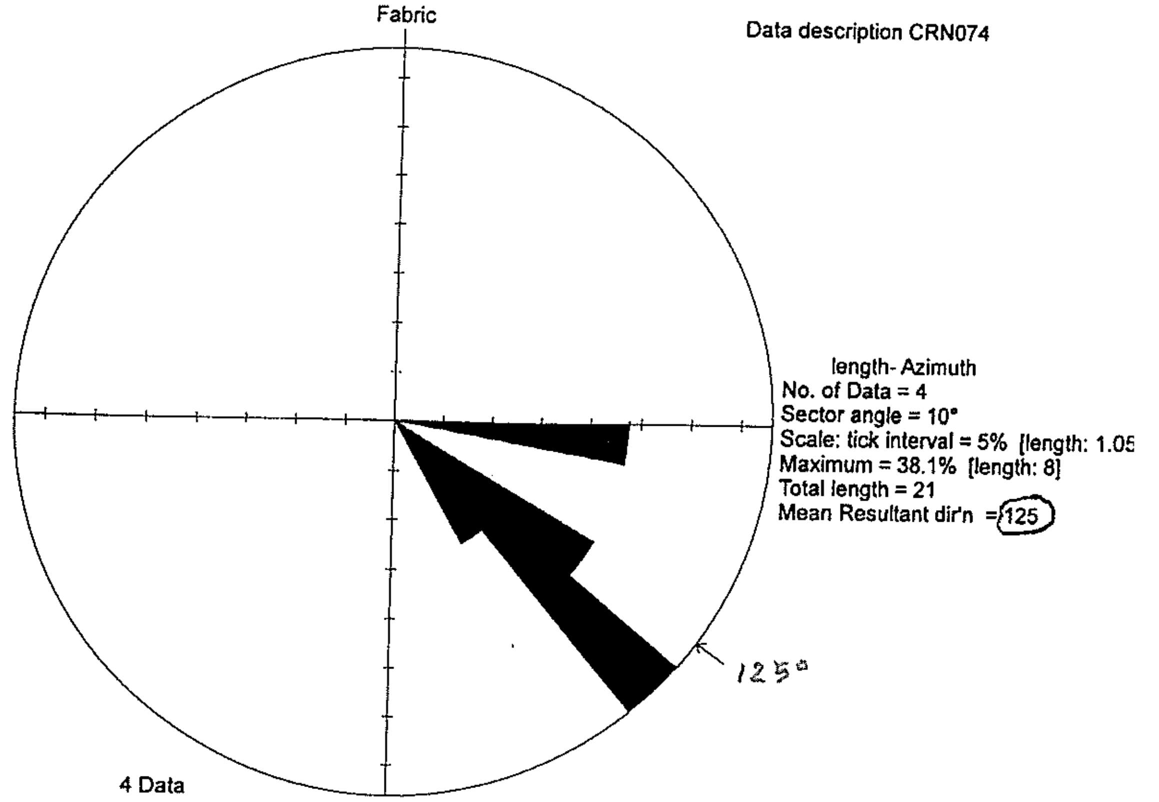
7



Data description CRN073B

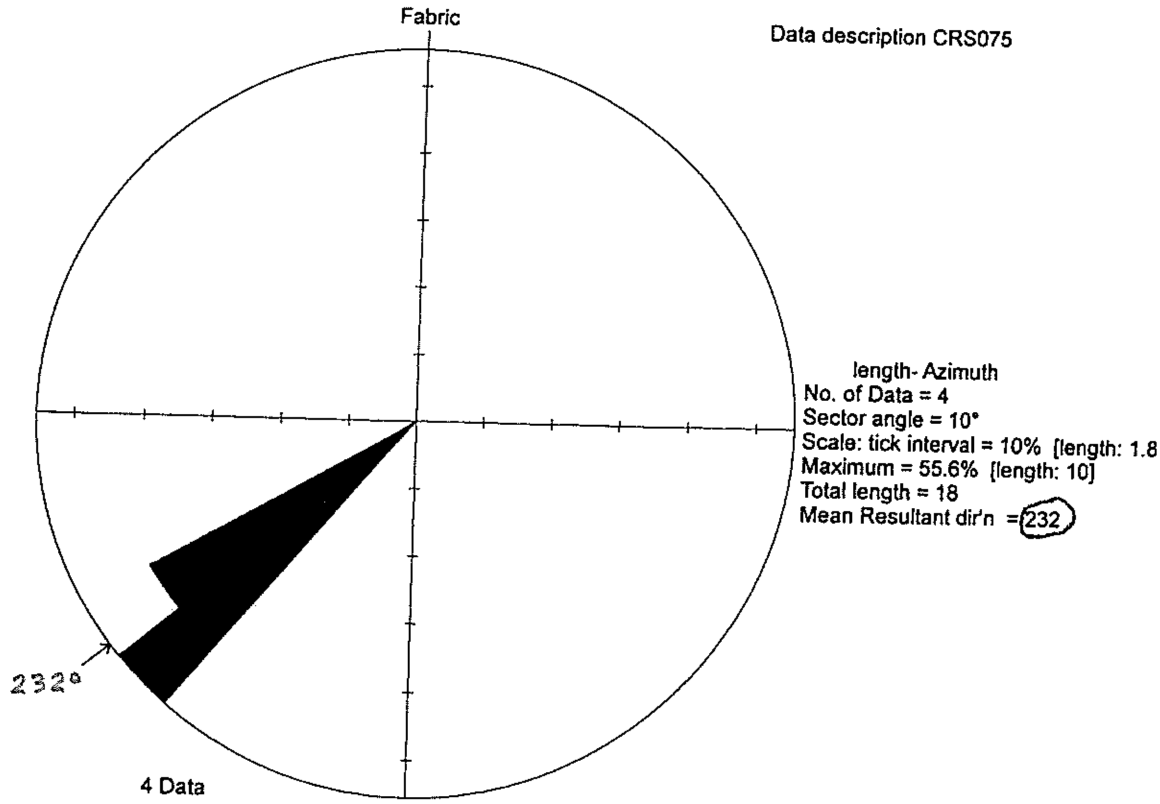
length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 10% [length: 3.5
Maximum = 51.4% [length: 18]
Total length = 35
Mean Resultant dir'n = 138
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

CRN074
4

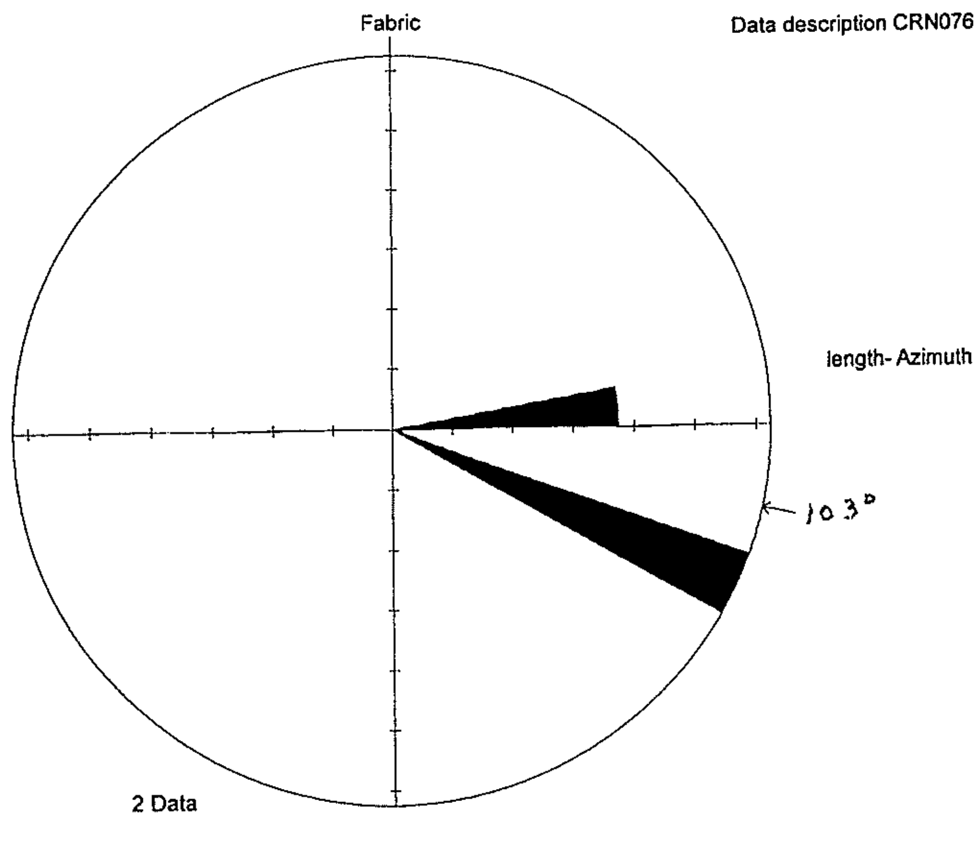


Fabric
Data description CRN074
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 1.05
Maximum = 38.1% [length: 8]
Total length = 21
Mean Resultant dir'n = 125
125°
4 Data

CRS075
4

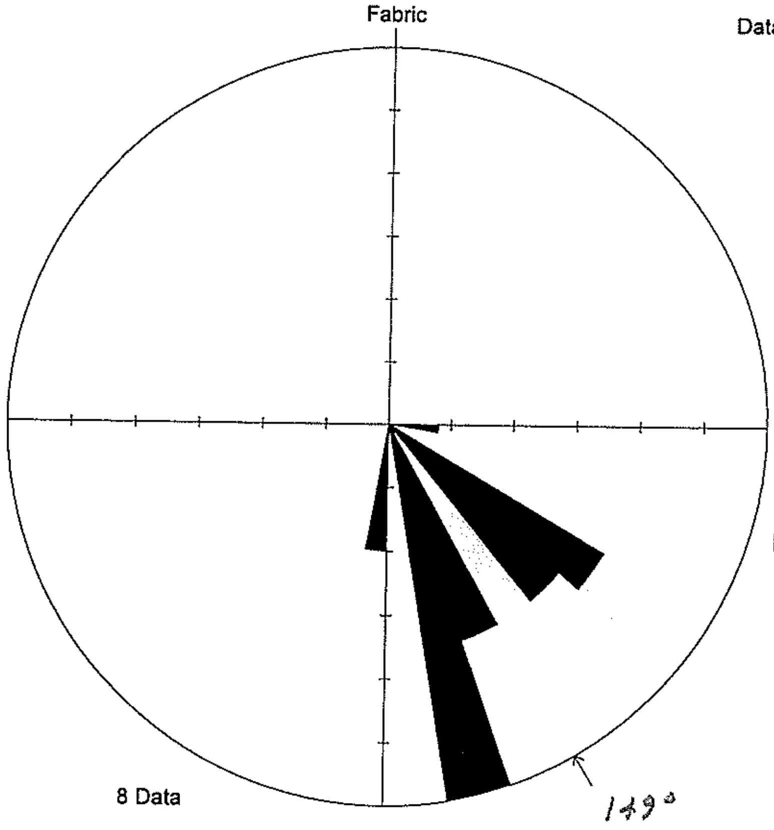

Fabric
Data description CRS075
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 1.8
Maximum = 55.6% [length: 10]
Total length = 18
Mean Resultant dir'n = 232
232°
4 Data

CRN076
2



CRS077A

8



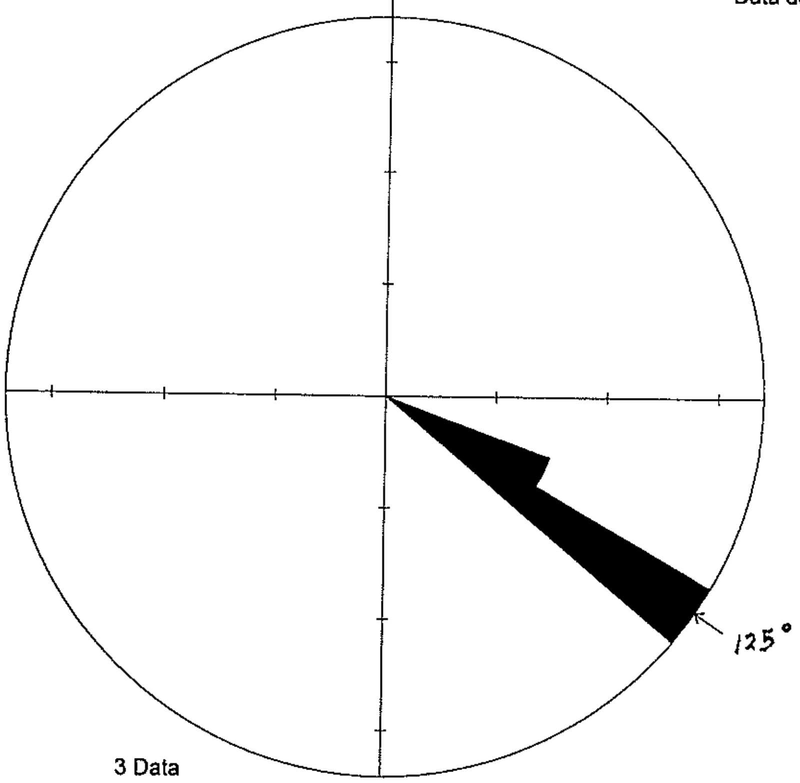
Data description CRS077A

length- Azimuth
No. of Data = 8
Sector angle = 10°
Scale: tick interval = 5% [length: 2.50
Maximum = 30% [length: 15]
Total length = 50
Mean Resultant dir'n = 149
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

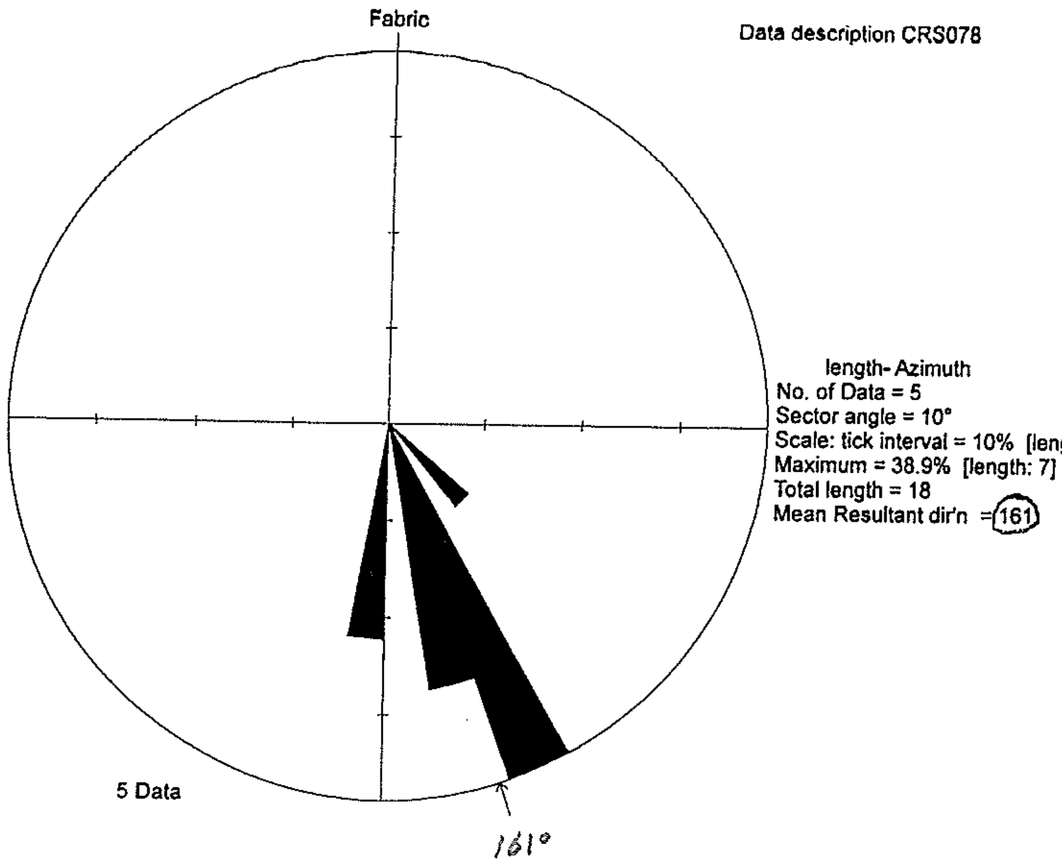
8 Data

CRS077B

3

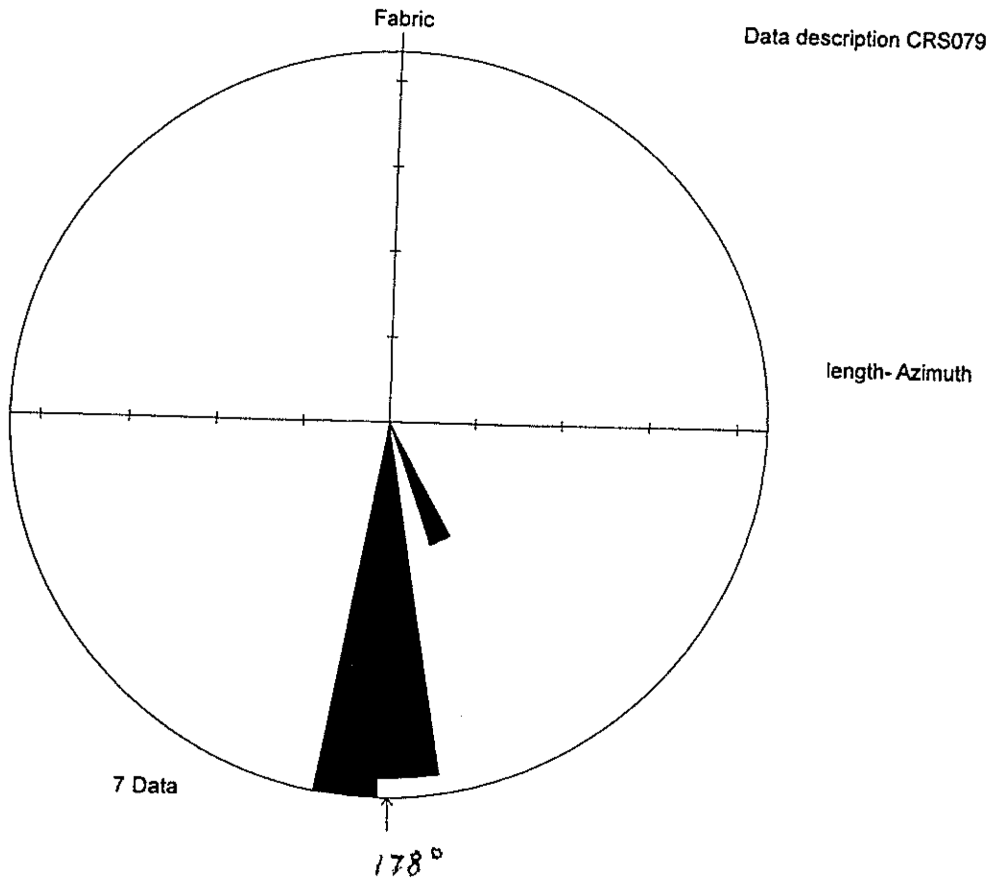


CRS078
5

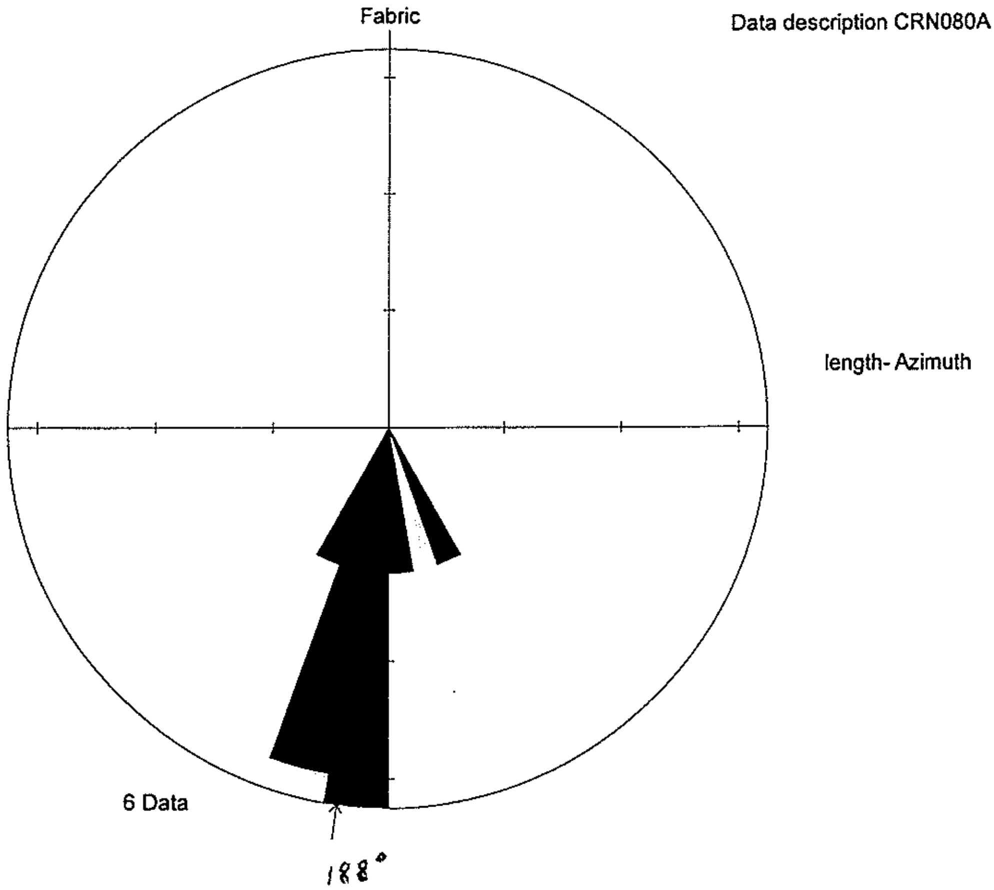


Fabric
Data description CRS078
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 1.8
Maximum = 38.9% [length: 7]
Total length = 18
Mean Resultant dir'n = 161
5 Data
161°

CRS079
7

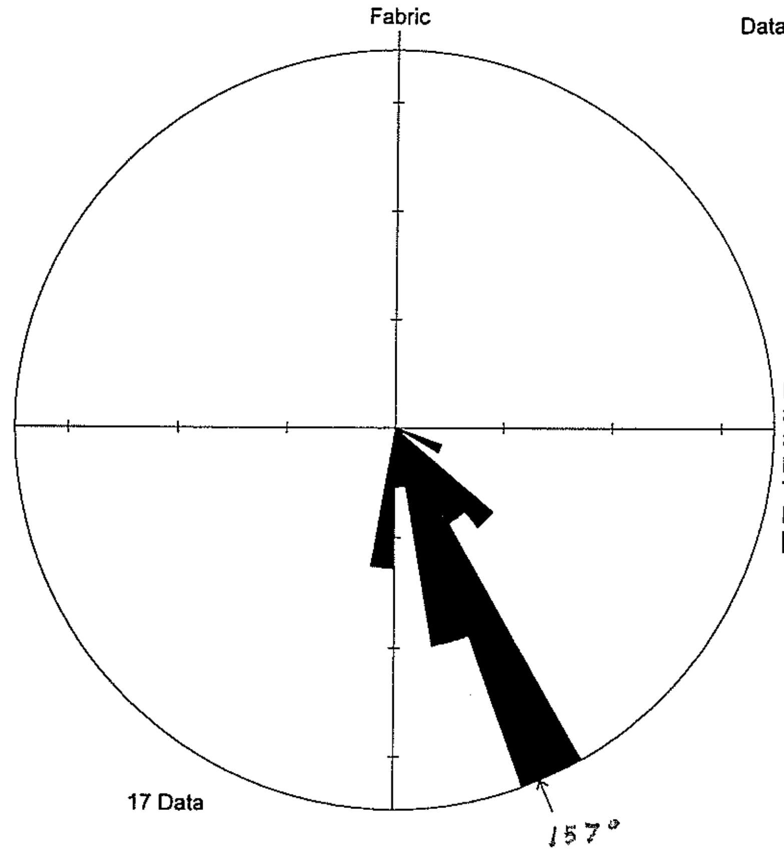


CRN080A
6



CRN080B

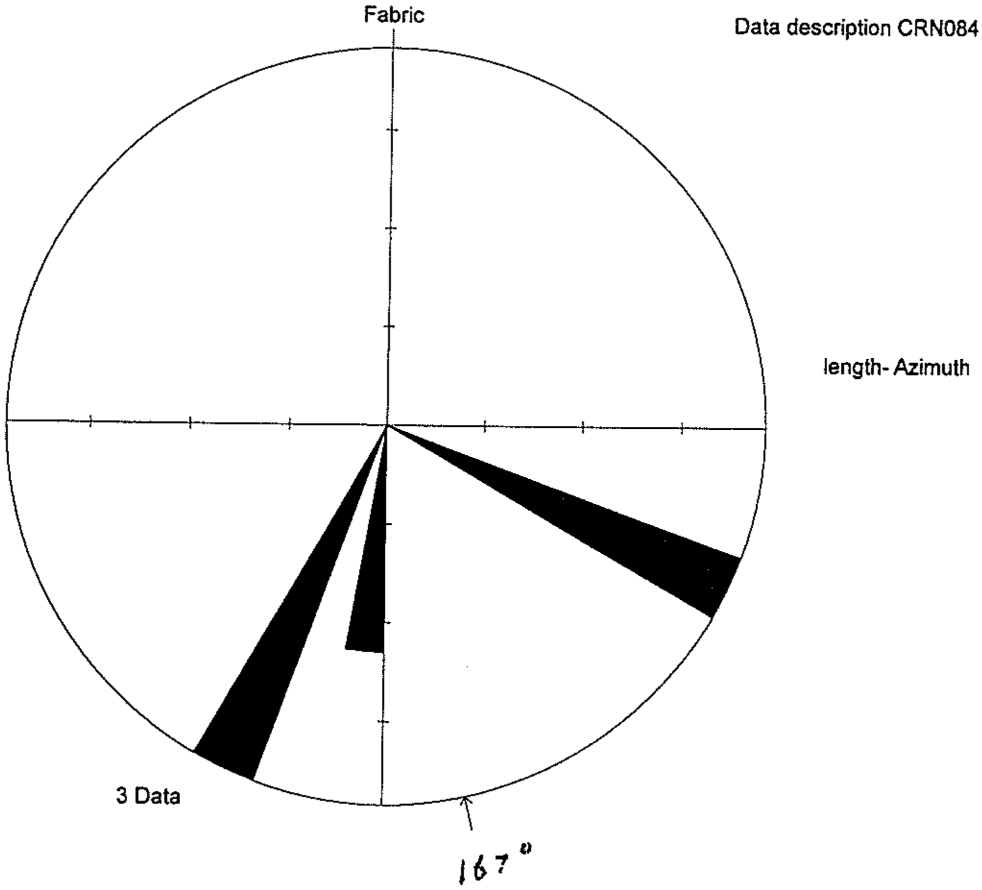
17



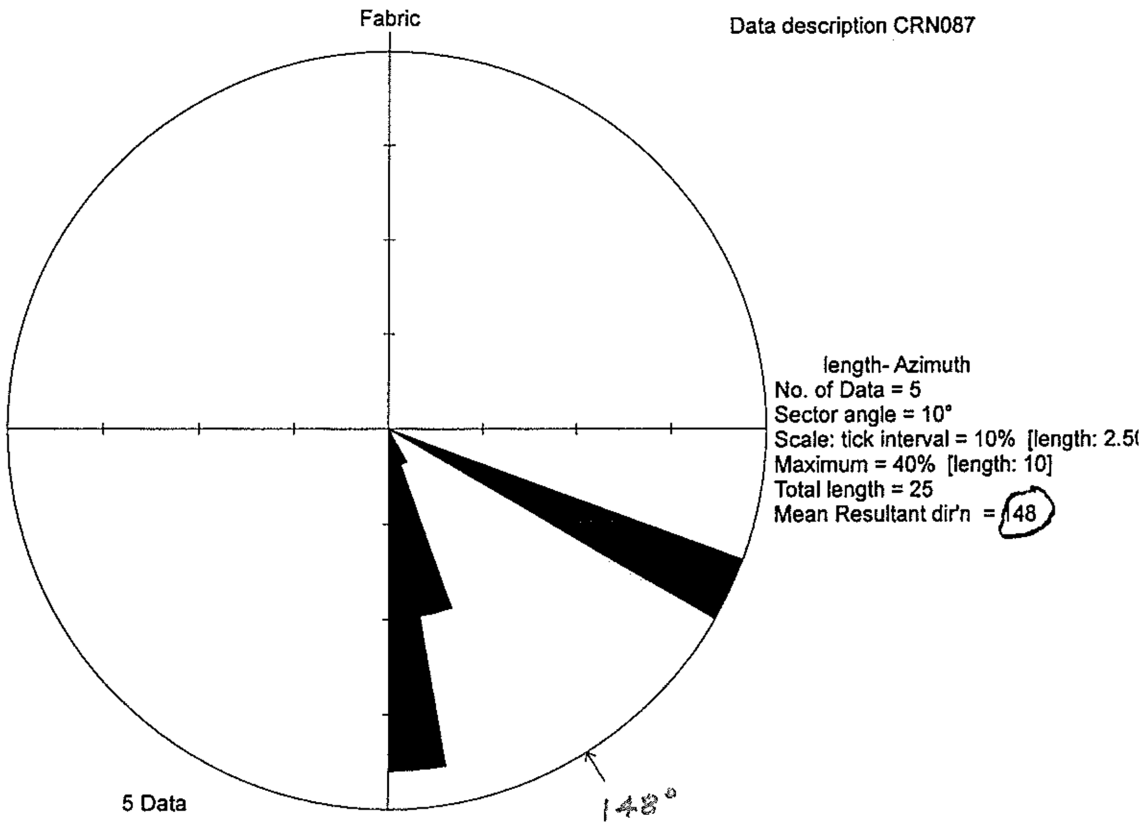
Data description CRN080B

length- Azimuth
No. of Data = 17
Sector angle = 10°
Scale: tick interval = 10% [length: 10
Maximum = 34.9% [length: 38]
Total length = 109
Mean Resultant dir'n = 157
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

CRN084 (rvsd)
3

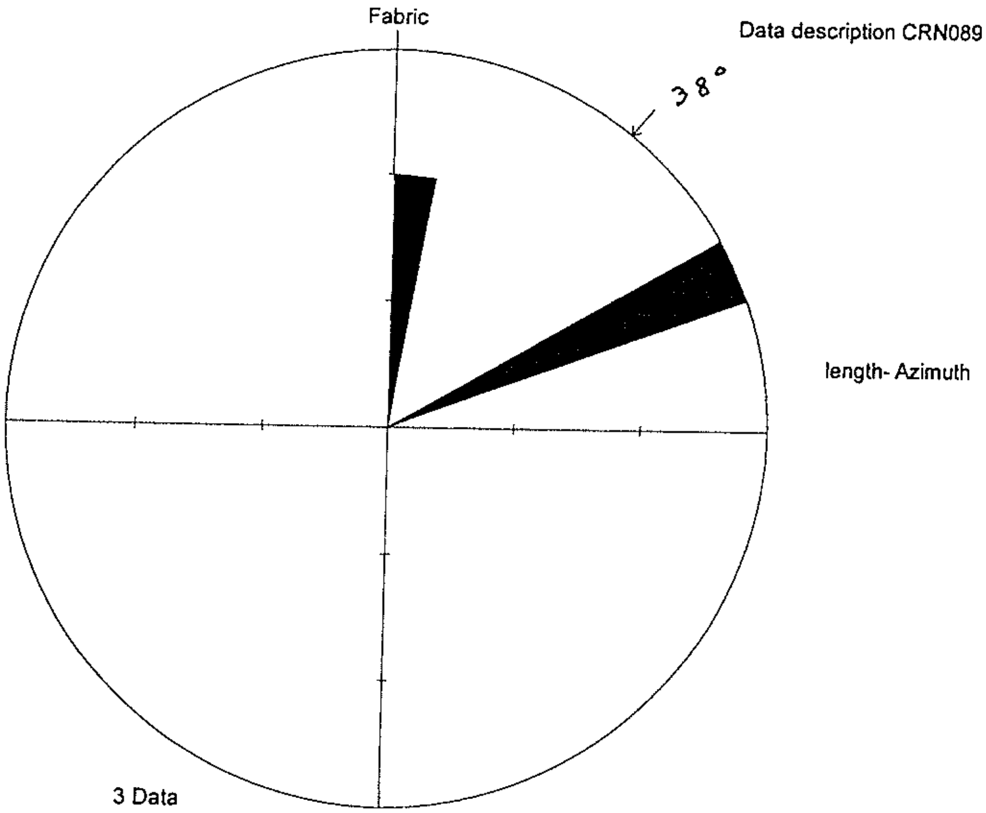


CRN087 (rvsd)
5



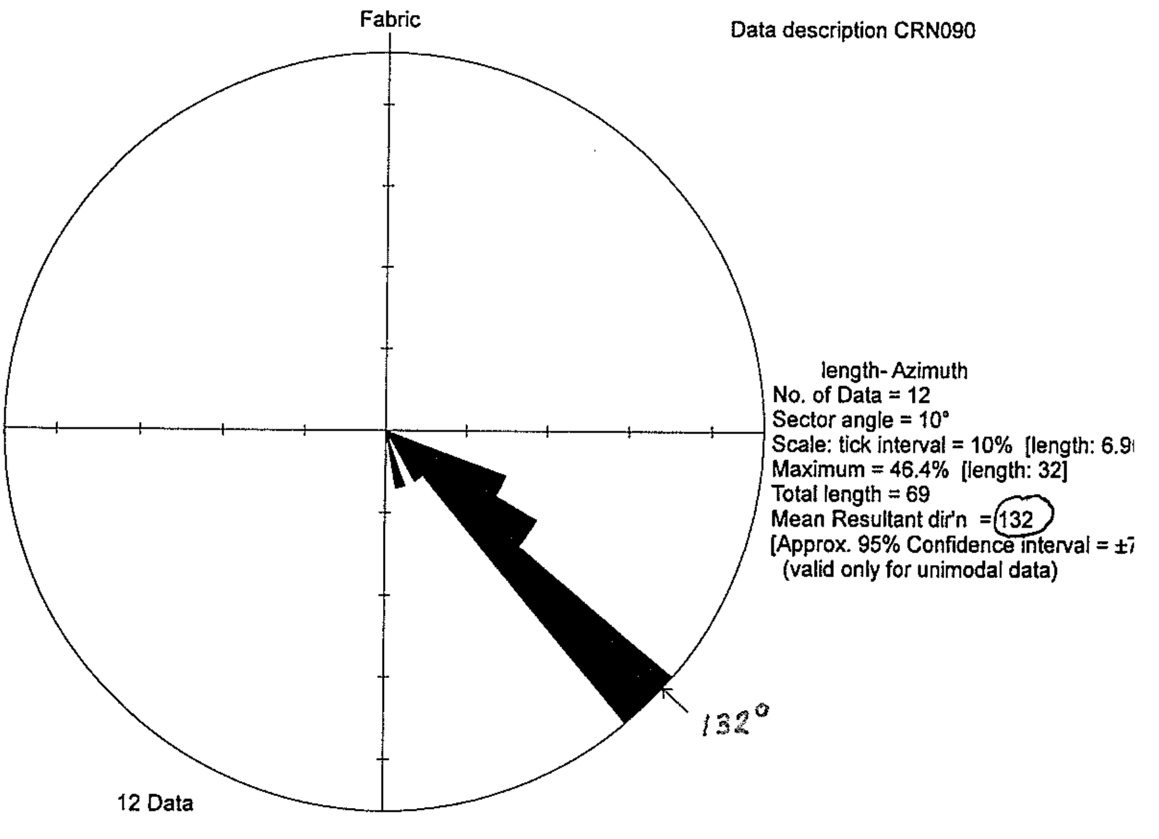
CRN089 reused.

3

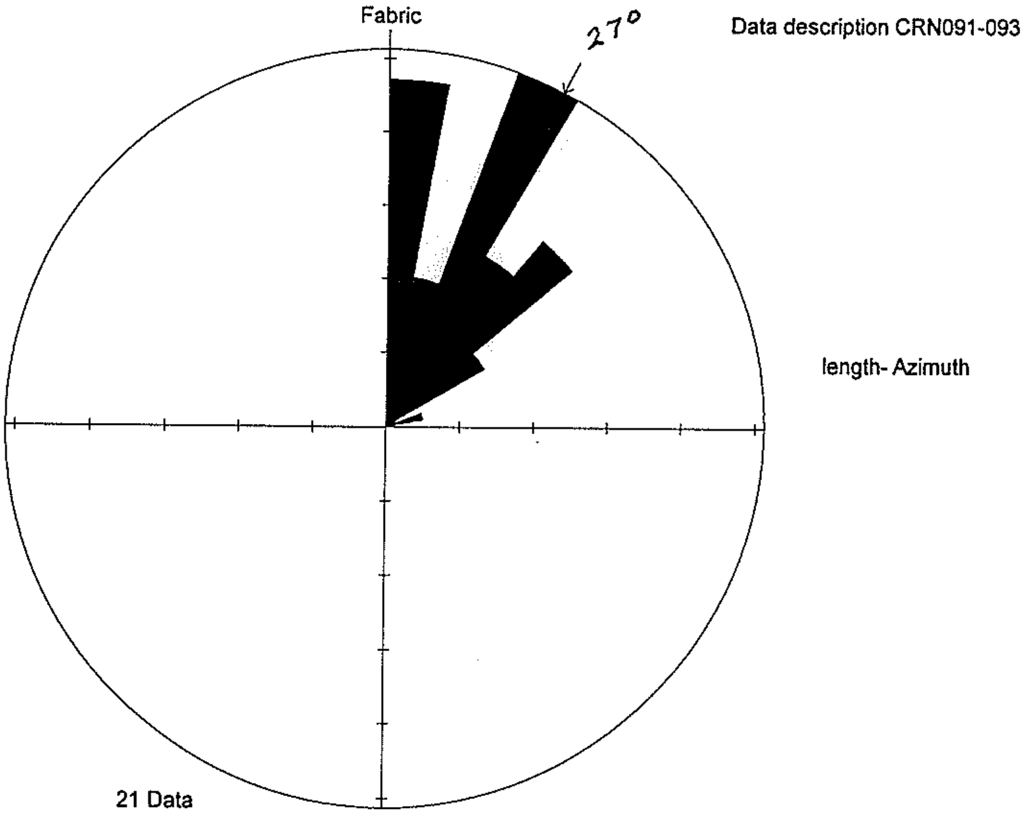


CRN090 (rvsd)

12

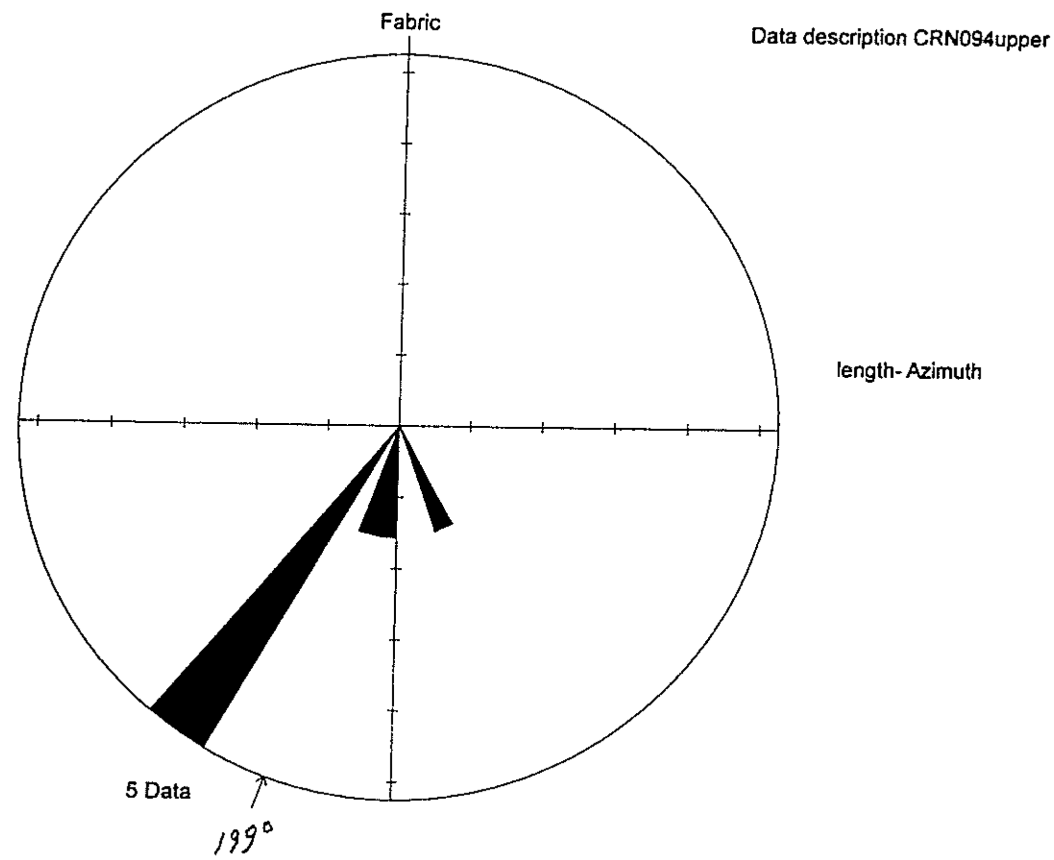


CRN091-093 (new)
21

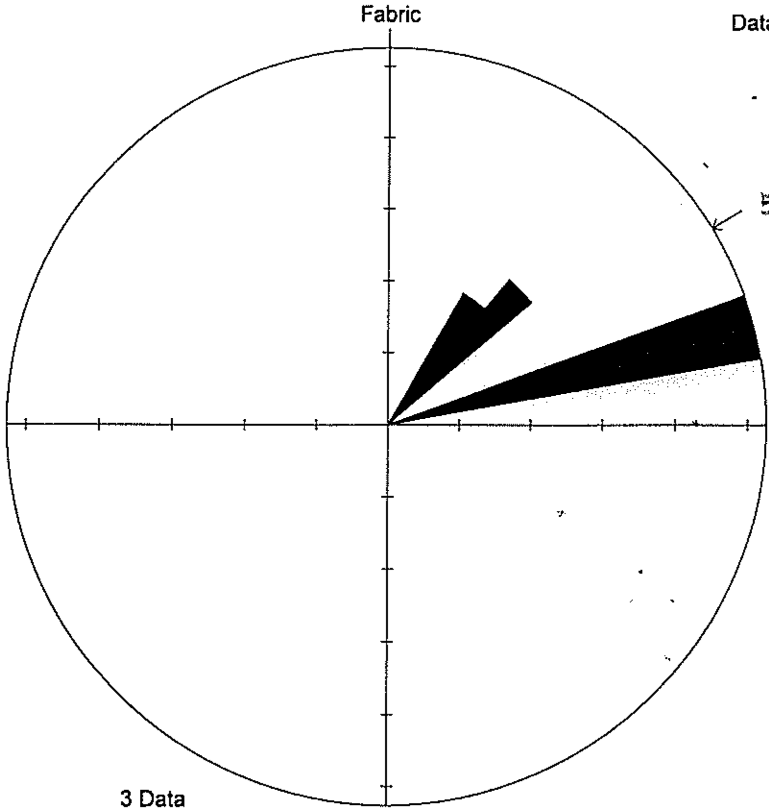


CRN094A upper

5



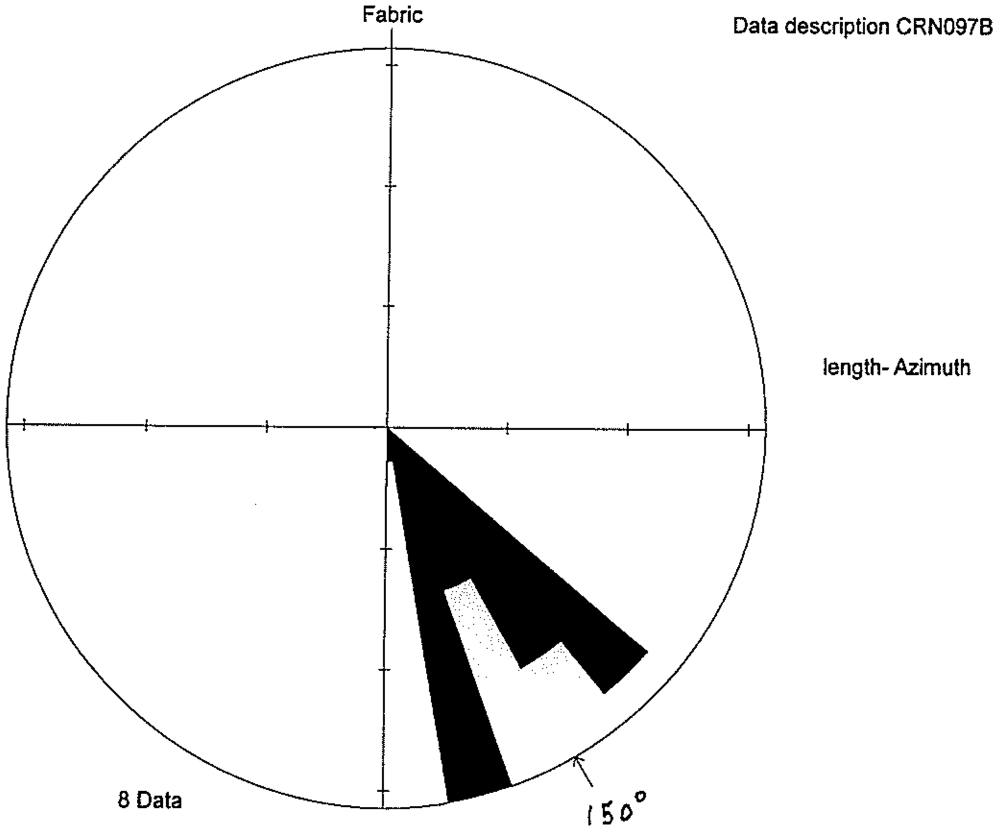
CRN097A (rvsd)
3



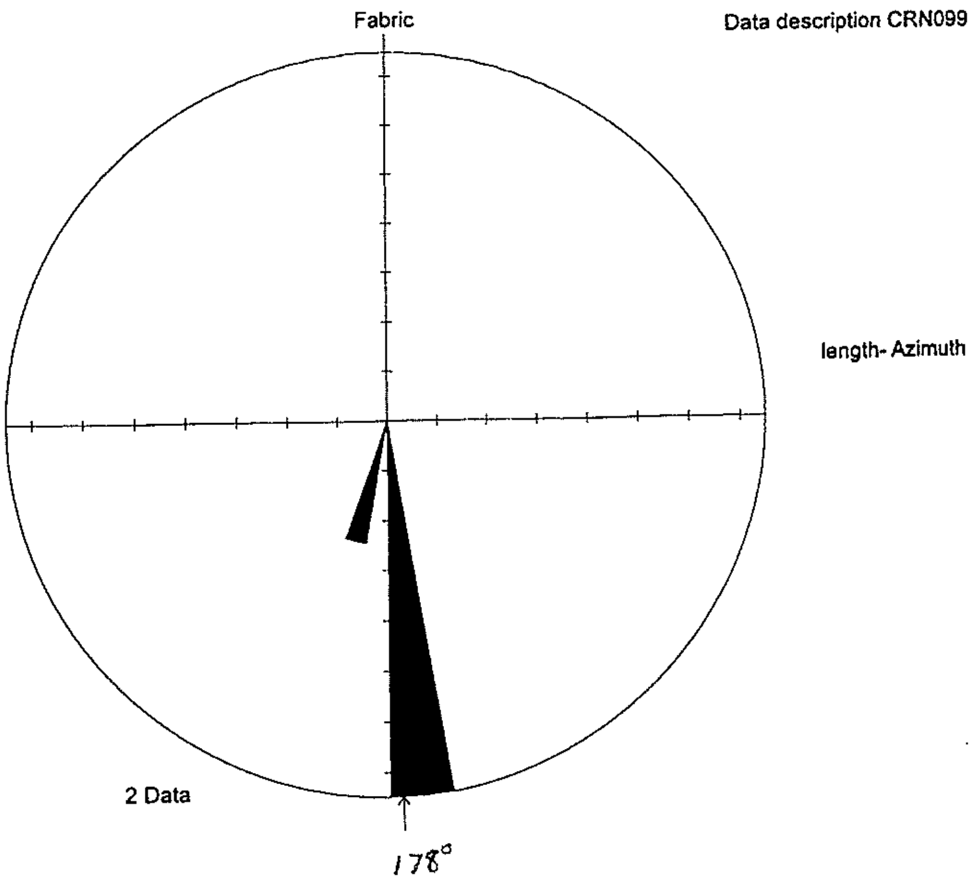
Data description CRN097A

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.
Maximum = 52.6% [length: 10]
Total length = 19
Mean Resultant dir'n = 059

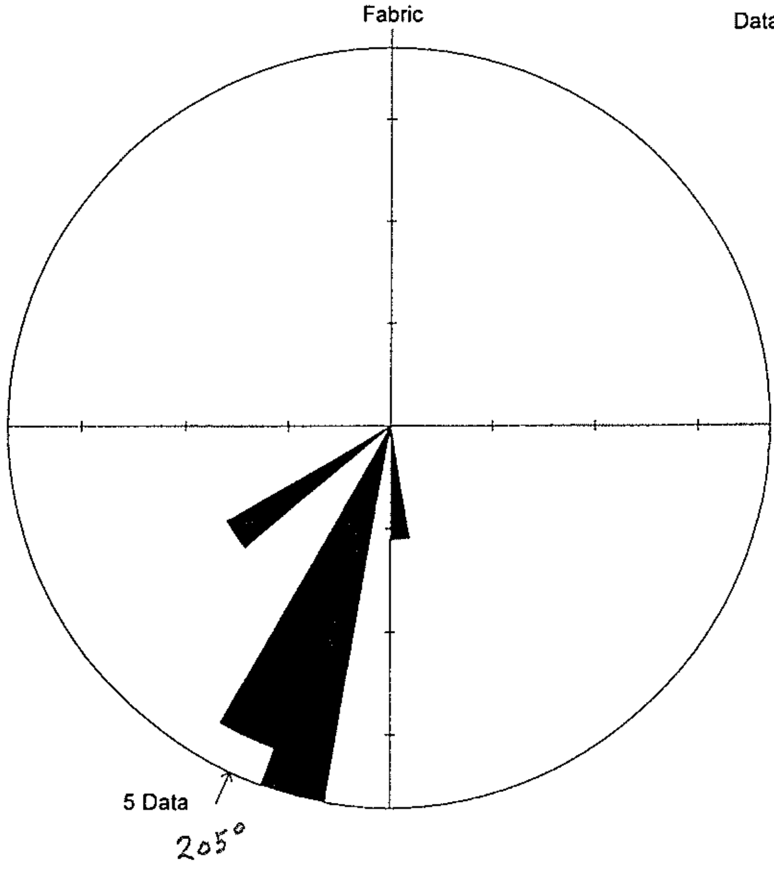
CRN097B (rvsd)
8



CRN099
2



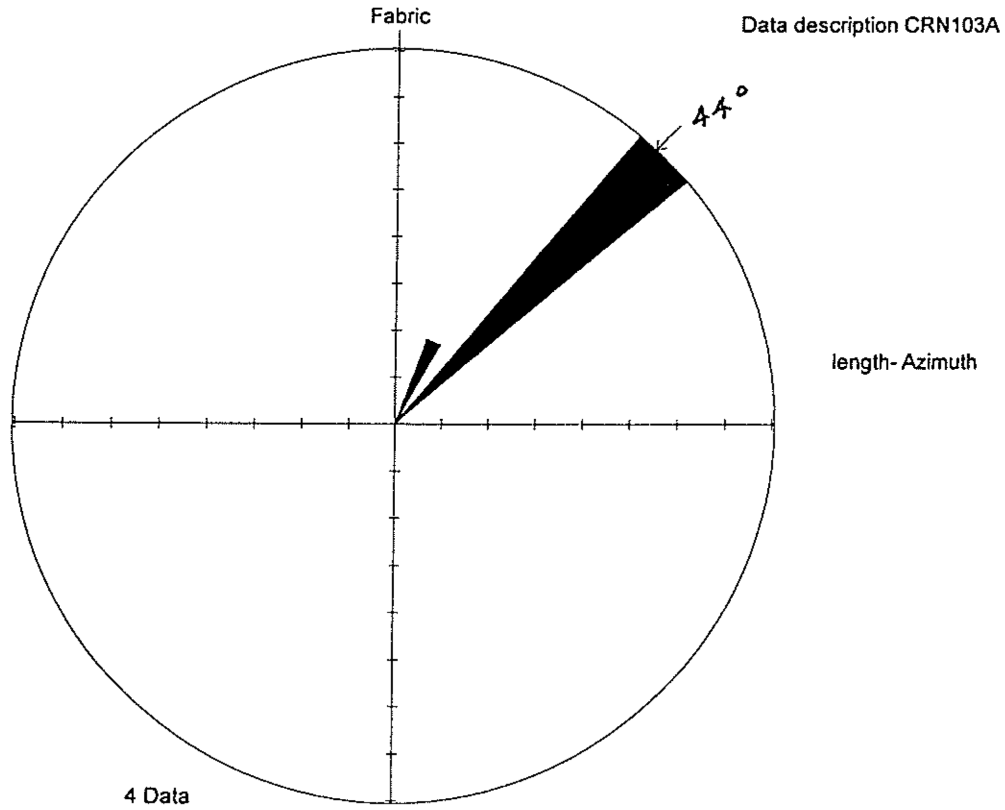
CRN100 (rvsd)
5



Data description CRN100

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 2.7
Maximum = 37.0% [length: 10]
Total length = 27
Mean Resultant dir'n = 205
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

CRN103A (rvsd)
4

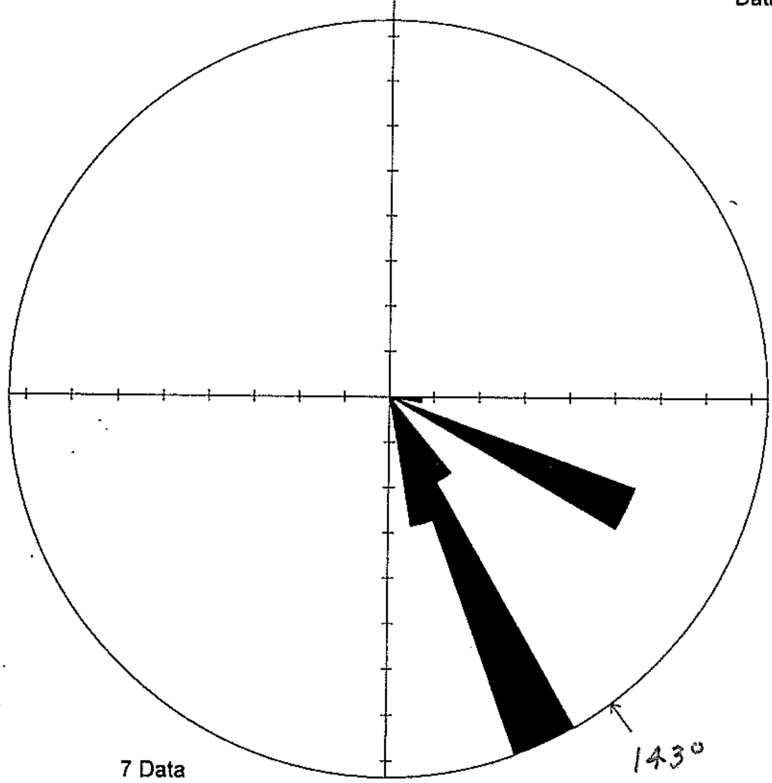


CRN103B

7

Fabric

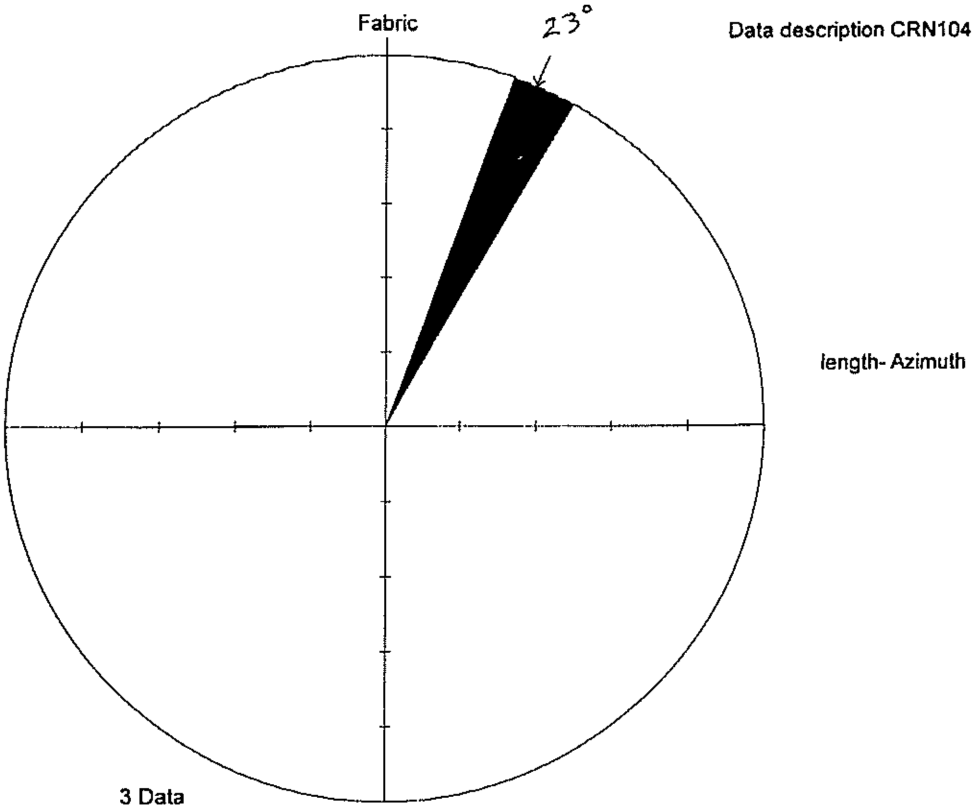
Data description CRN103B



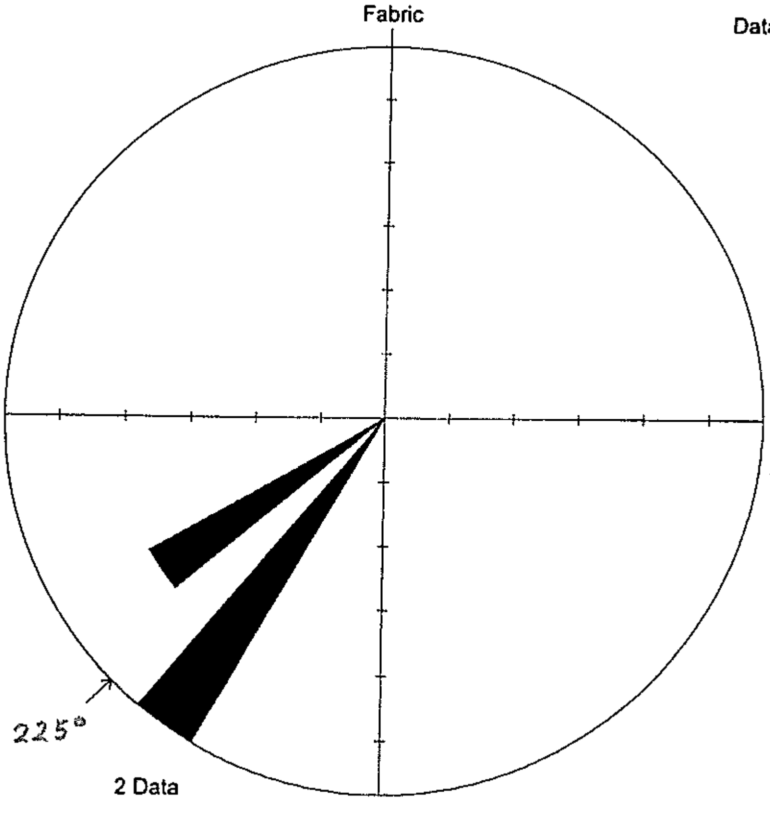
length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 5% [length: 2.75
Maximum = 41.8% [length: 23]
Total length = 55
Mean Resultant dir'n = 143
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

7 Data

CRN104
3



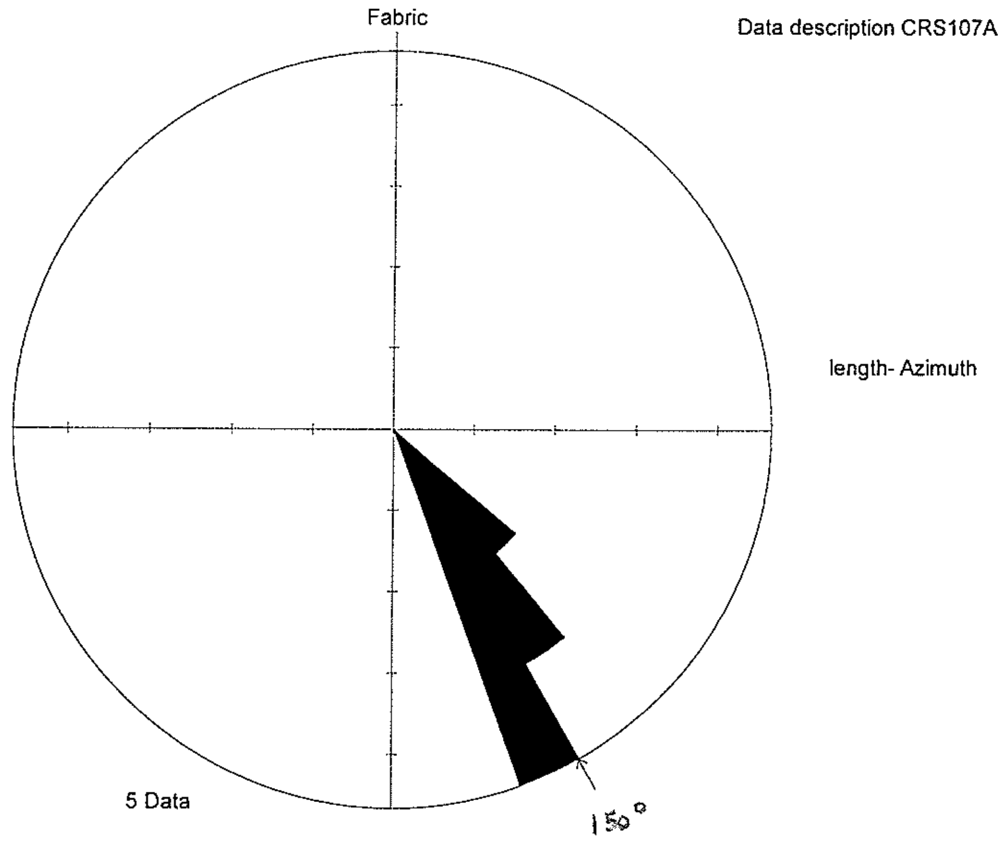
CRN105
2



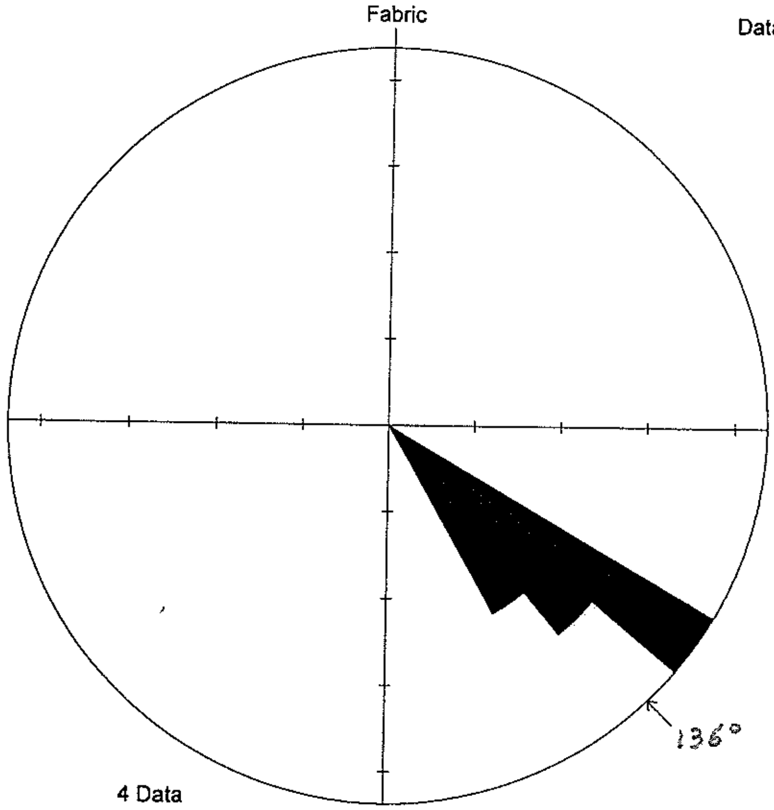
Data description CRN105

length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.2(
Maximum = 58.3% [length: 7]
Total length = 12
Mean Resultant dir'n = 225

CRS107A
5



CRS107B
4

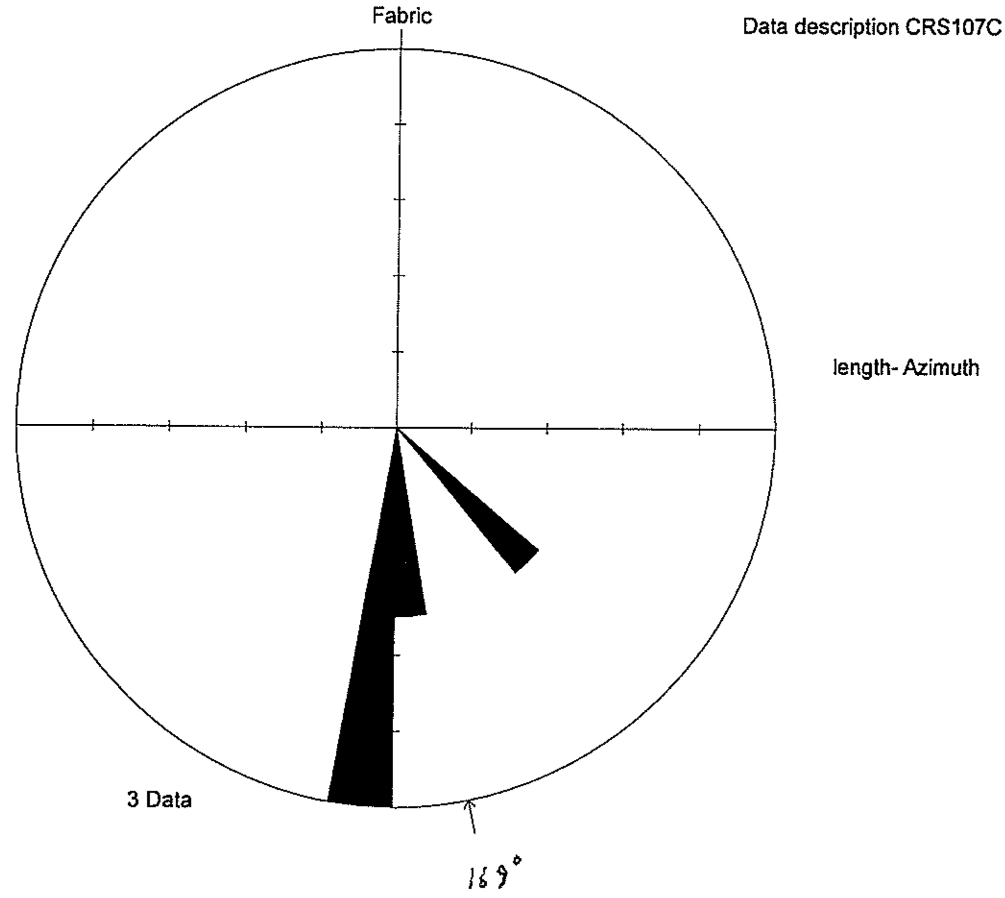


Data description CRS107B

length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 1.
Maximum = 43.8% [length: 7]
Total length = 16
Mean Resultant dir'n = 136

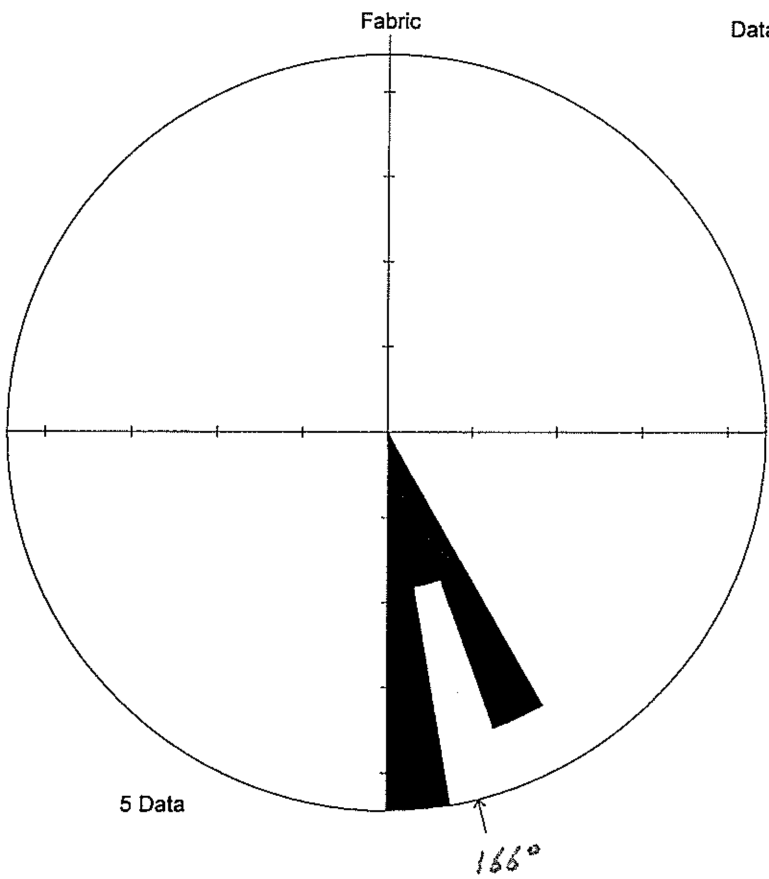
CRS107C

3



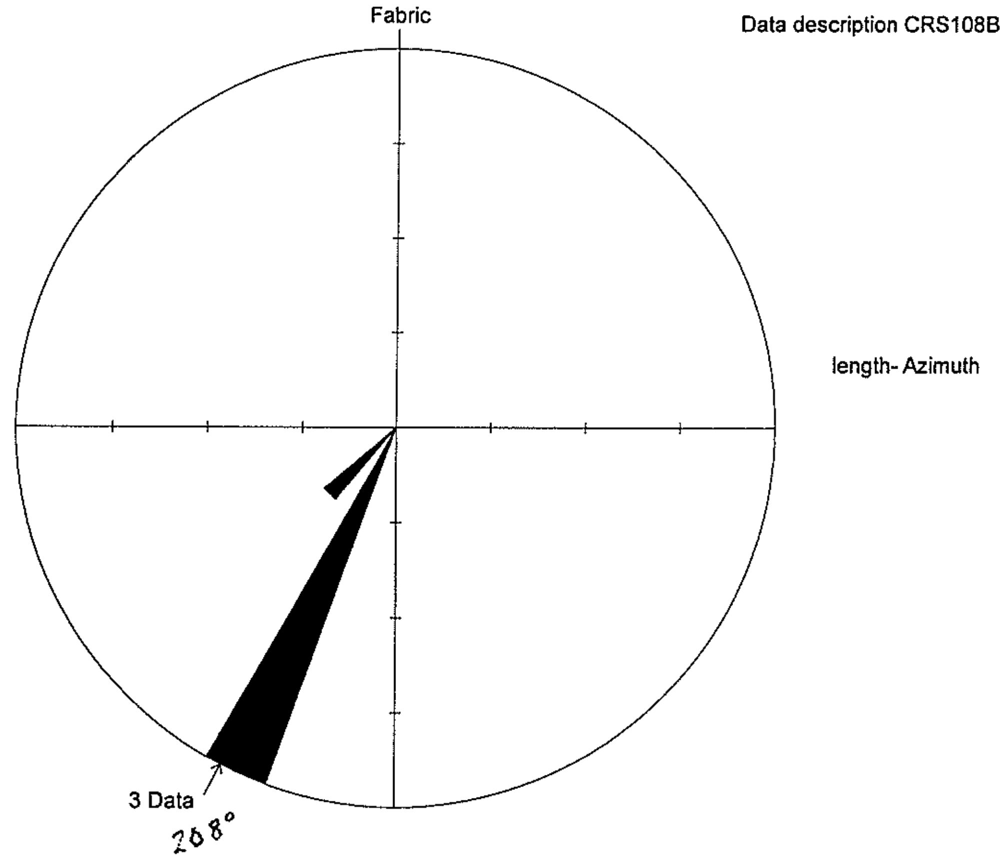
CRS108A
5

Data description CRS108A

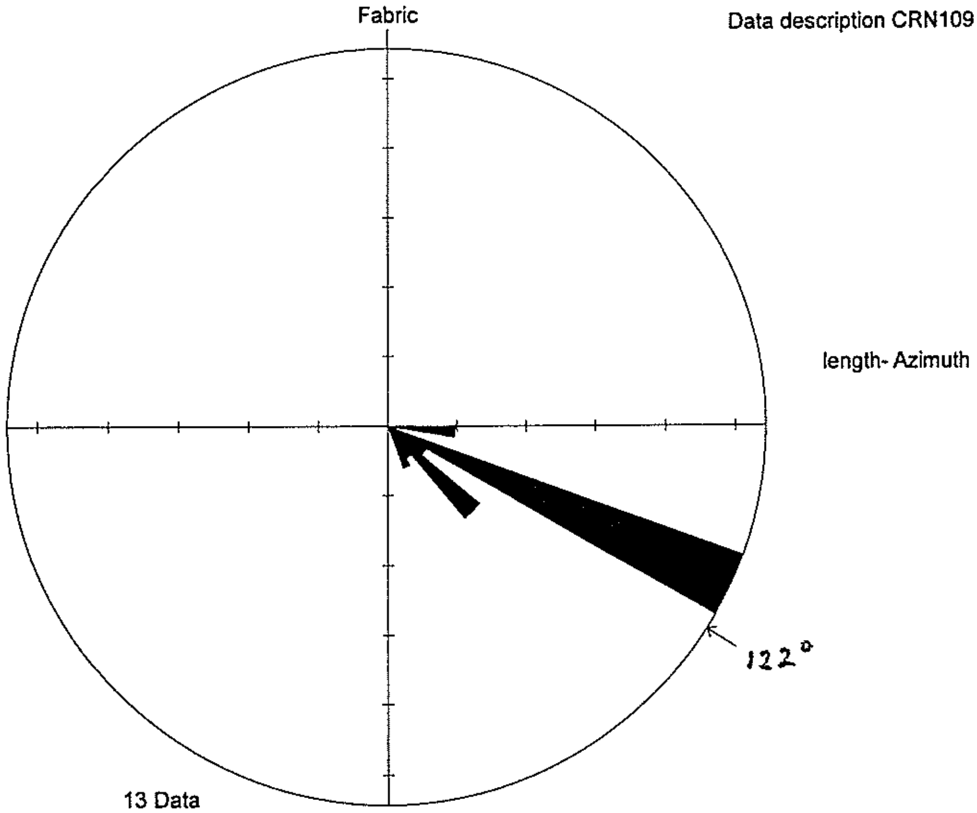


length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 2.
Maximum = 44.4% [length: 12]
Total length = 27
Mean Resultant dir'n = 166
[Approx. 95% Confidence interval = :
(valid only for unimodal data)

CRS108B
3

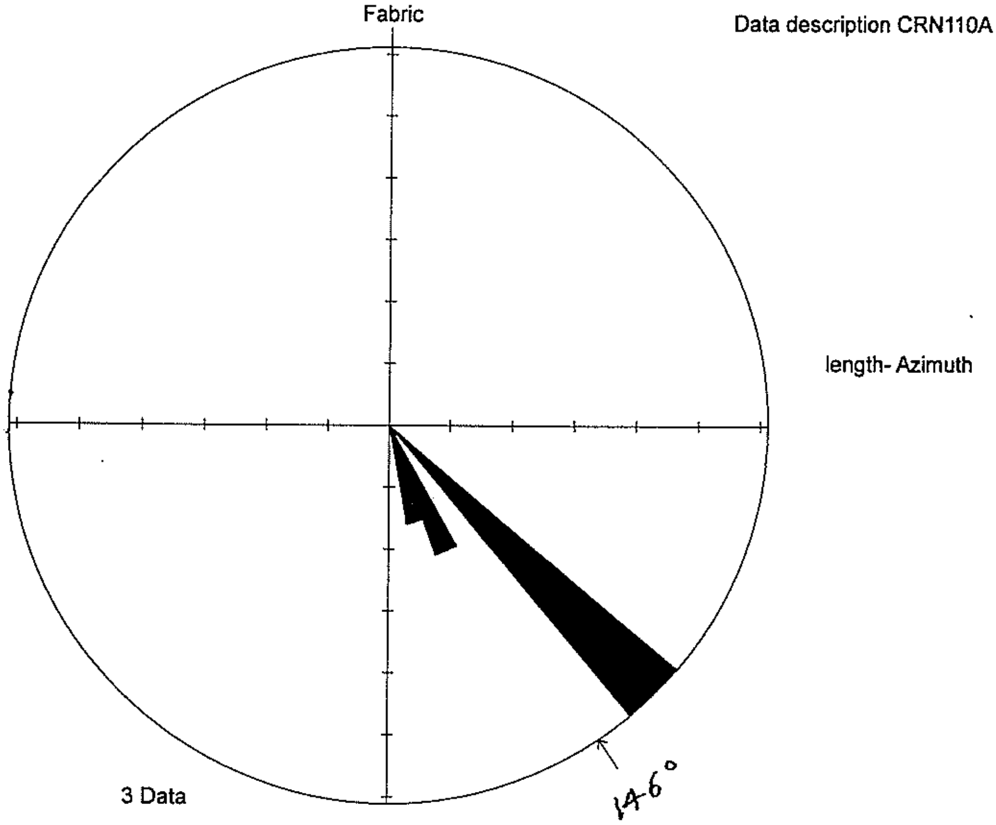


CRN109 (rvsd)
13

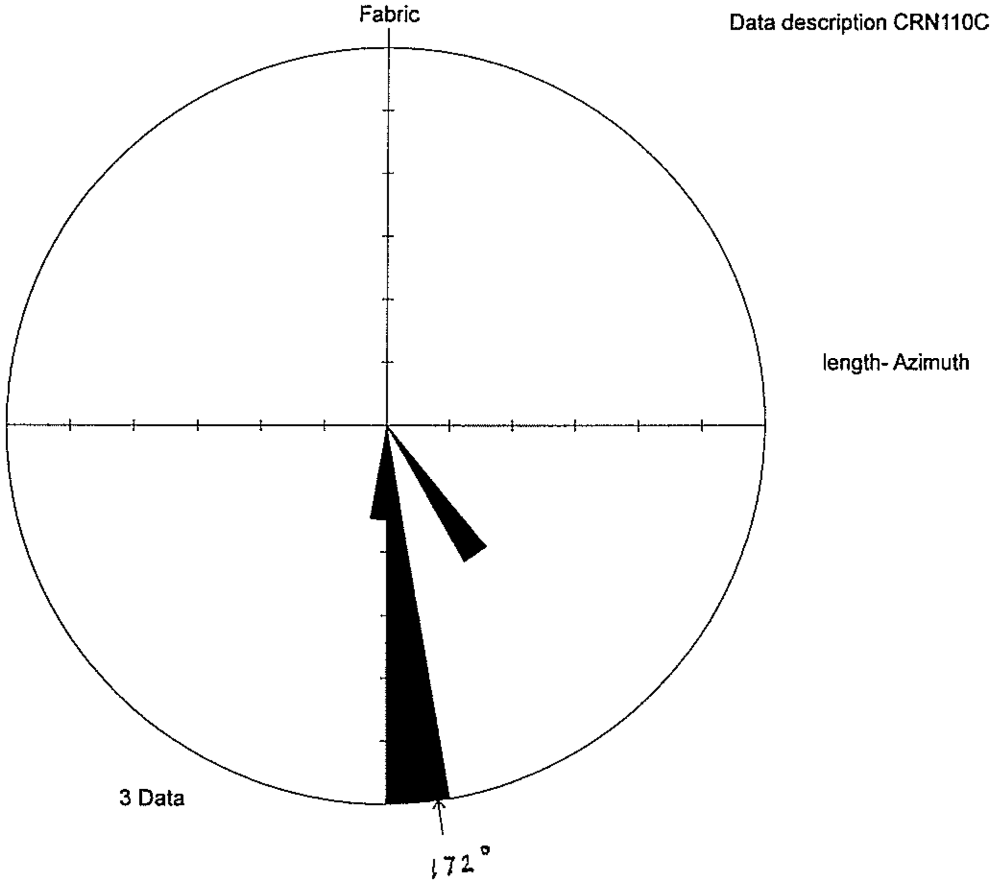


CRN110A (wsd)

3

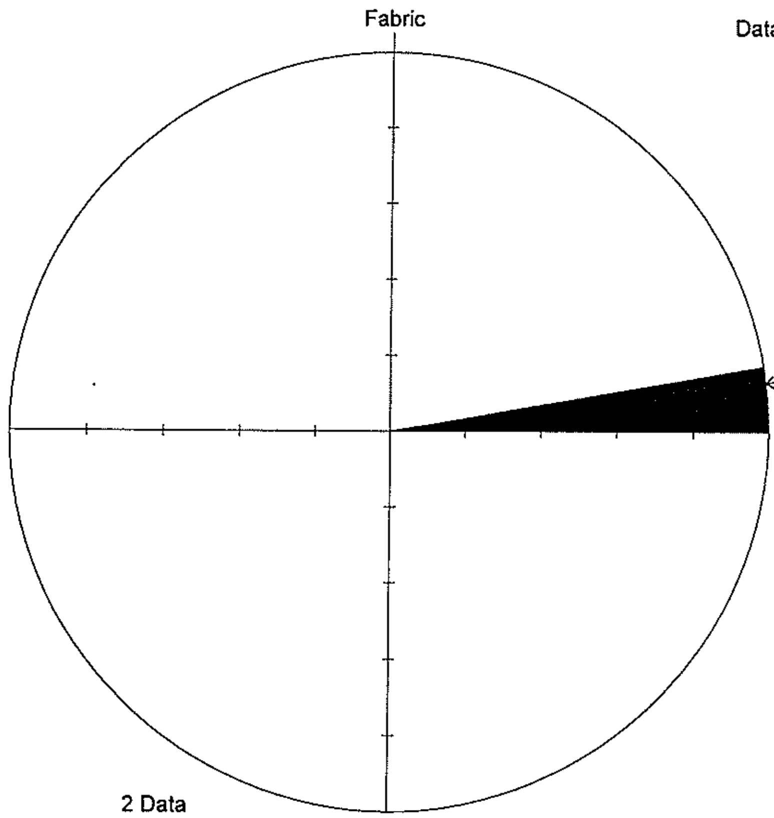


CRN110C
3



CRN110D

2

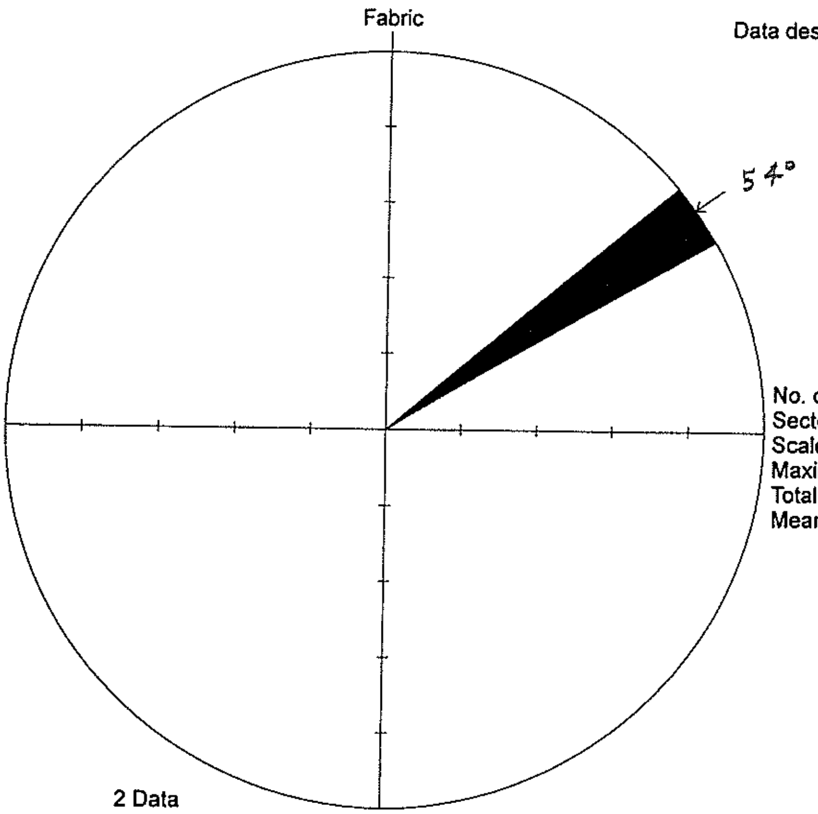


Data description CRN110D

length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 20% [length: 2.4
Maximum = 100% [length: 12]
Total length = 12
Mean Resultant dir'n = 083

CRN110E (new)
2

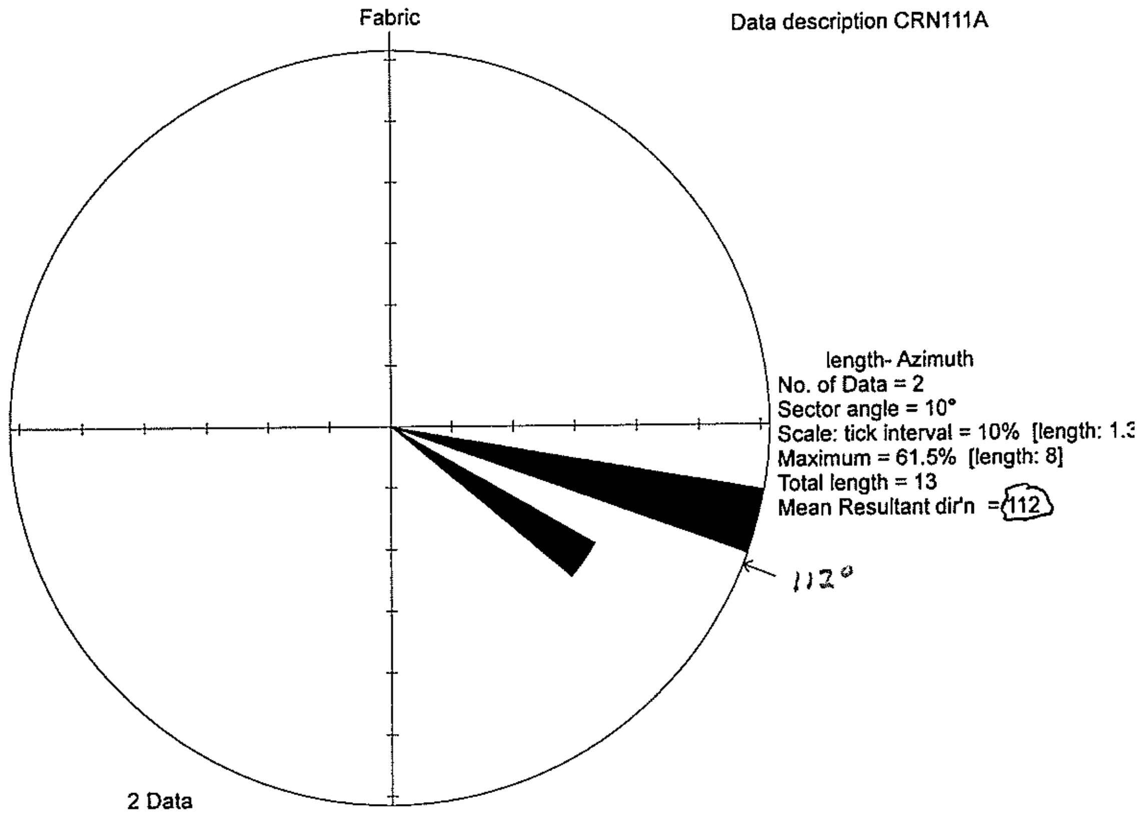
Data description CRN110E



length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 20% [length: 2.
Maximum = 100% [length: 14]
Total length = 14
Mean Resultant dir'n = 054

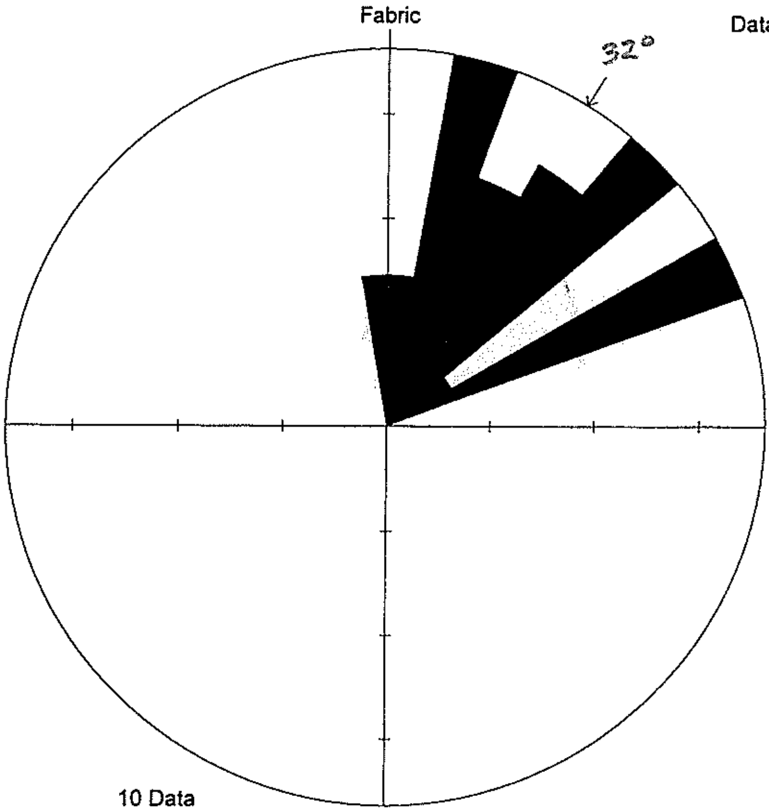
CRN111A

2



Fabric
Data description CRN111A
length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.3
Maximum = 61.5% [length: 8]
Total length = 13
Mean Resultant dir'n = 112
112°
2 Data

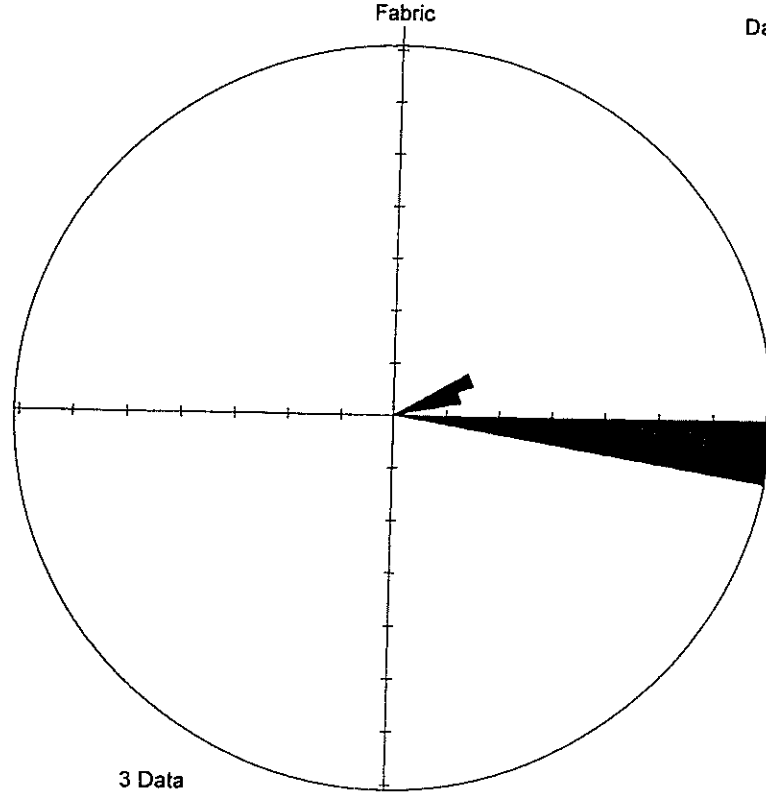
CRN111B
10



Data description CRN111B

length- Azimuth
No. of Data = 10
Sector angle = 10°
Scale: tick interval = 5% [length: 2.7
Maximum = 18.2% [length: 10]
Total length = 55
Mean Resultant dir'n = 032
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

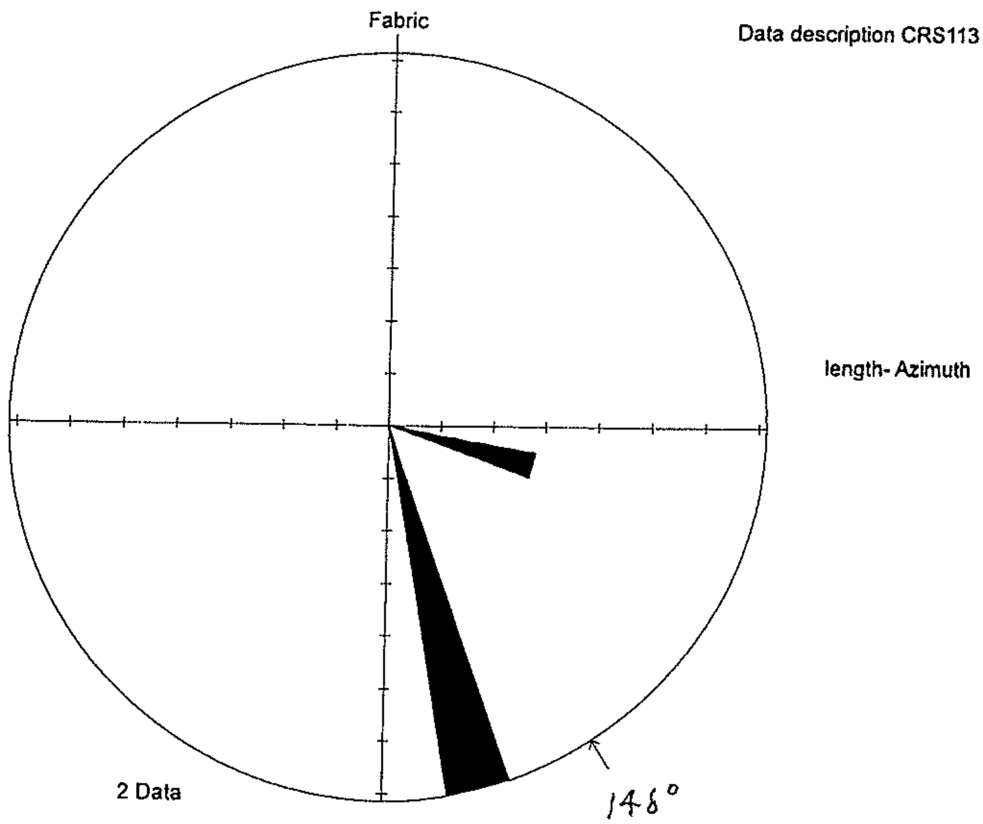
CRS112
3



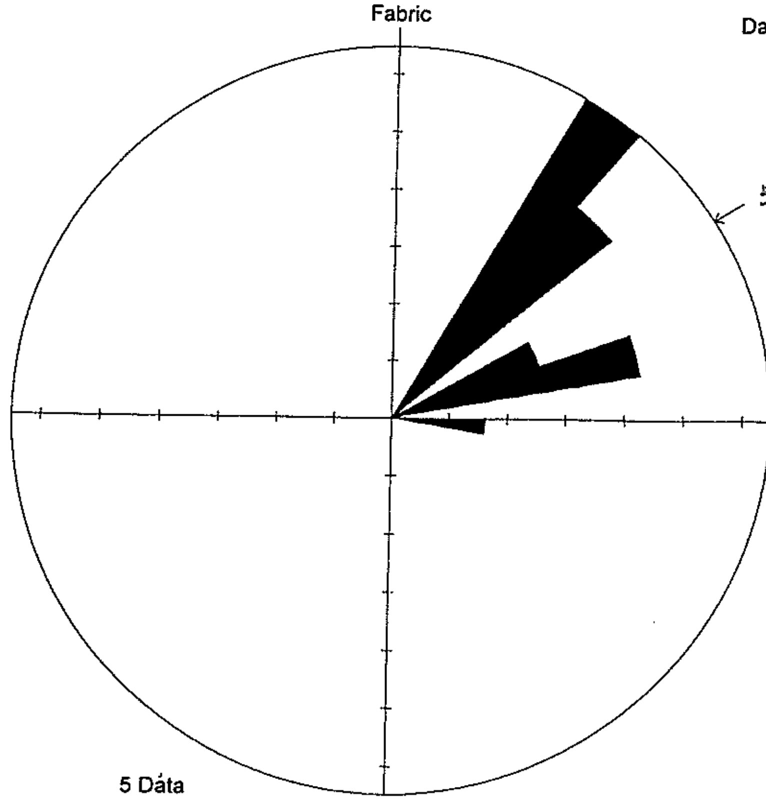
Data description CRS112

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 3.1(
Maximum = 71.0% [length: 22]
Total length = 31
Mean Resultant dir'n = 090
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

CRS113
2



CRN114
5

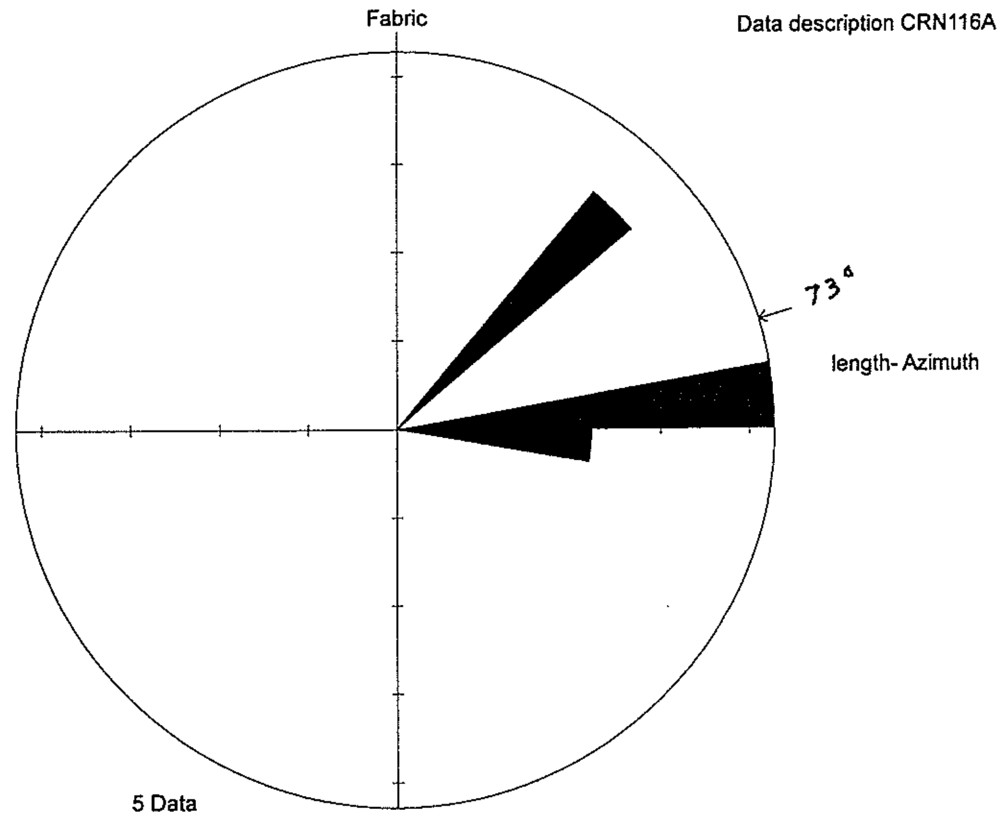


Data description CRN114

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 5% [length: 1.85]
Maximum = 32.4% [length: 12]
Total length = 37
Mean Resultant dir'n = 057
[Approx. 95% Confidence interval = ±15
(valid only for unimodal data)

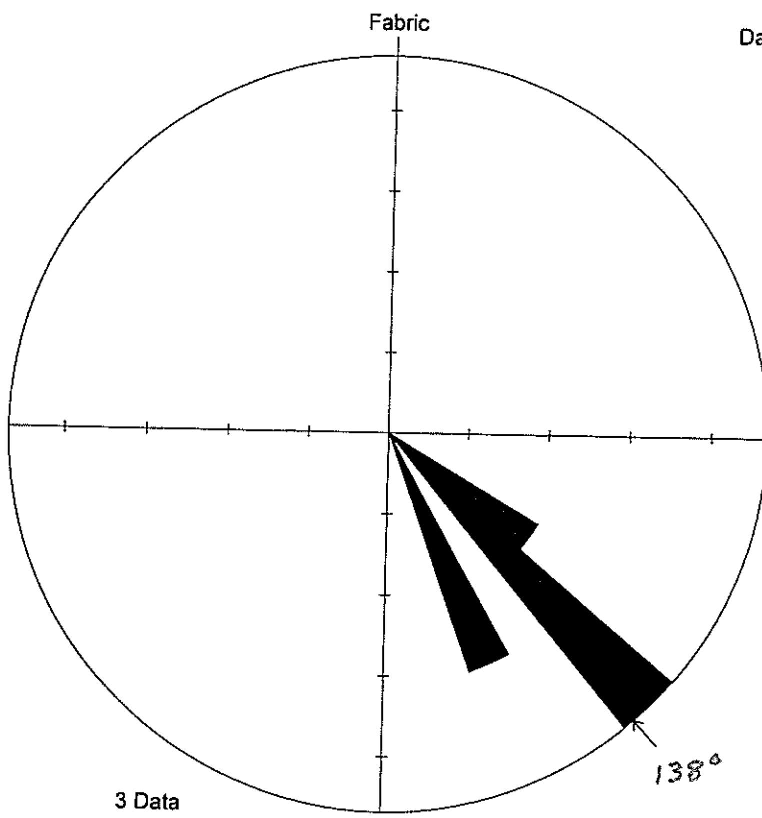
CRN116A

5



CRN116B

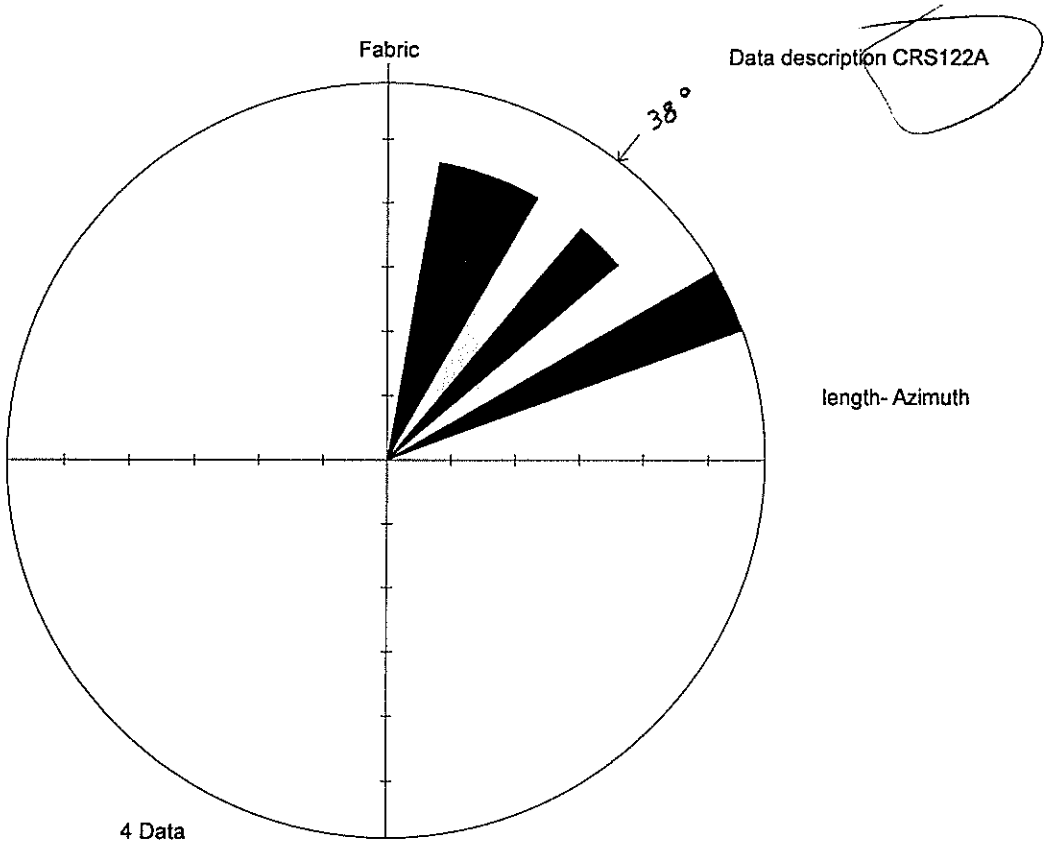
3



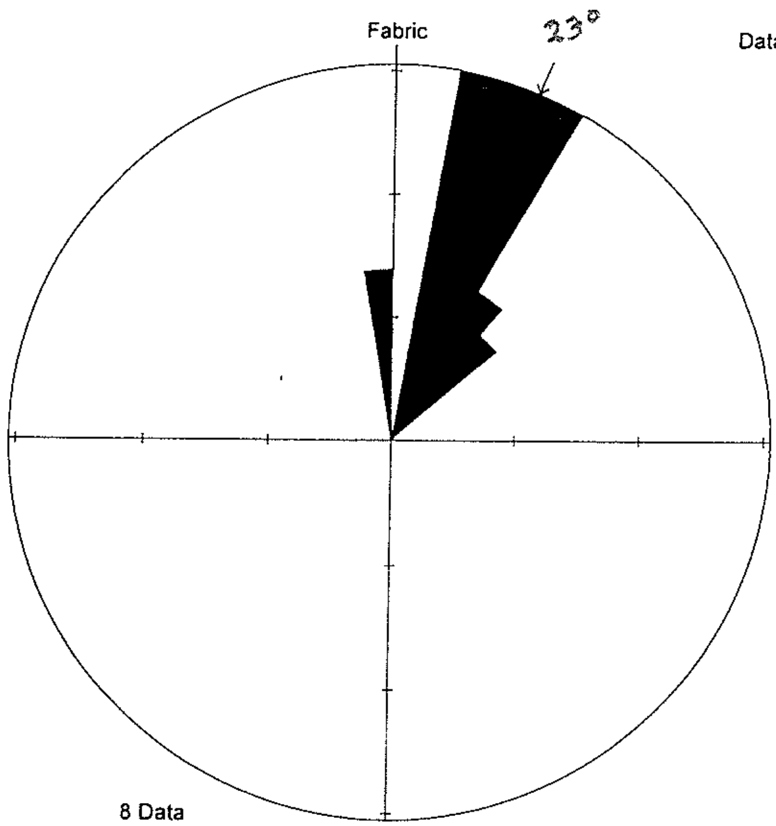
Data description CRN116B

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 3.20]
Maximum = 46.9% [length: 15]
Total length = 32
Mean Resultant dir'n = 138
[Approx. 95% Confidence interval = ±13
(valid only for unimodal data)

CRS122A
4



CRS122B
8

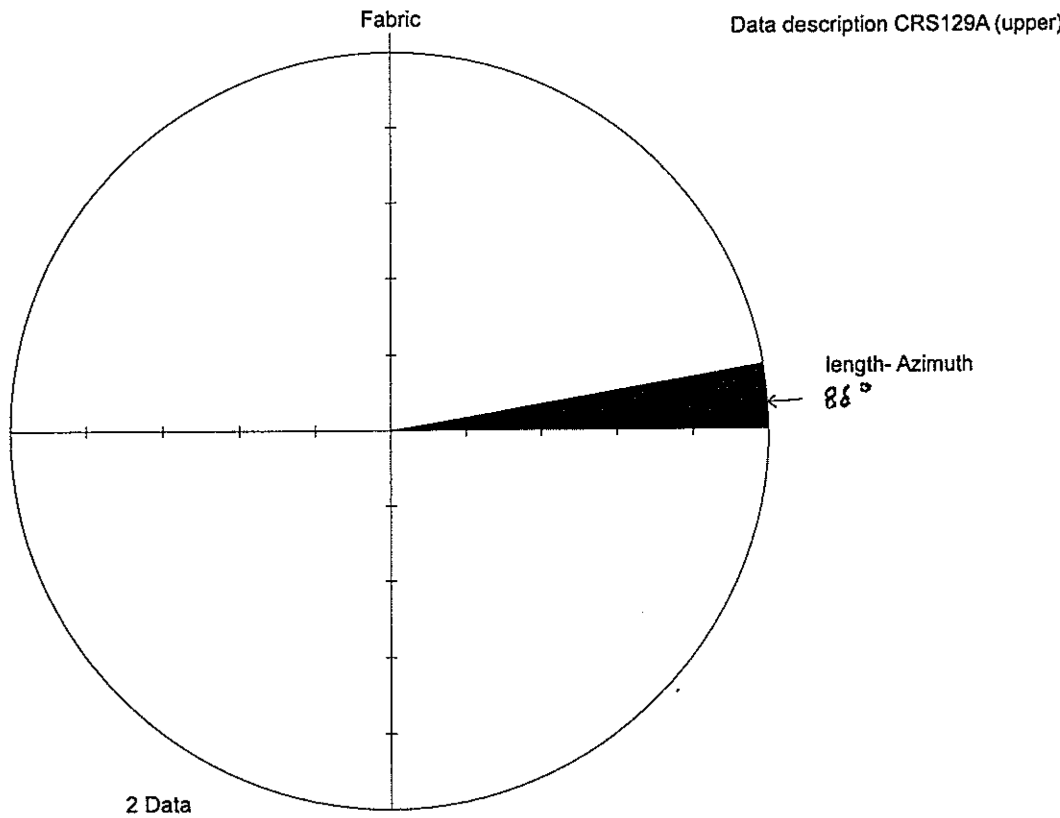


Data description CRS122B

length- Azimuth
No. of Data = 8
Sector angle = 10°
Scale: tick interval = 10% [length: 3.60]
Maximum = 30.6% [length: 11]
Total length = 36
Mean Resultant dir'n = 023
[Approx. 95% Confidence interval = ±10.
(valid only for unimodal data)

CRS 129A (upper)

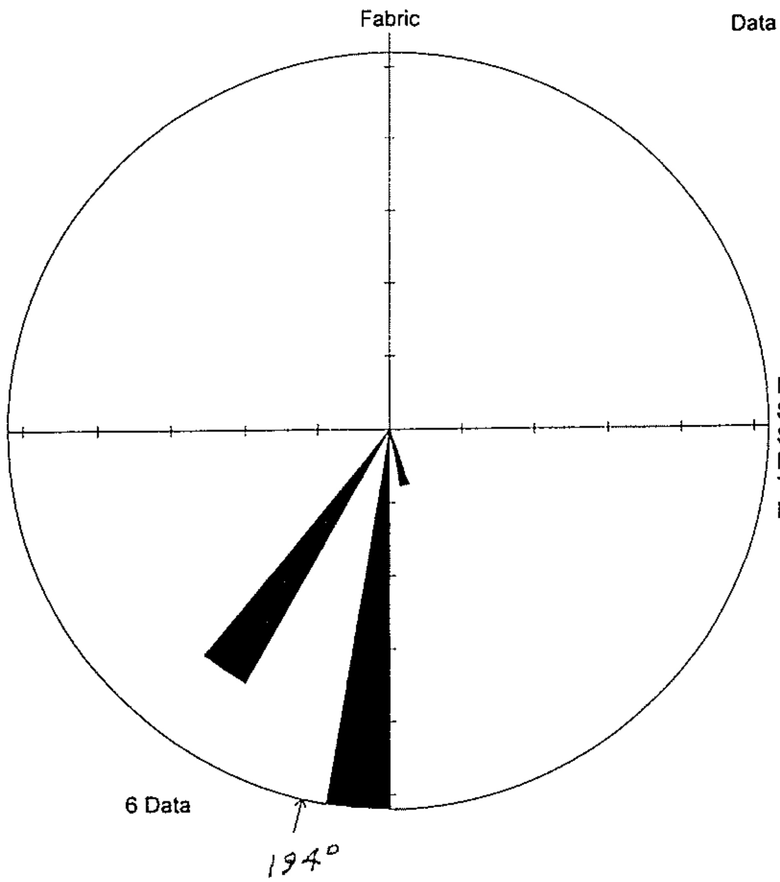
2



middle

CRS129B

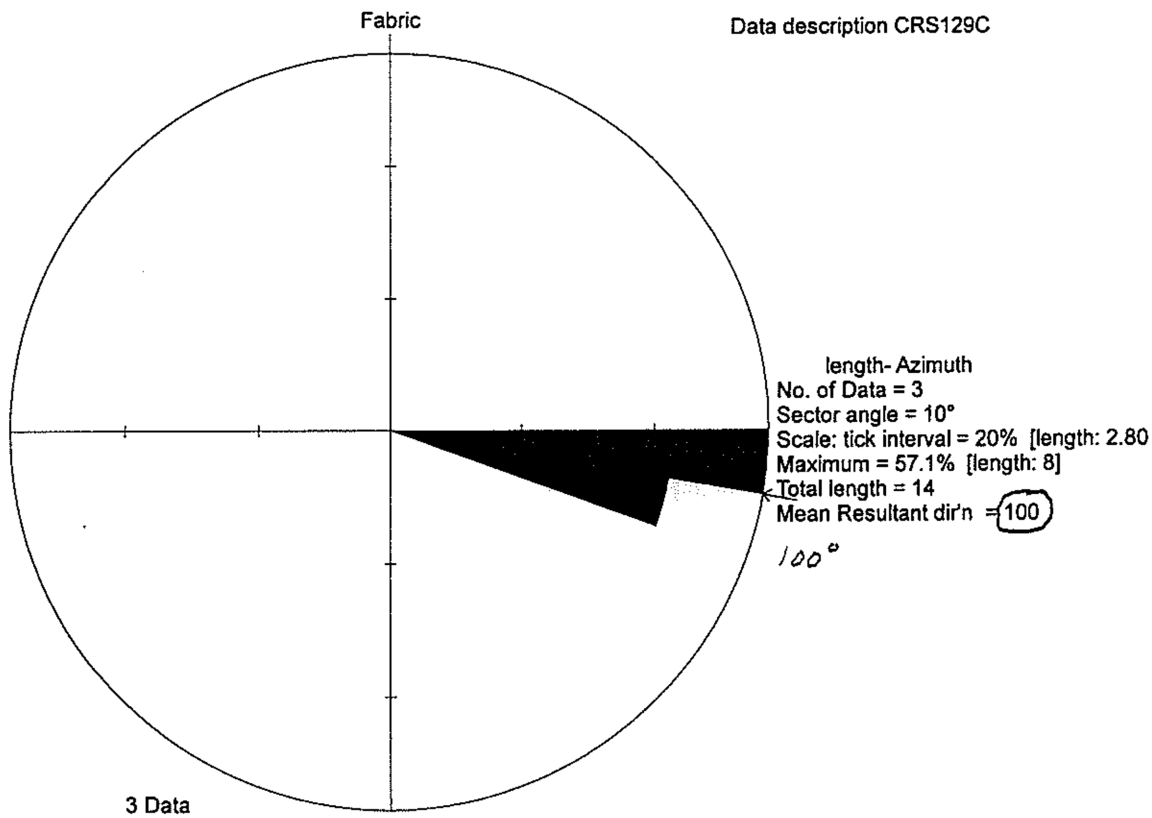
6



Data description CRS129B (lower)

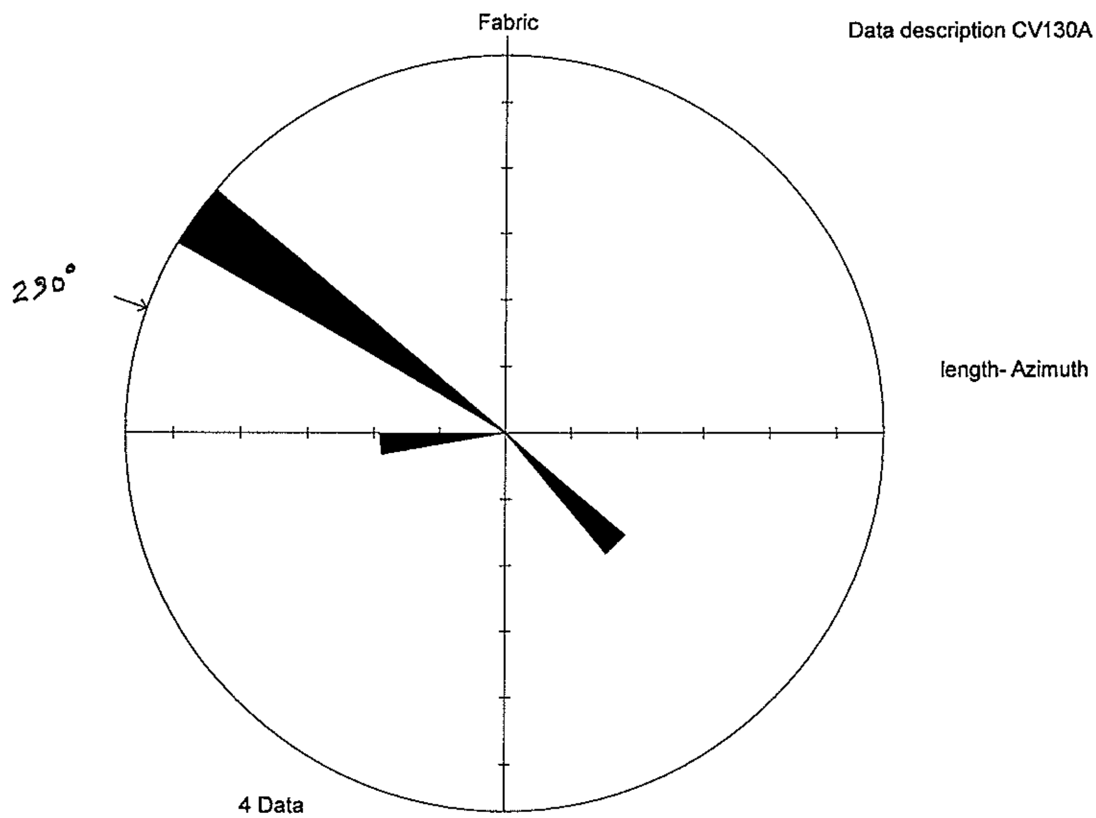
length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 10% [length: 2.50
Maximum = 52% [length: 13]
Total length = 25
Mean Resultant dir'n = 194

CRS129C
3


Fabric
Data description CRS129C
length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 20% [length: 2.80
Maximum = 57.1% [length: 8]
Total length = 14
Mean Resultant dir'n = 100
100°
3 Data

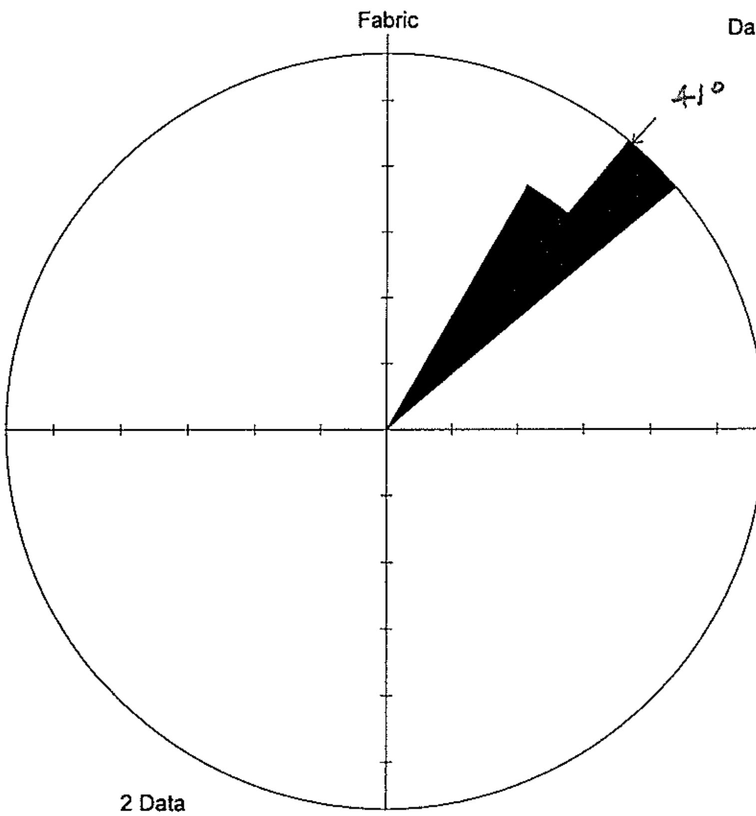
CV130A

4



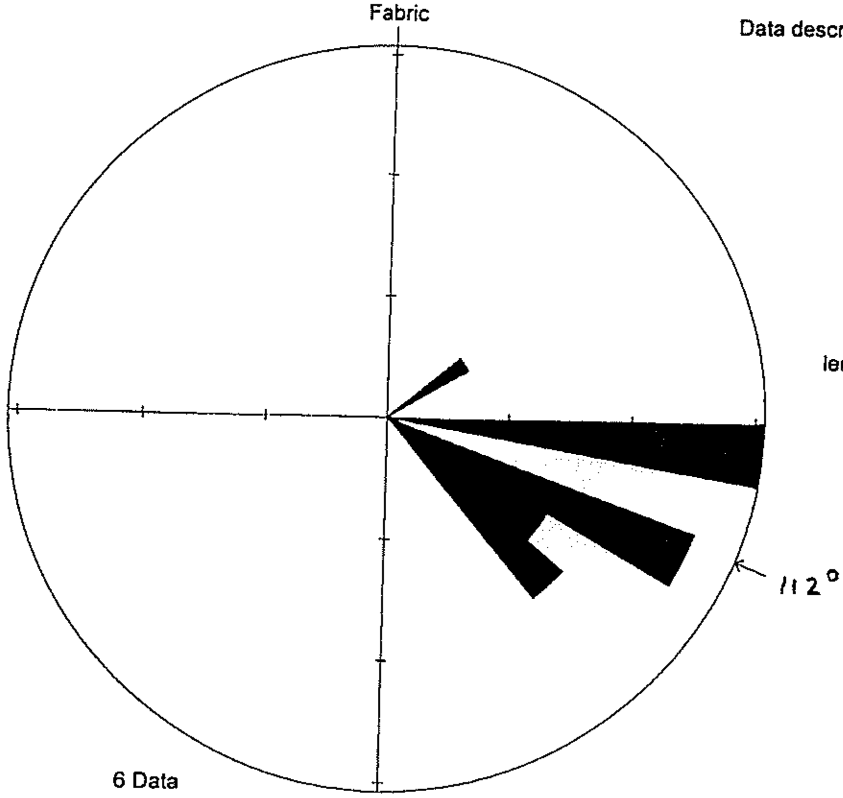
CV130B
2

Data description CV130B

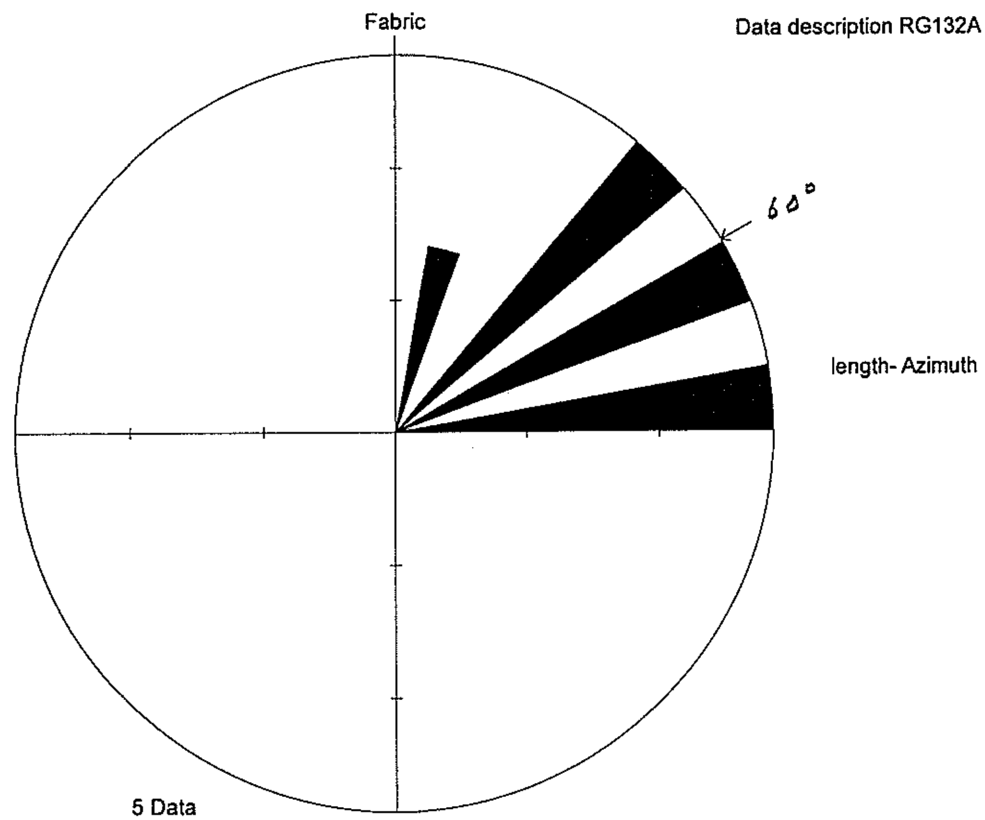


length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 0.70]
Maximum = 57.1% [length: 4]
Total length = 7
Mean Resultant dir'n = 041

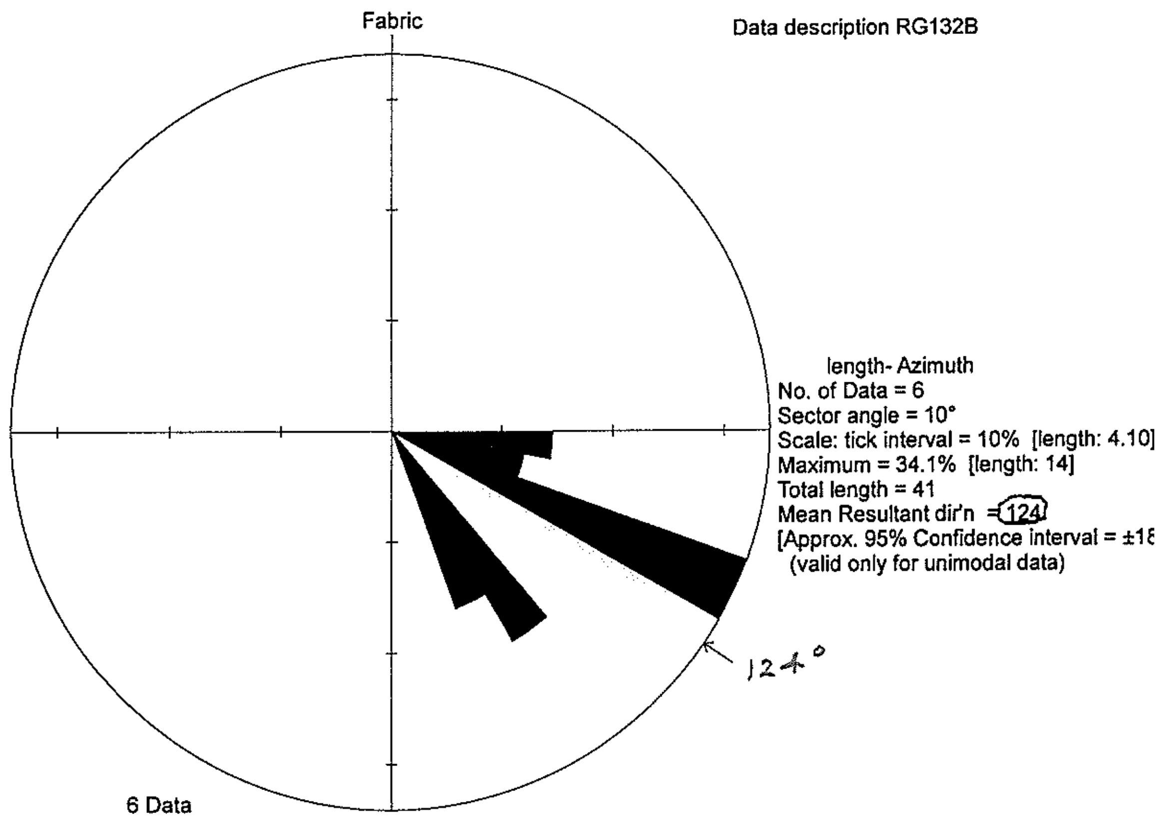
RG131
6



RG132A
5

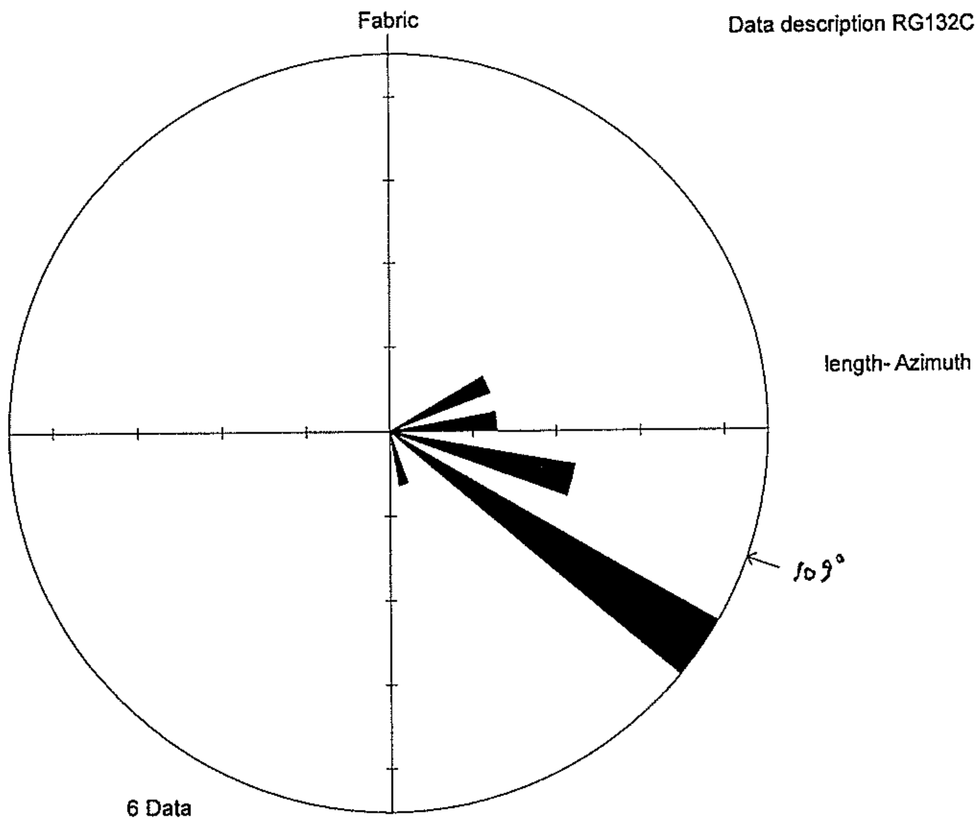


RG132B
6

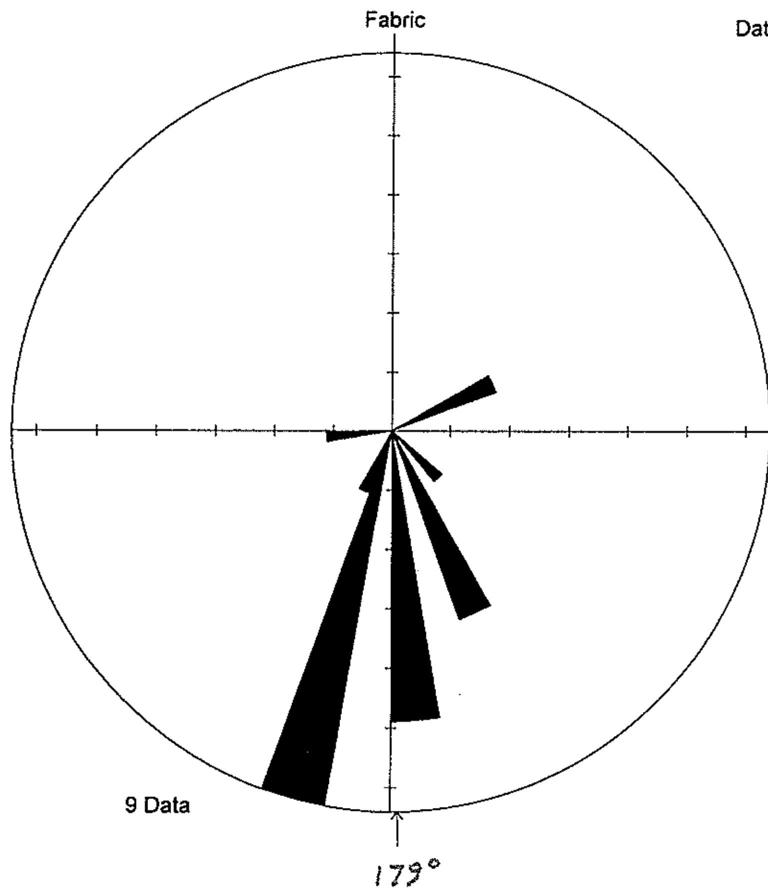


Fabric
Data description RG132B
length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 10% [length: 4.10]
Maximum = 34.1% [length: 14]
Total length = 41
Mean Resultant dir'n = 124
[Approx. 95% Confidence interval = ±18
(valid only for unimodal data)
124°
6 Data

RG132C
6



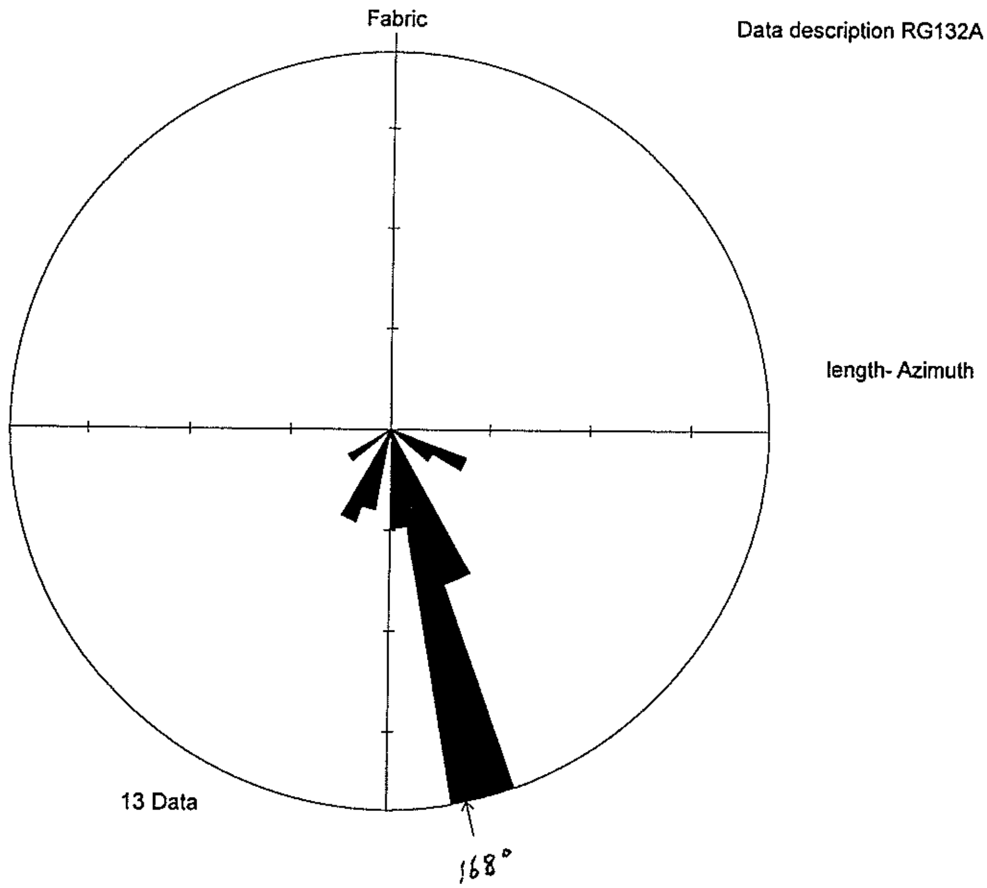
RG132D
9



Data description RG132D

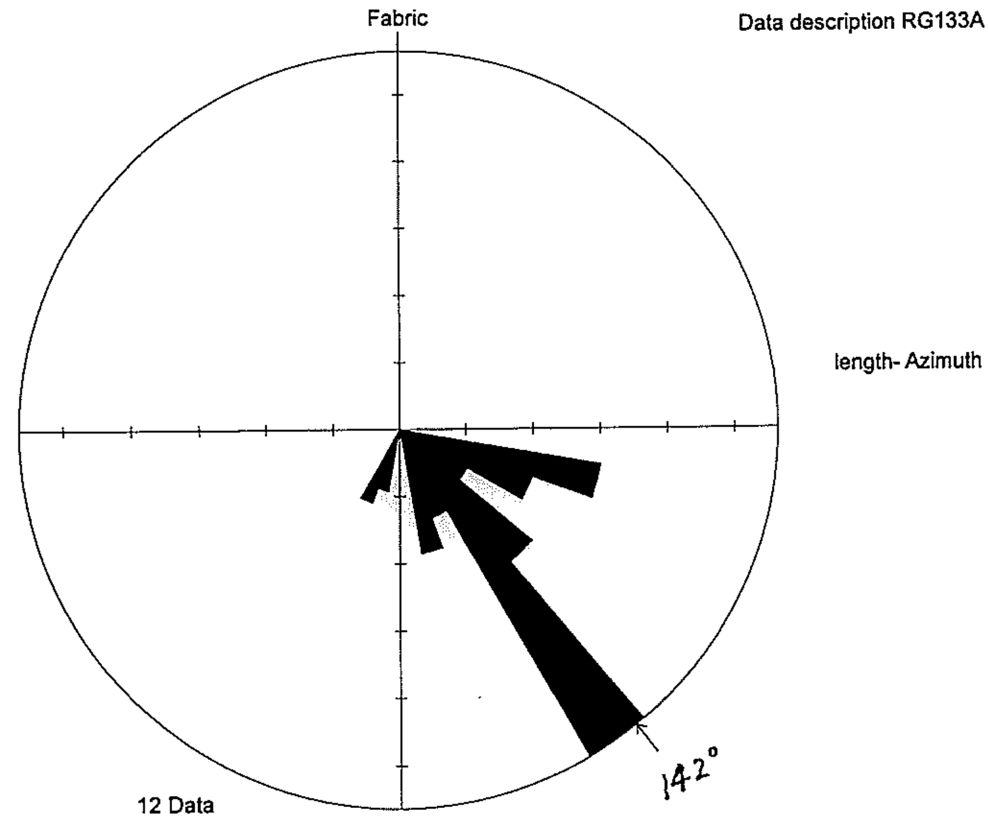
length- Azimuth
No. of Data = 9
Sector angle = 10°
Scale: tick interval = 5% [length: 2.65]
Maximum = 32.1% [length: 17]
Total length = 53
Mean Resultant dir'n = 179
[Approx. 95% Confidence interval = ±2
(valid only for unimodal data)

RG132E
13

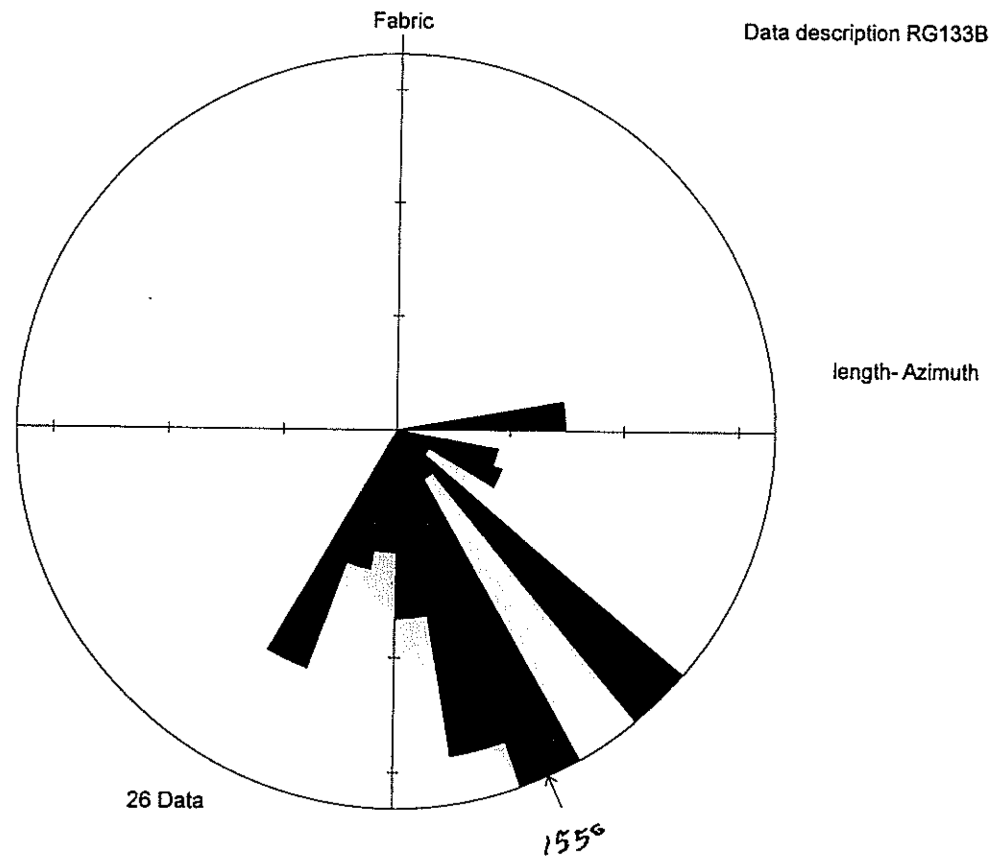


RG133A (rvsd)

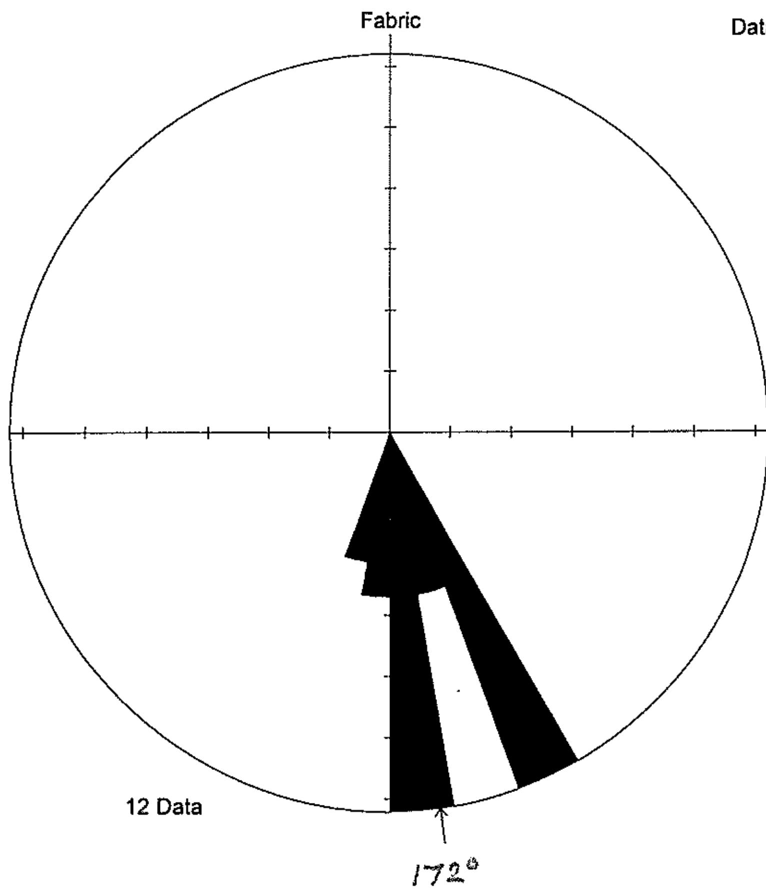
12



RG133B (rvsd)
26



RG133C
12

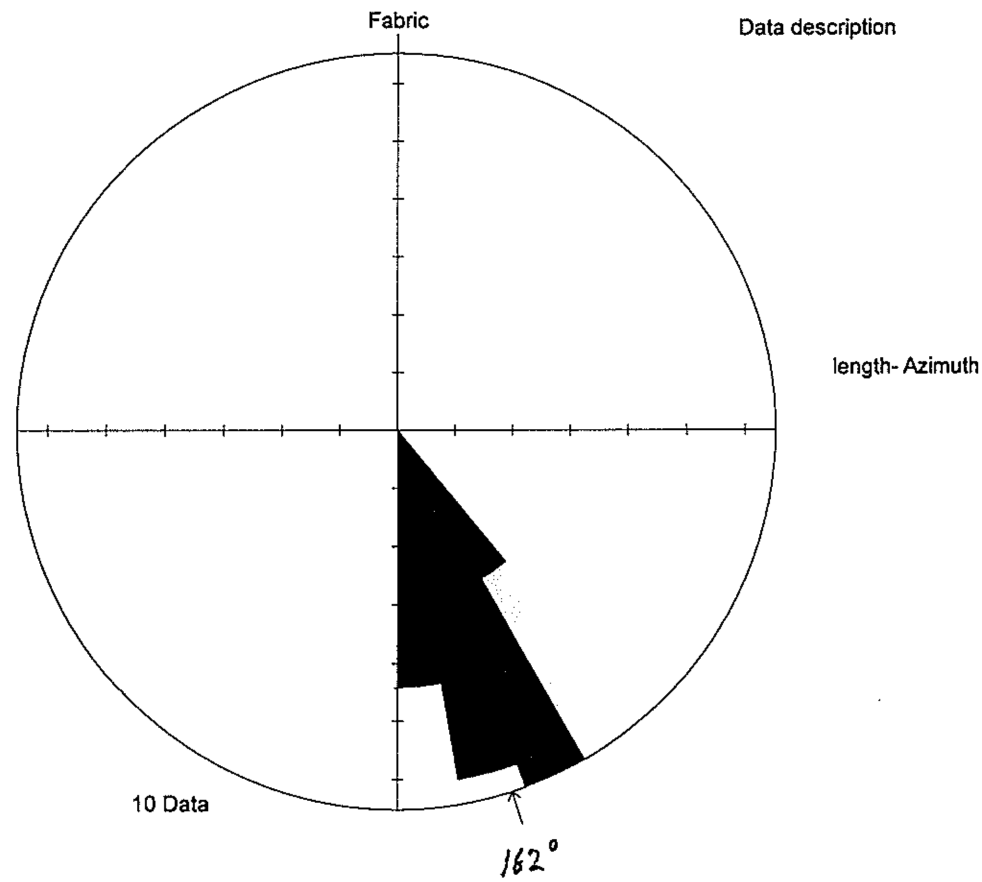


Data description RG133C

length- Azimuth
No. of Data = 12
Sector angle = 10°
Scale: tick interval = 5% [length: 3.70]
Maximum = 31.1% [length: 23]
Total length = 74
Mean Resultant dir'n = 172
[Approx. 95% Confidence interval = ±7
(valid only for unimodal data)

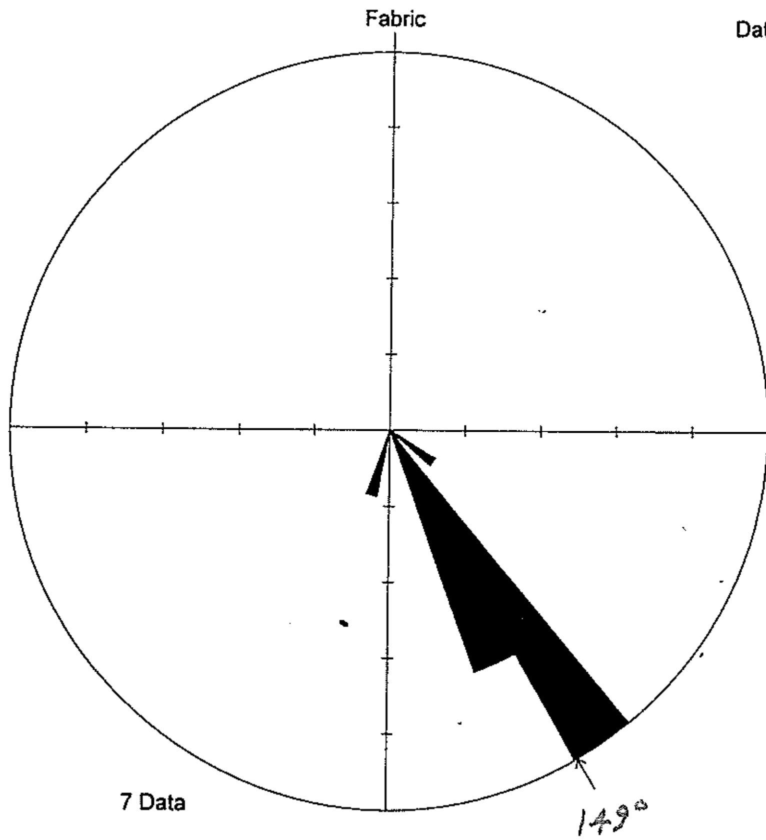
RG134A (rvsd)

10



RG134B
7

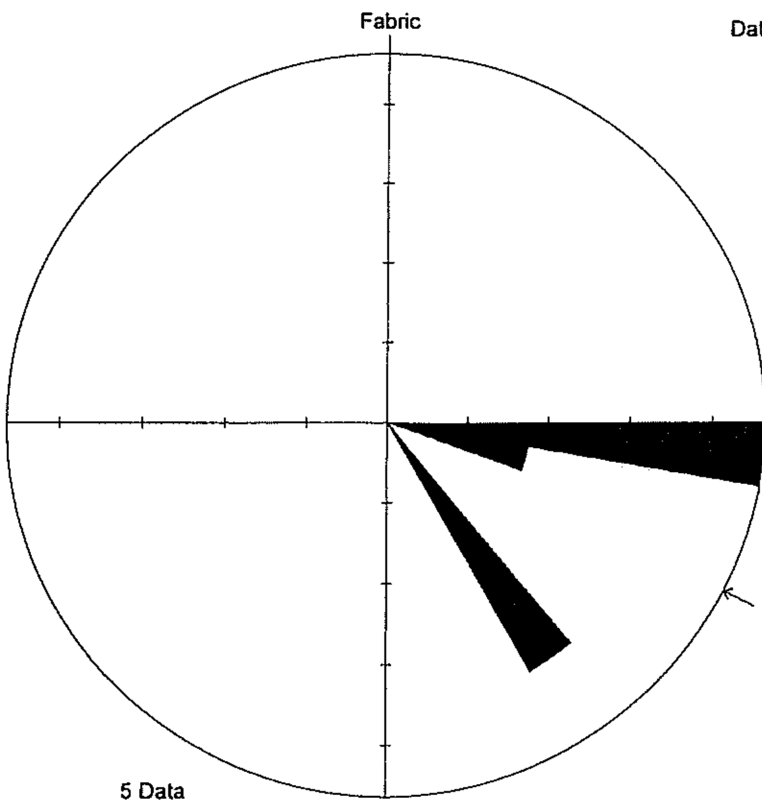
Data description RG134B



length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 10% [length: 5.60
Maximum = 50% [length: 28]
Total length = 56
Mean Resultant dir'n = 149
[Approx. 95% Confidence interval = ±1'
(valid only for unimodal data)

RG135
5

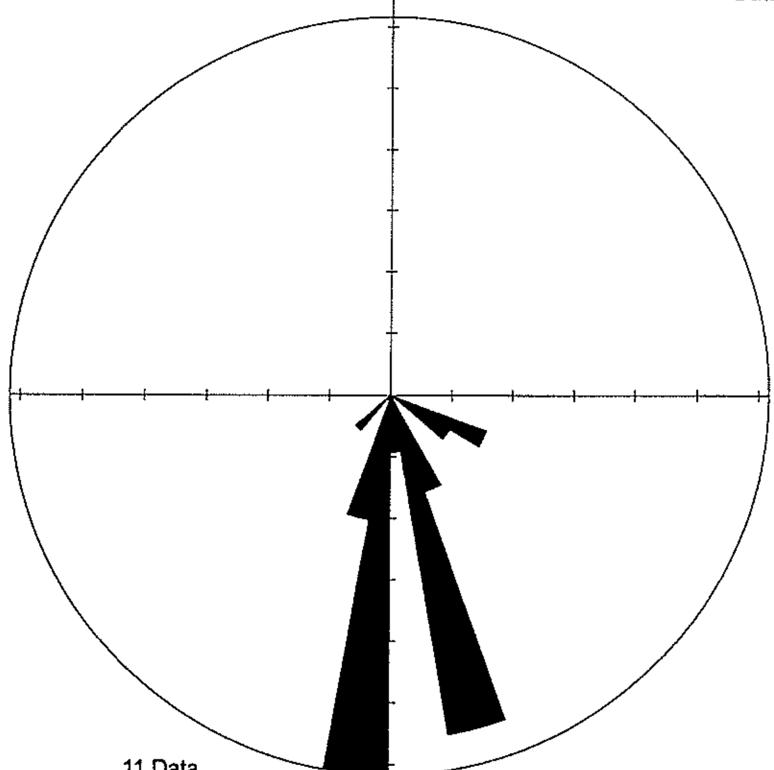
Data description RG135



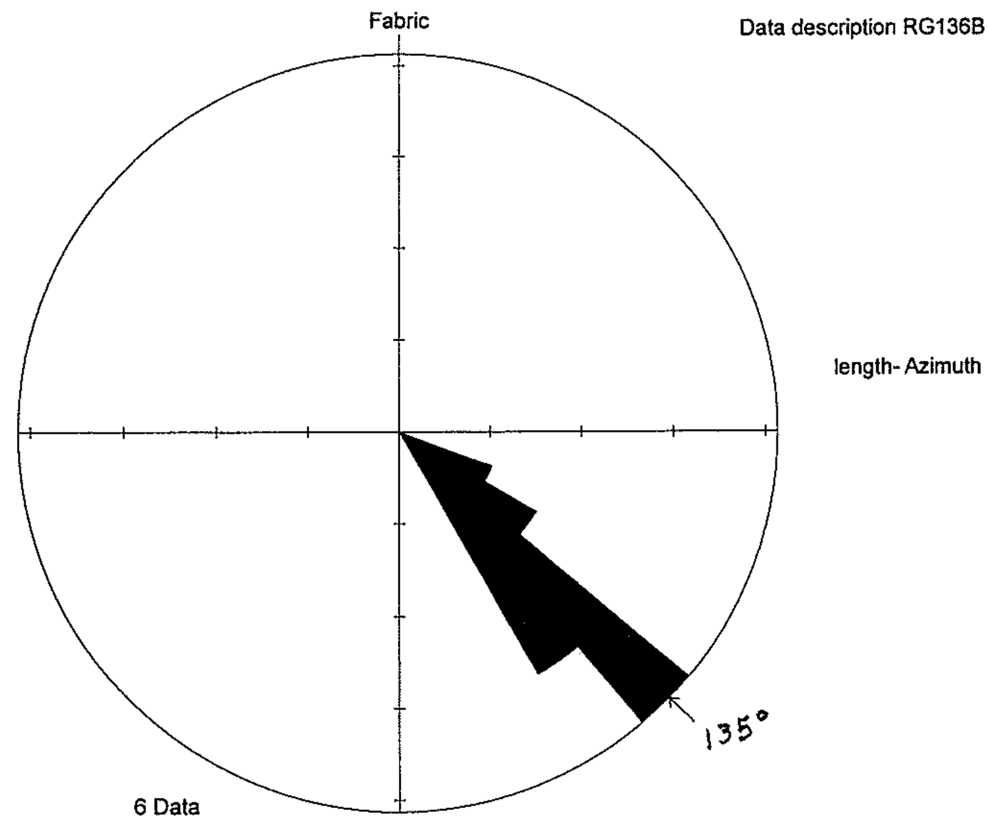
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 2.80]
Maximum = 46.4% [length: 13]
Total length = 28
Mean Resultant dir'n = 117
[Approx. 95% Confidence interval = ±18.
(valid only for unimodal data)

117°

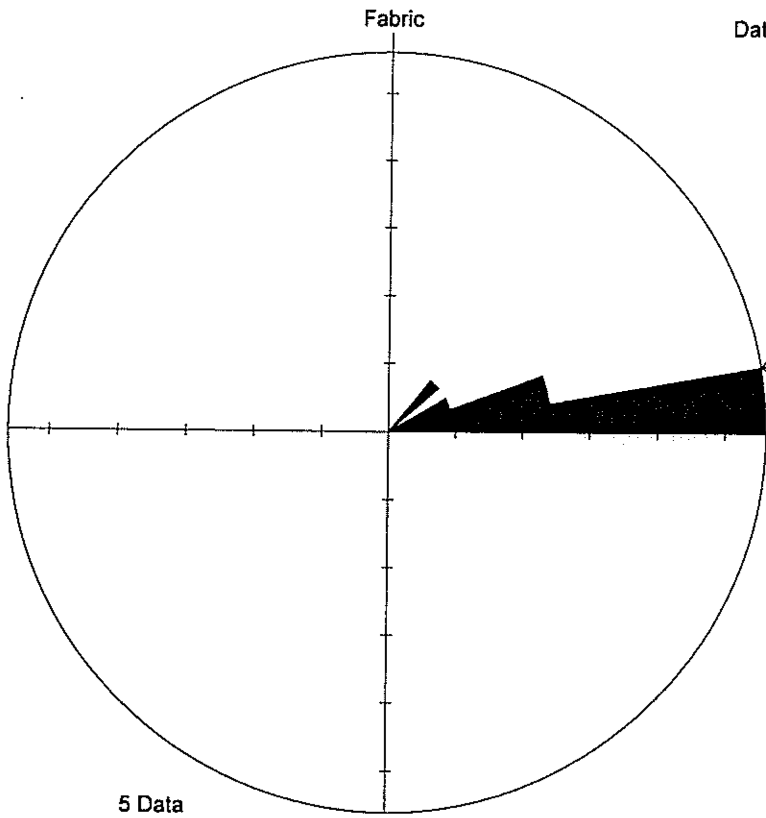
RG136A
11



RG 136 B (rvsd)



RG 136 C
(new)
5

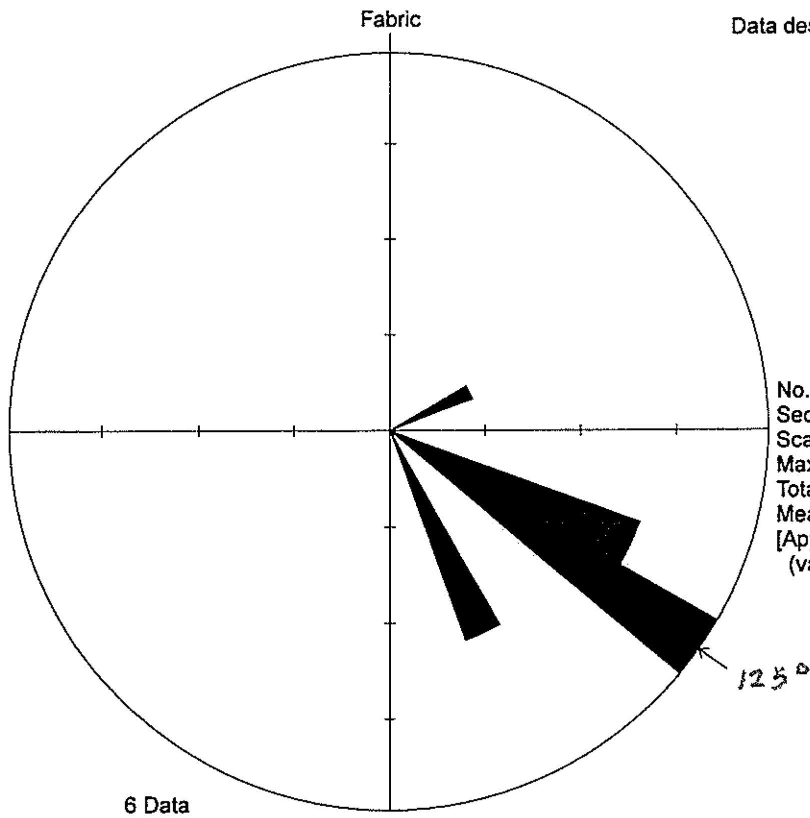


Data description RG136C

80°

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 4.1C
Maximum = 56.1% [length: 23]
Total length = 41
Mean Resultant dir'n = 080
[Approx. 95% Confidence interval = ±1:
(valid only for unimodal data)

RG137B
6

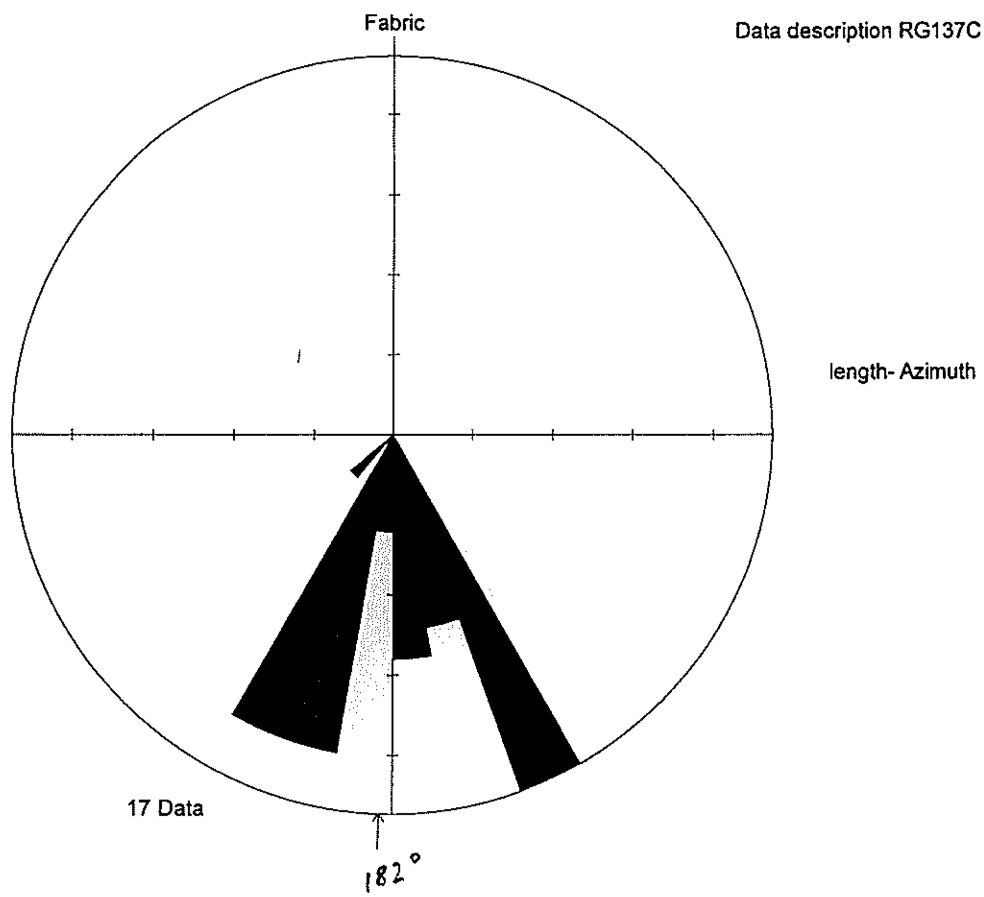


Data description RG137B

length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 10% [length: 4.30]
Maximum = 39.5% [length: 17]
Total length = 43
Mean Resultant dir'n = 125
[Approx. 95% Confidence interval = ±16.
(valid only for unimodal data)

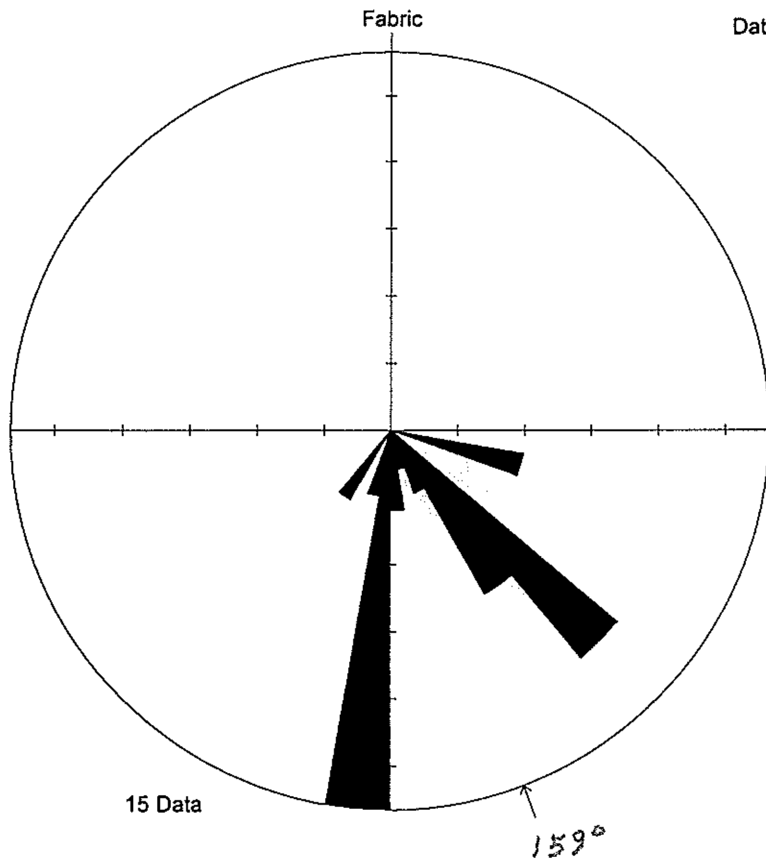
RG137C

17



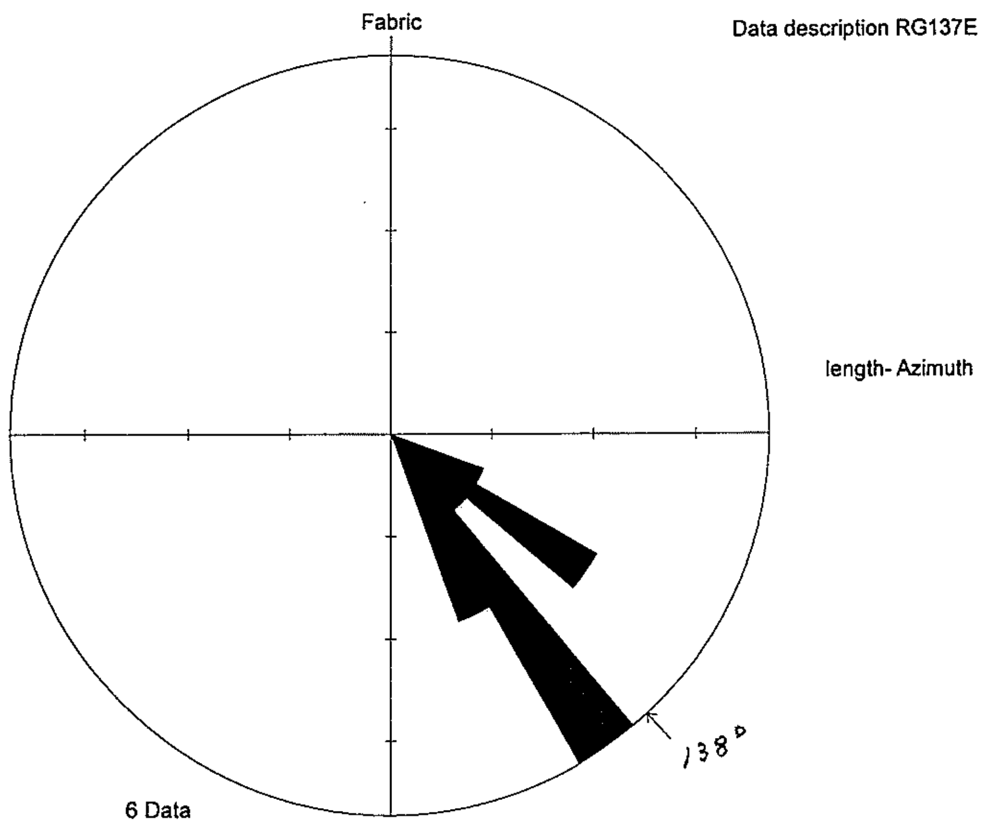
RG137D
15

Data description RG137D

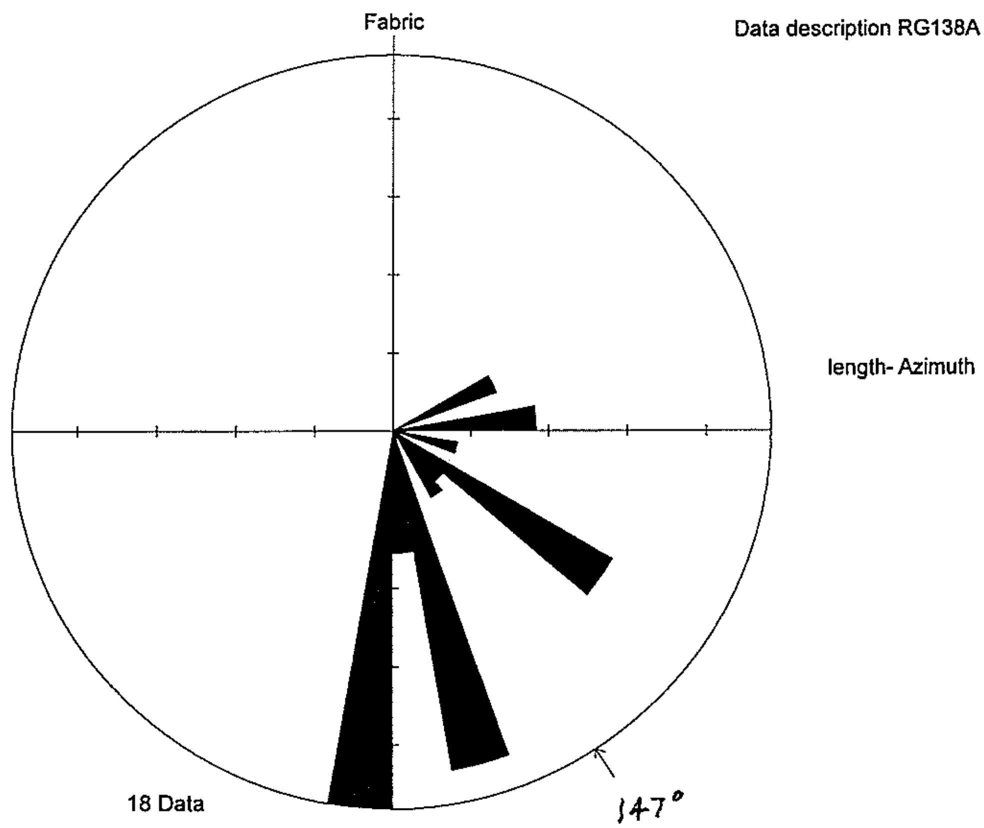


length- Azimuth
No. of Data = 15
Sector angle = 10°
Scale: tick interval = 5% [length: 4.95]
Maximum = 28.3% [length: 28]
Total length = 99
Mean Resultant dir'n = 159
[Approx. 95% Confidence interval = ±16
(valid only for unimodal data)

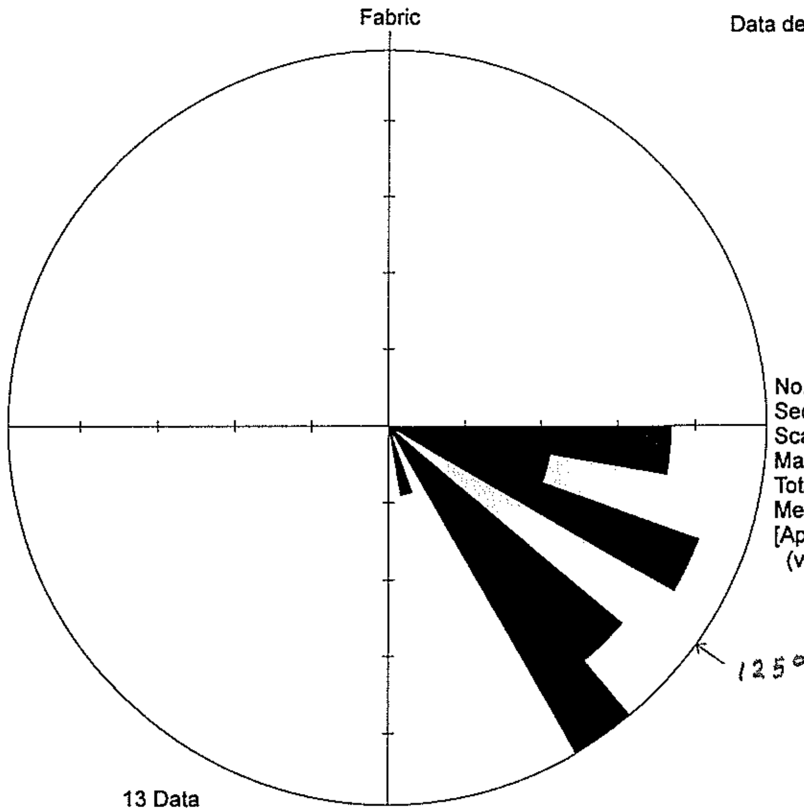
RG137E
6



RG138A
18



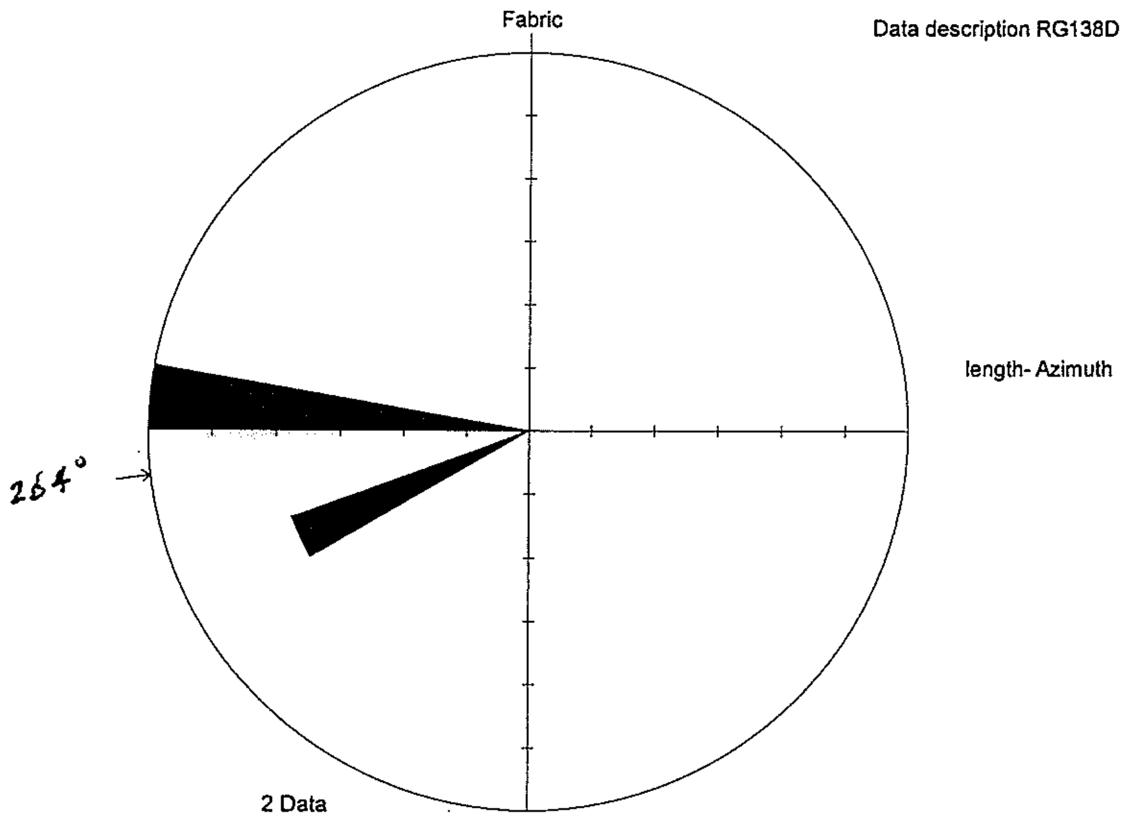
RG138B
13



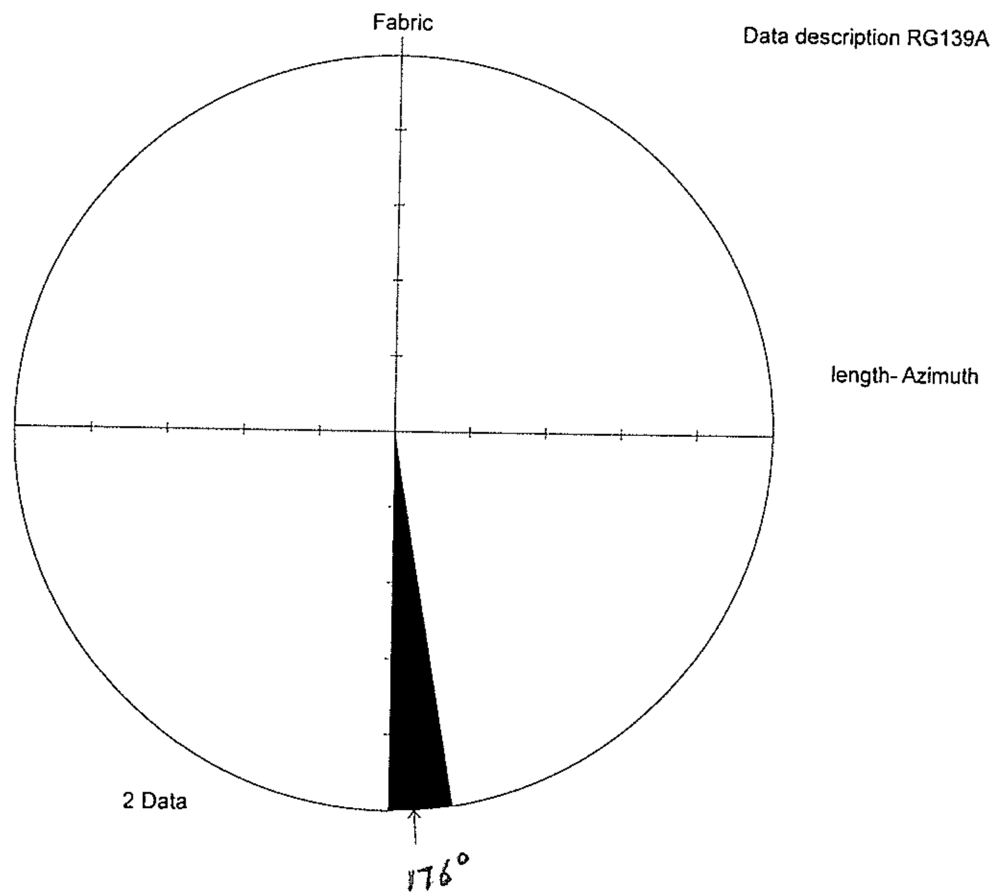
Data description RG138B

length- Azimuth
No. of Data = 13
Sector angle = 10°
Scale: tick interval = 5% [length: 3.25]
Maximum = 24.6% [length: 16]
Total length = 65
Mean Resultant dir'n = 125
[Approx. 95% Confidence interval = ±10
(valid only for unimodal data)

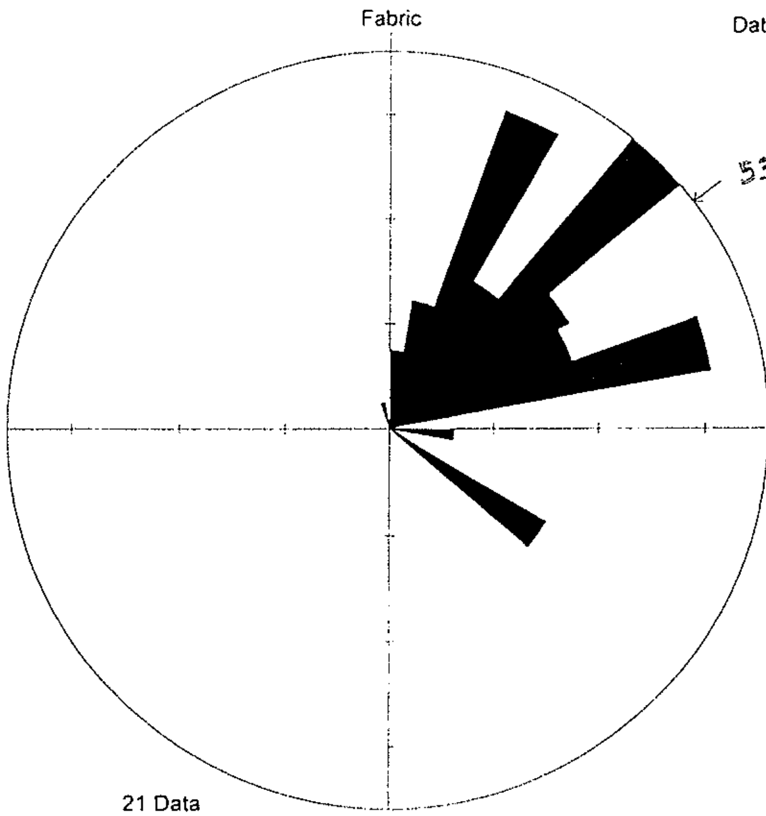
RG138D (new)
2



RG 139A (rvsd)
2



RG139B
21

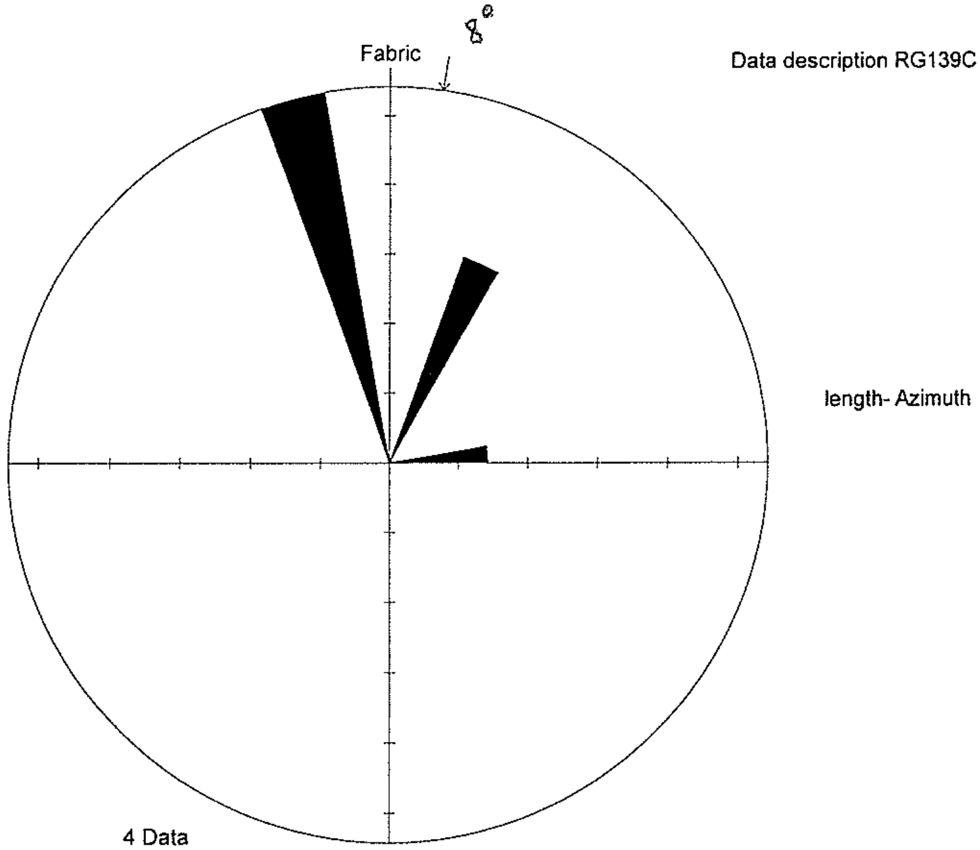


Data description RG139B

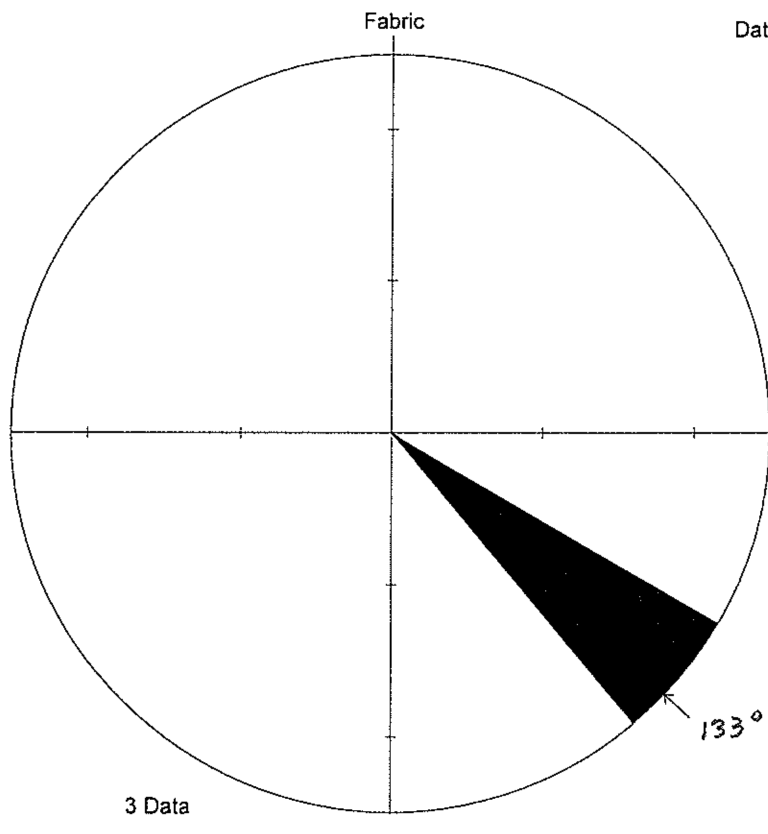
length- Azimuth
No. of Data = 21
Sector angle = 10°
Scale: tick interval = 5% [length: 8.05]
Maximum = 18.0% [length: 29]
Total length = 161
Mean Resultant dir'n = 053
[Approx. 95% Confidence interval = ±13
(valid only for unimodal data)

RG 139C (rvsd)

4



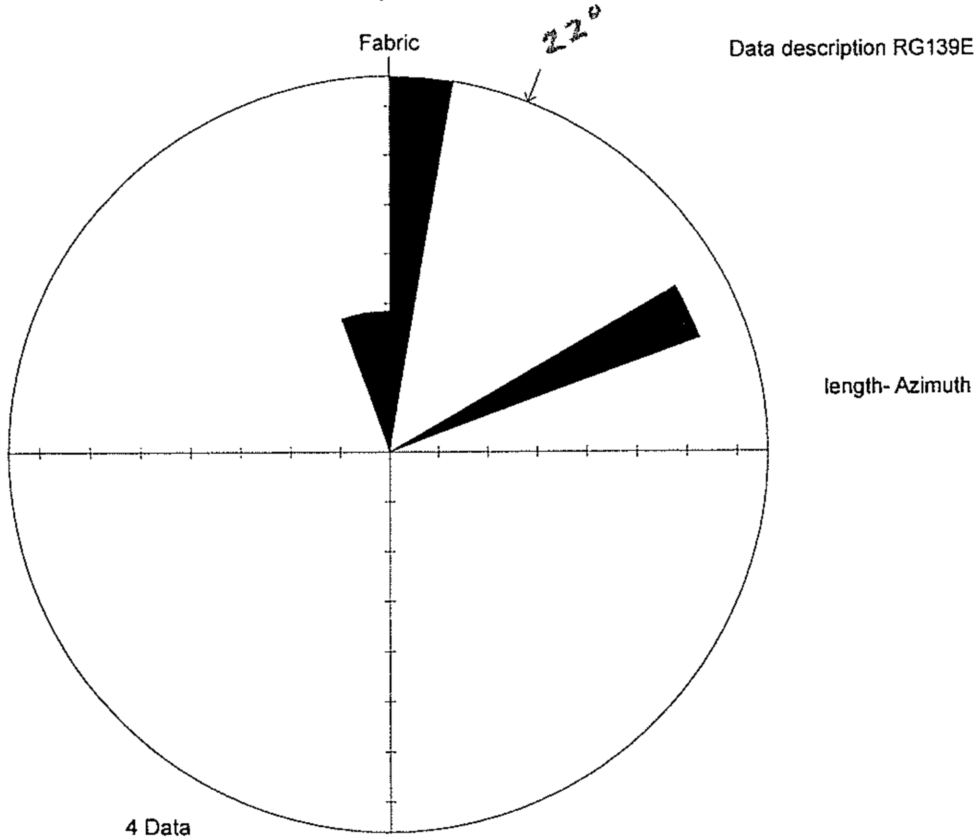
RG139D (rvsd)
3



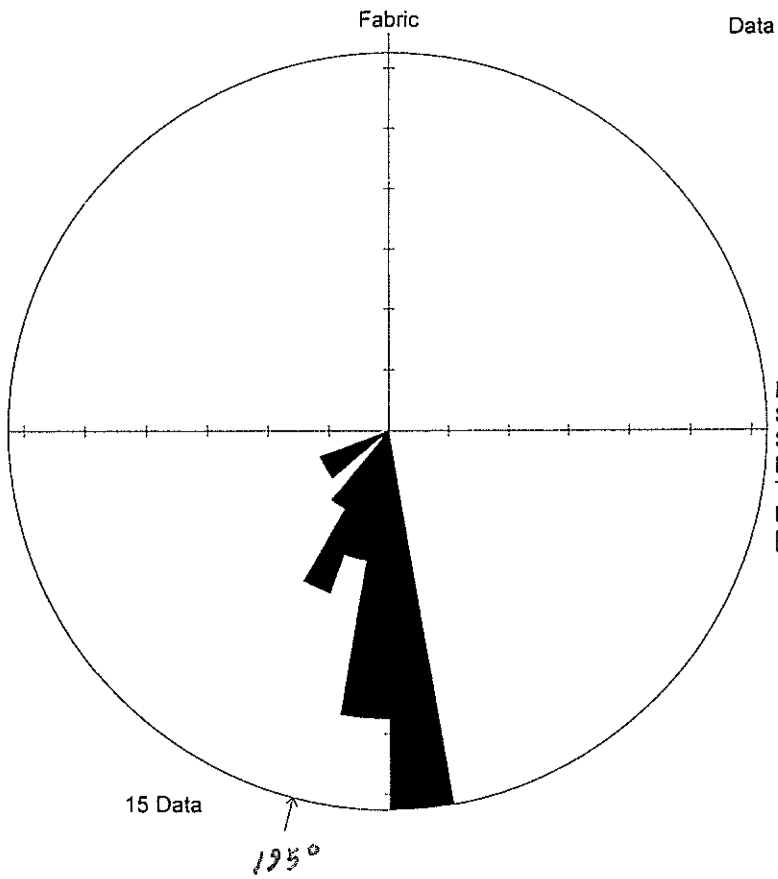
Data description RG139D

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 20% [length: 3.60
Maximum = 50% [length: 9]
Total length = 18
Mean Resultant dir'n = 133

RG139E
4



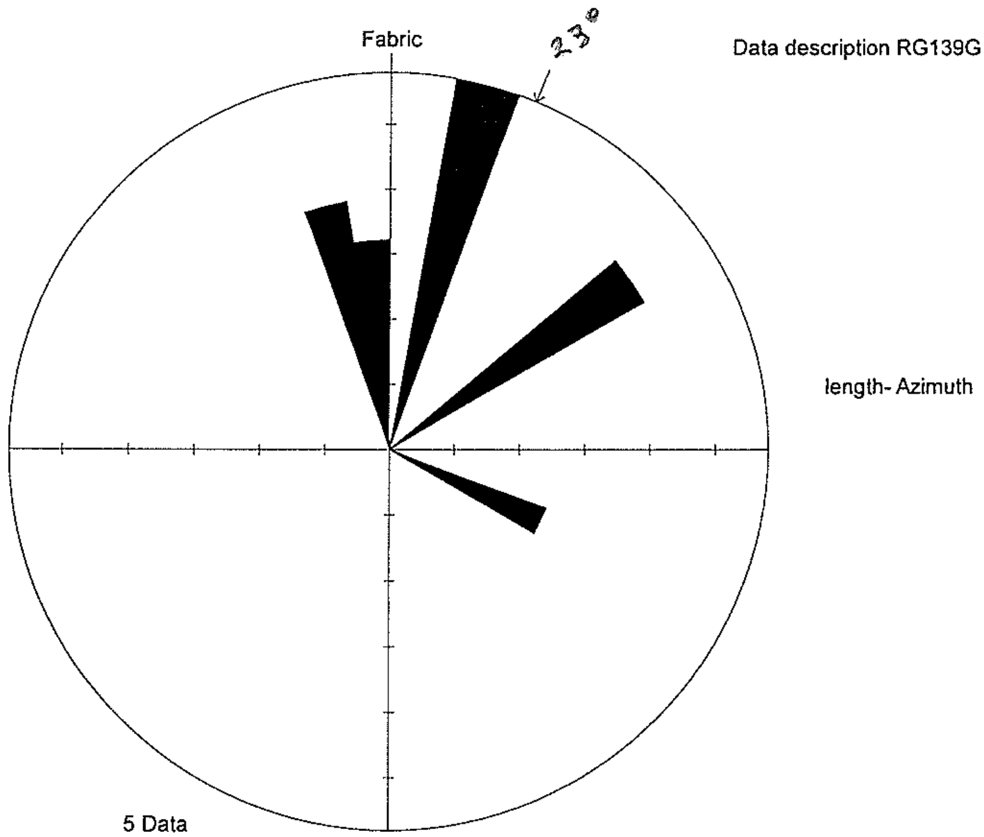
RG139F
15



Data description RG139F

length- Azimuth
No. of Data = 15
Sector angle = 10°
Scale: tick interval = 5% [length: 7.35]
Maximum = 31.3% [length: 46]
Total length = 147
Mean Resultant dir'n = 195
[Approx. 95% Confidence interval = ±1C
(valid only for unimodal data)

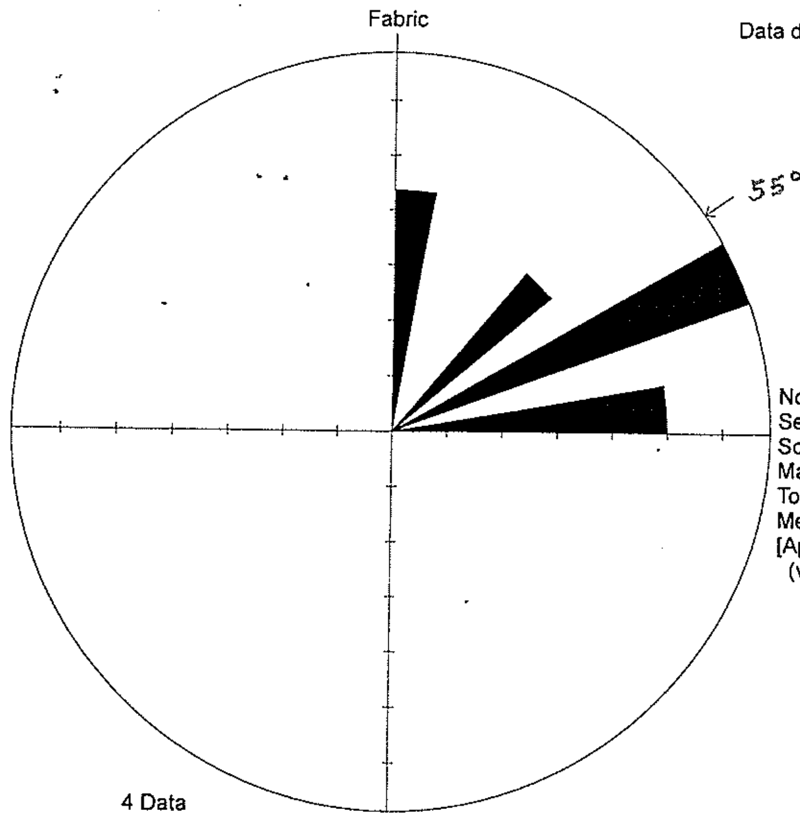
RG139G (rvsd)



RG139H (new)

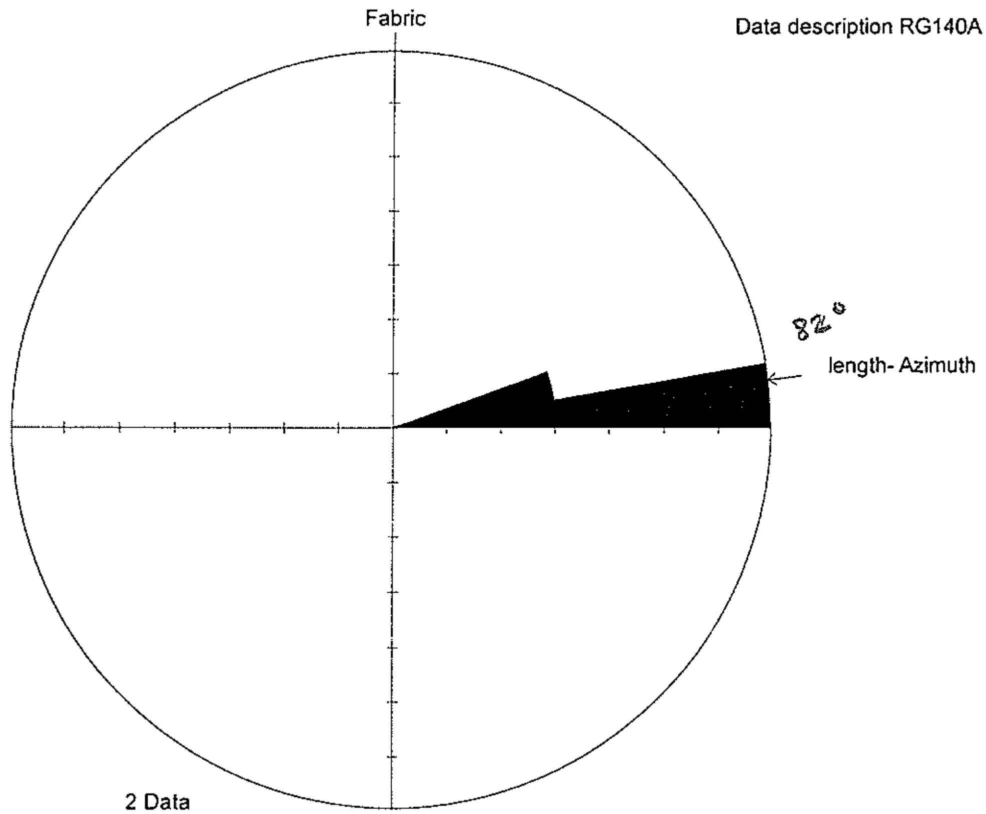
4

Data description RG139H

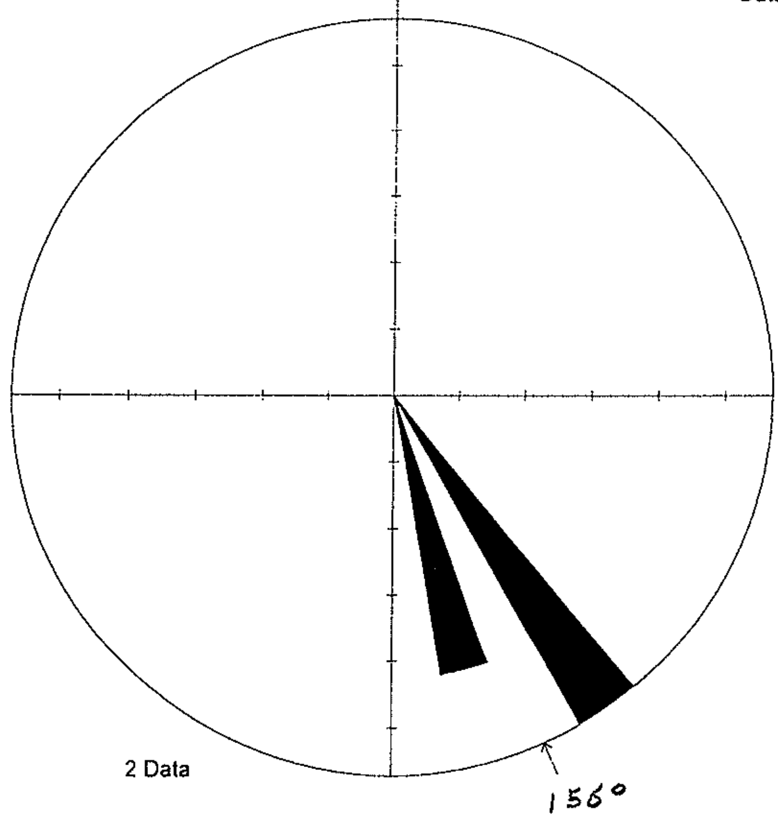


length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 1.60]
Maximum = 34.4% [length: 11]
Total length = 32
Mean Resultant dir'n = 055
[Approx. 95% Confidence interval = ±3
(valid only for unimodal data)

RG140A
2



RG140B
2

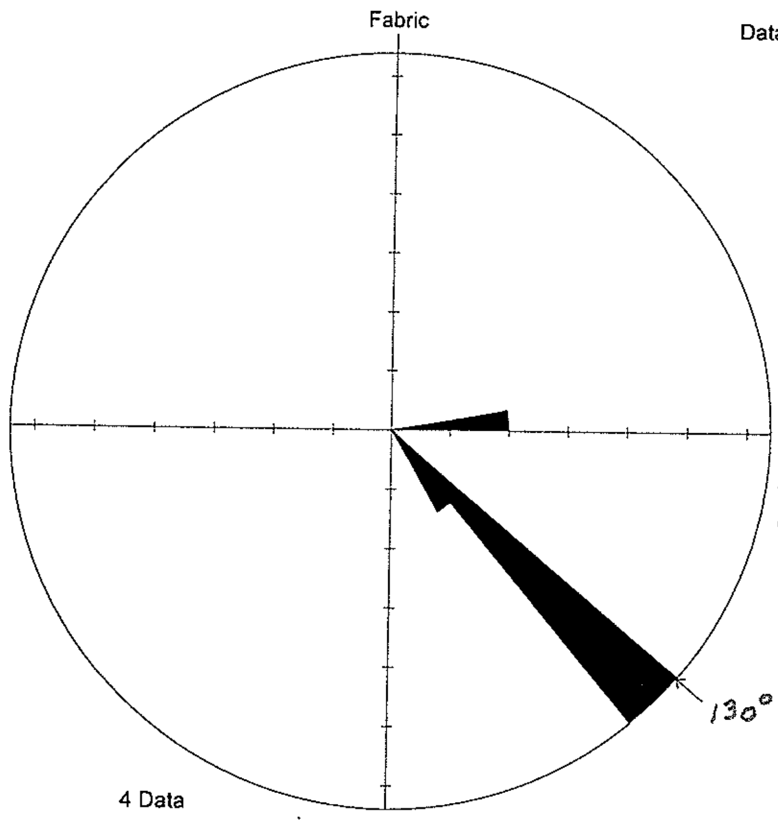


Data description RG140B

length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.40]
Maximum = 57.1% [length: 8]
Total length = 14
Mean Resultant dir'n = 156

RG141 (rvsd)

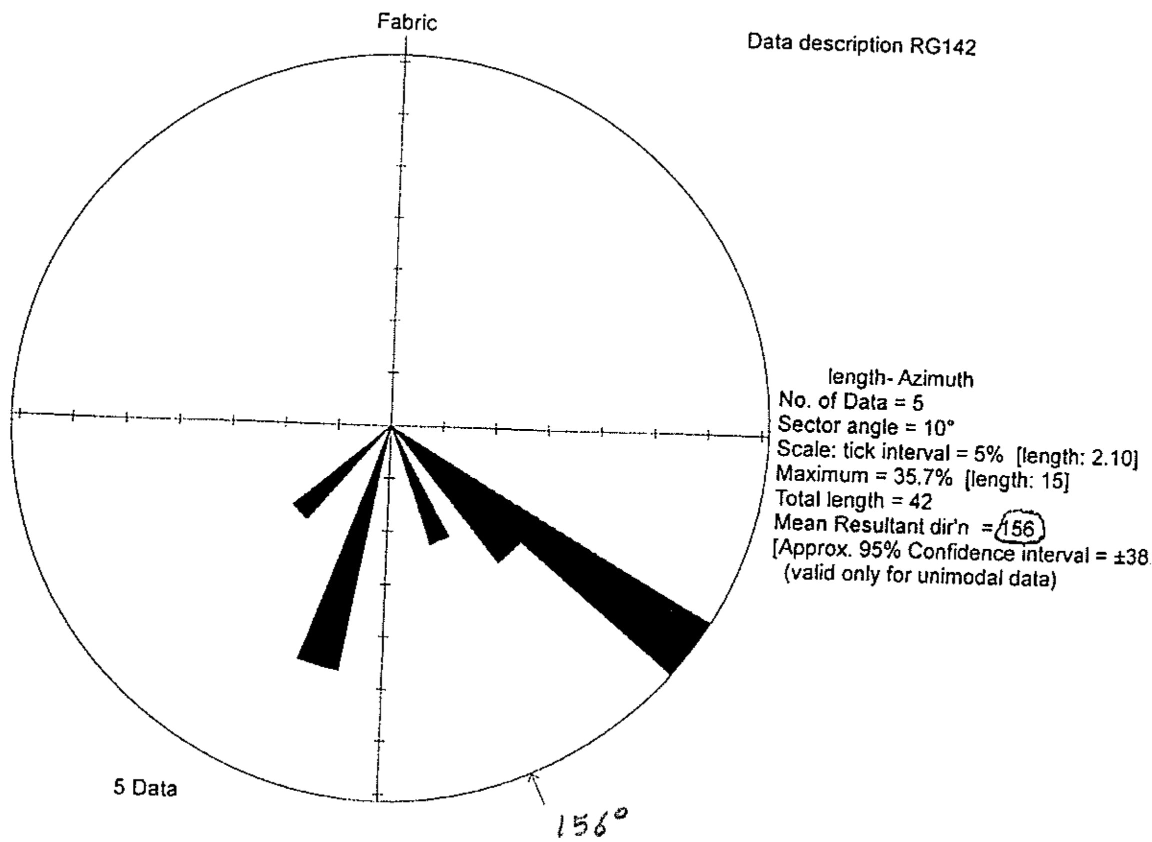
4



Data description RG141

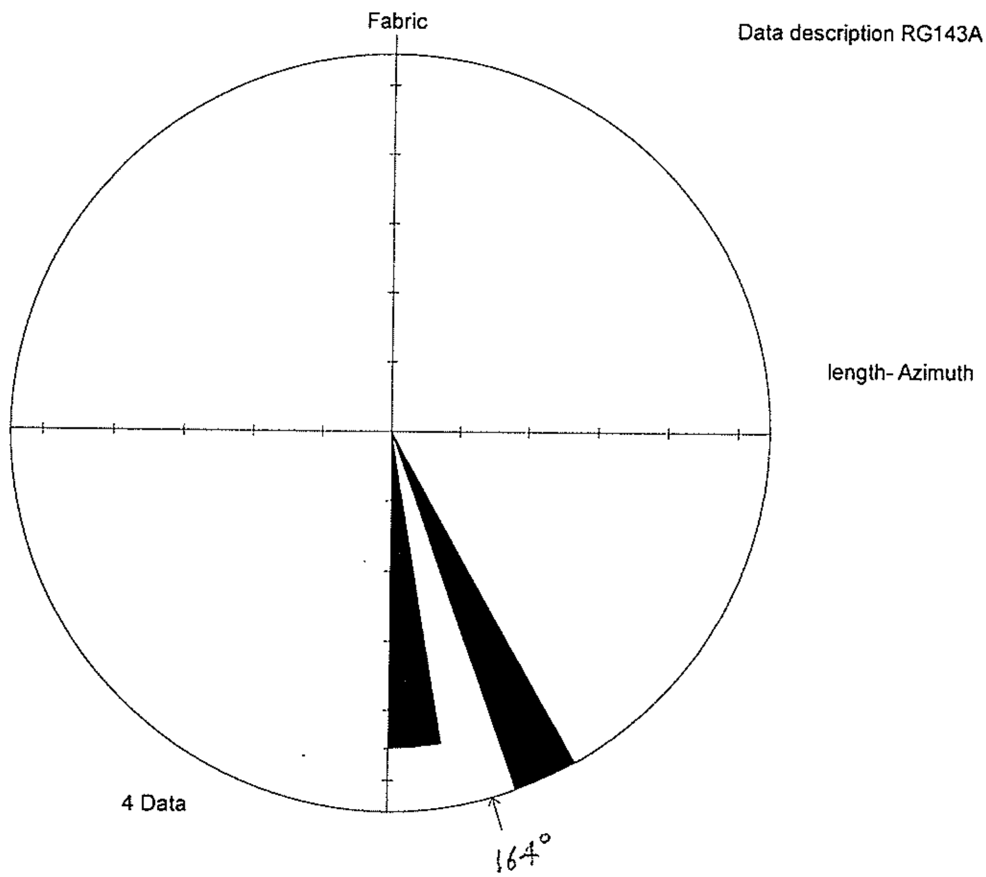
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 2.50]
Maximum = 64% [length: 16]
Total length = 25
Mean Resultant dir'n = 130

RG142
5

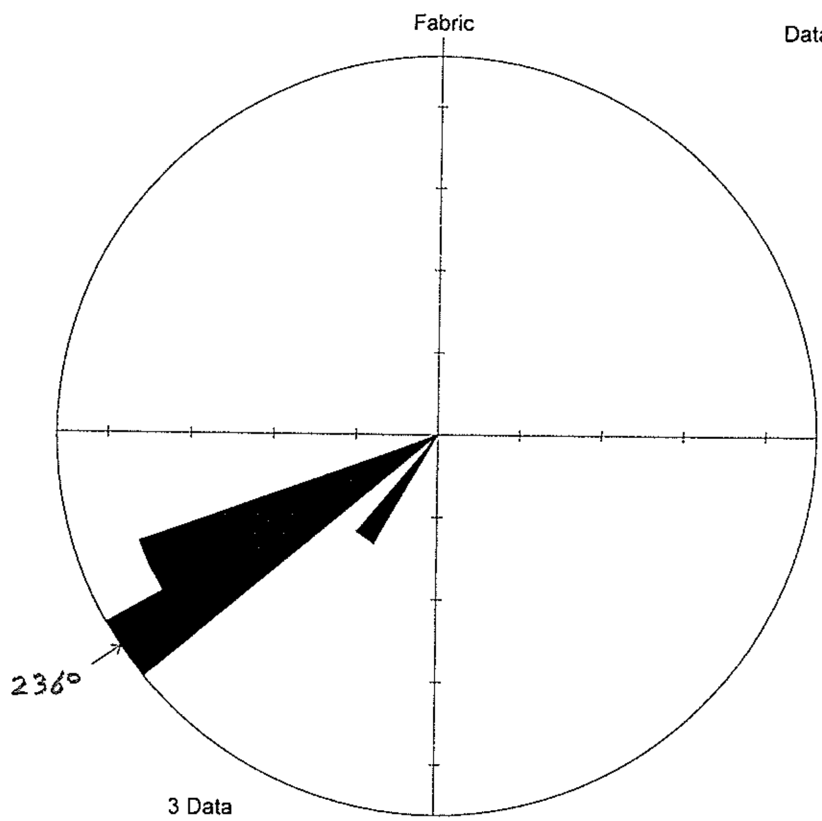

Fabric
Data description RG142
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 5% [length: 2.10]
Maximum = 35.7% [length: 15]
Total length = 42
Mean Resultant dir'n = 156
[Approx. 95% Confidence interval = ±38
(valid only for unimodal data)
5 Data
156°

RG 143A (now)

4



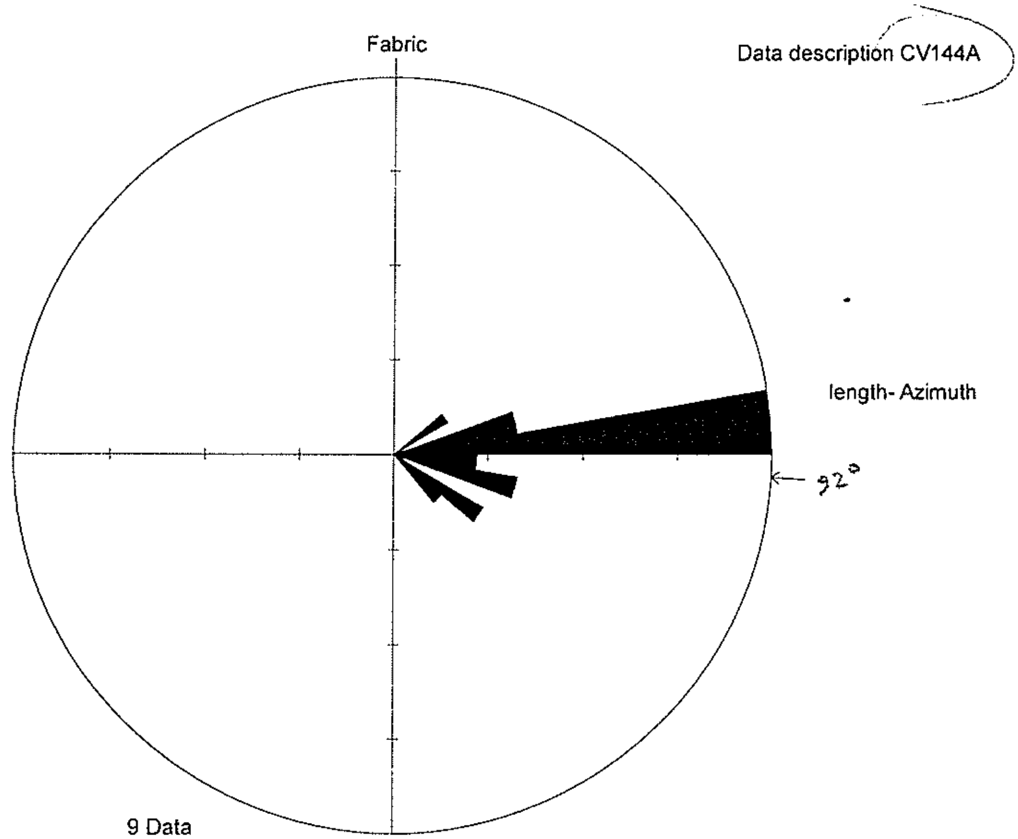
RG143B (new)
3



Data description RG143B

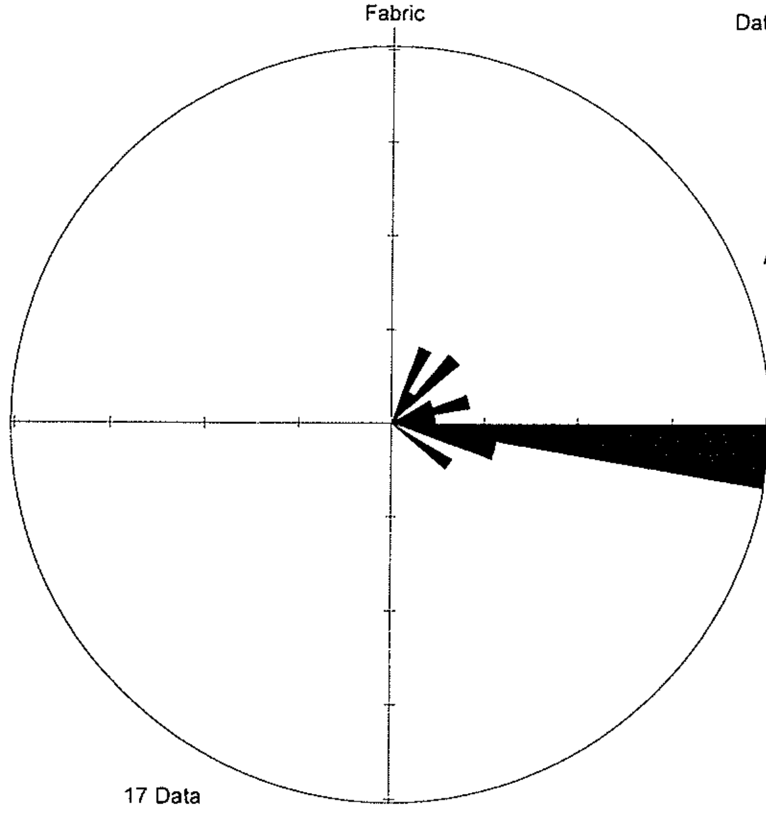
length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.30]
Maximum = 46.2% [length: 6]
Total length = 13
Mean Resultant dir'n = 236

CV144A
9



CV144B
17

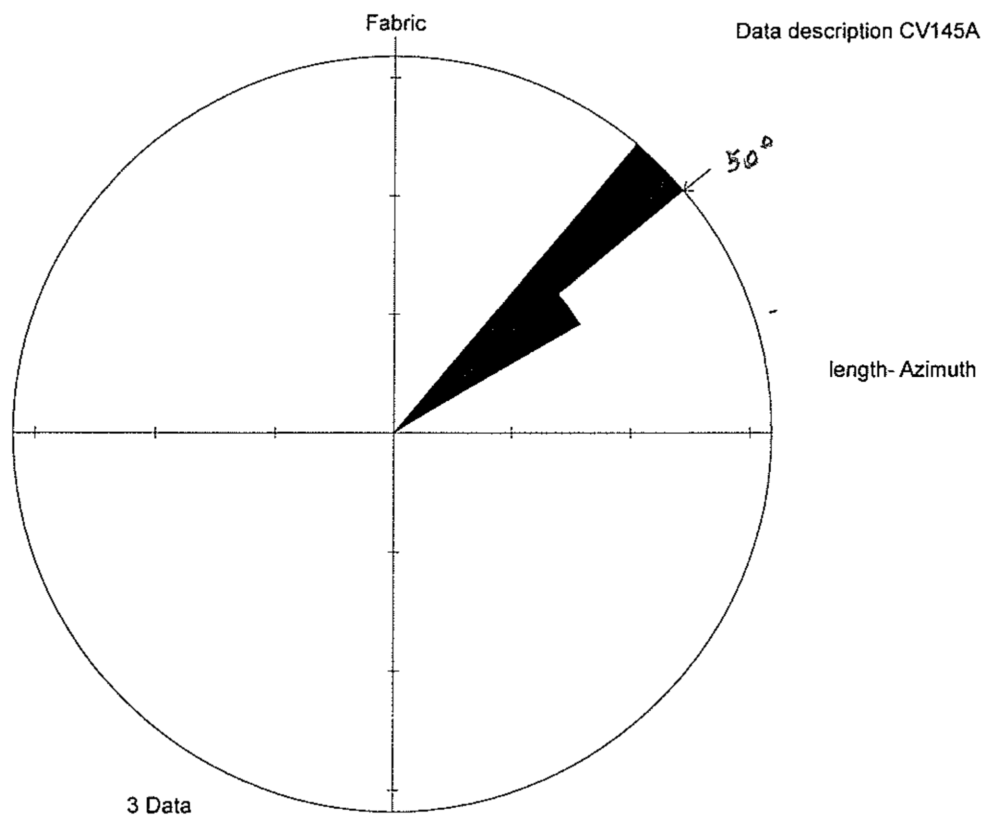
Data description CV144B



82°

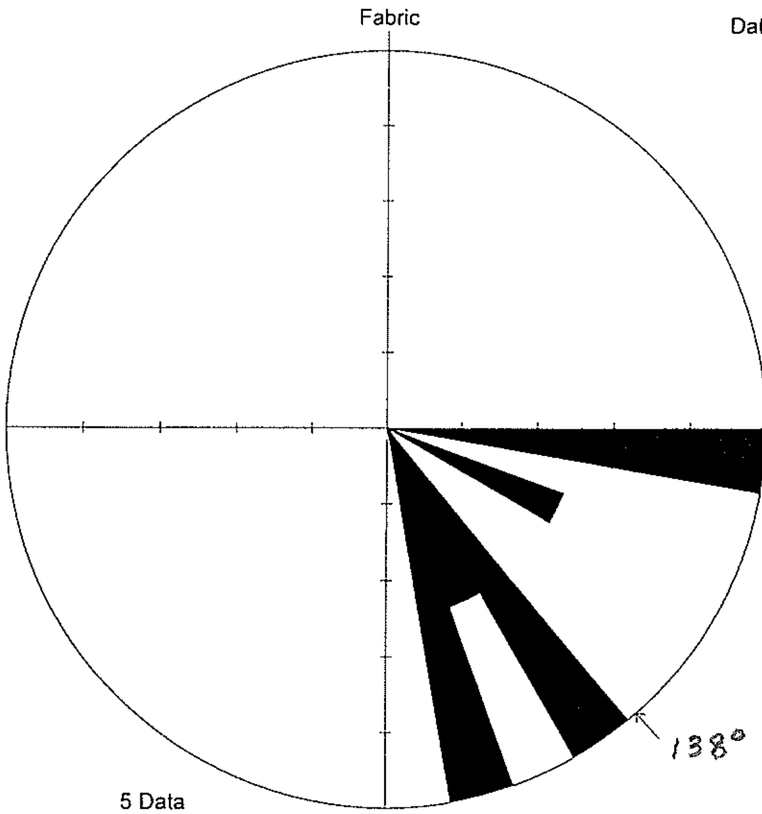
length- Azimuth
No. of Data = 17
Sector angle = 10°
Scale: tick interval = 10% [length: 10.4(
Maximum = 40.4% [length: 42]
Total length = 104
Mean Resultant dir'n = 082
[Approx. 95% Confidence interval = ±12
(valid only for unimodal data)

CV 145A (rvsd)
3



CV145B

5

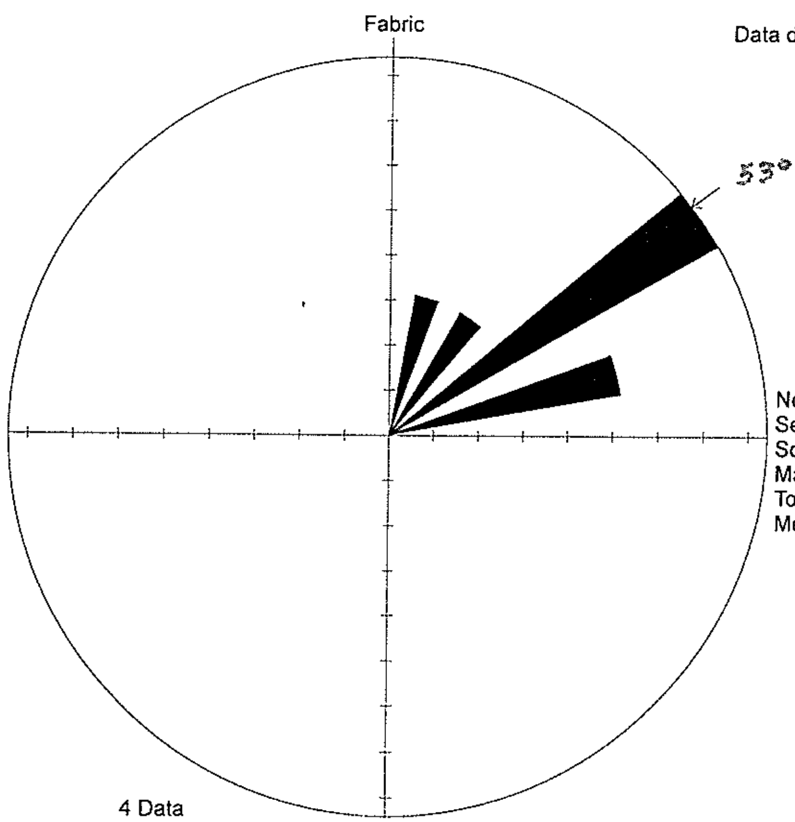


Data description CV145B

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 5% [length: 1.20]
Maximum = 25% [length: 6]
Total length = 24
Mean Resultant dir'n = 138

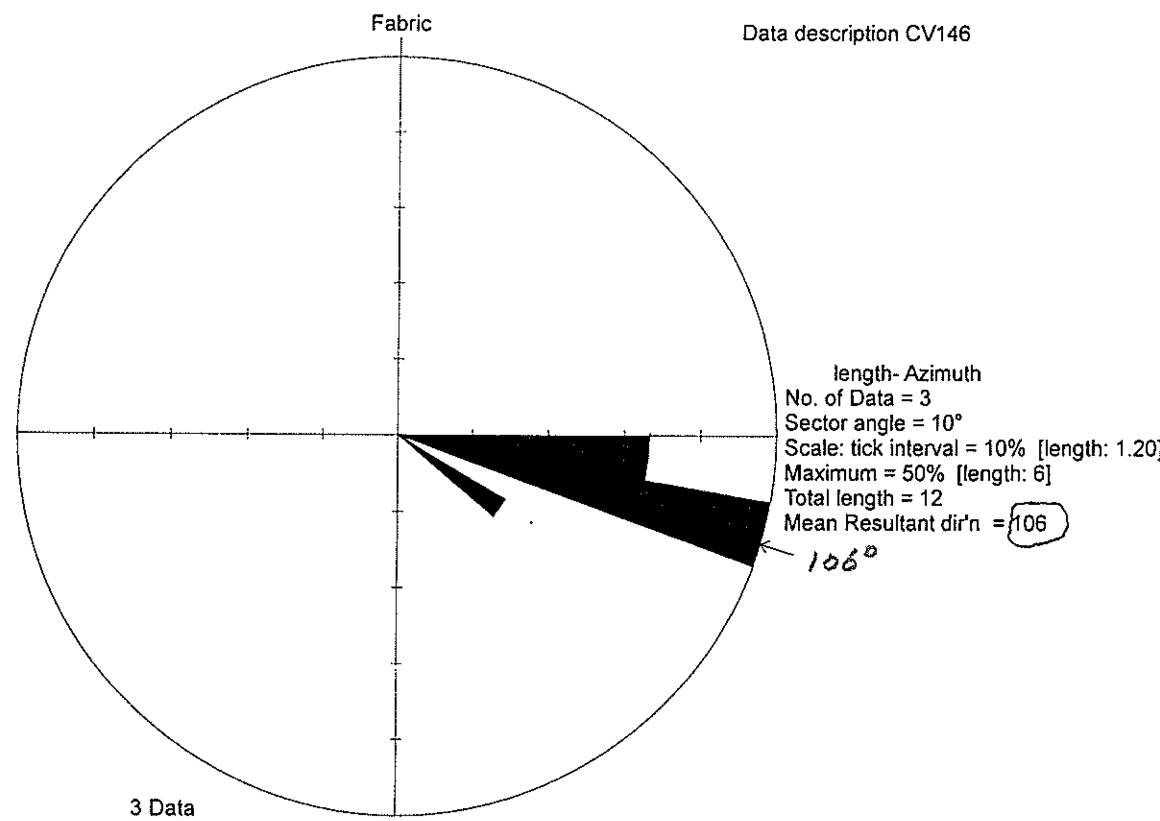
CV145C
4

Data description CV145C



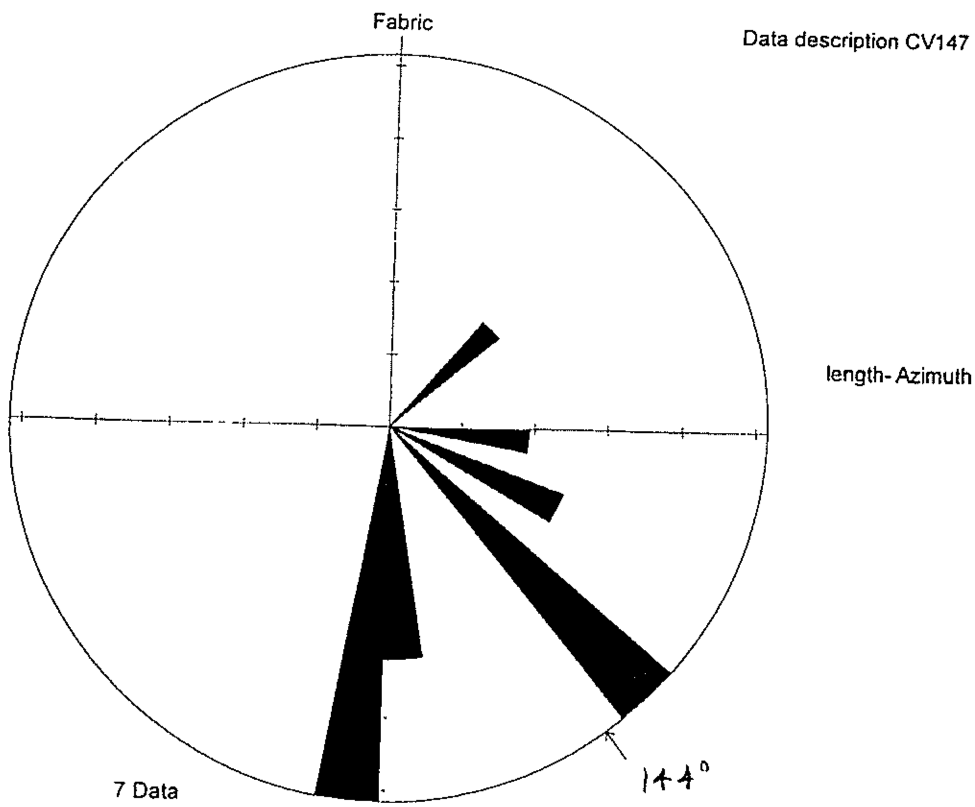
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 0.95]
Maximum = 42.1% [length: 8]
Total length = 19
Mean Resultant dir'n = 053

CV146 (rvsd)
3



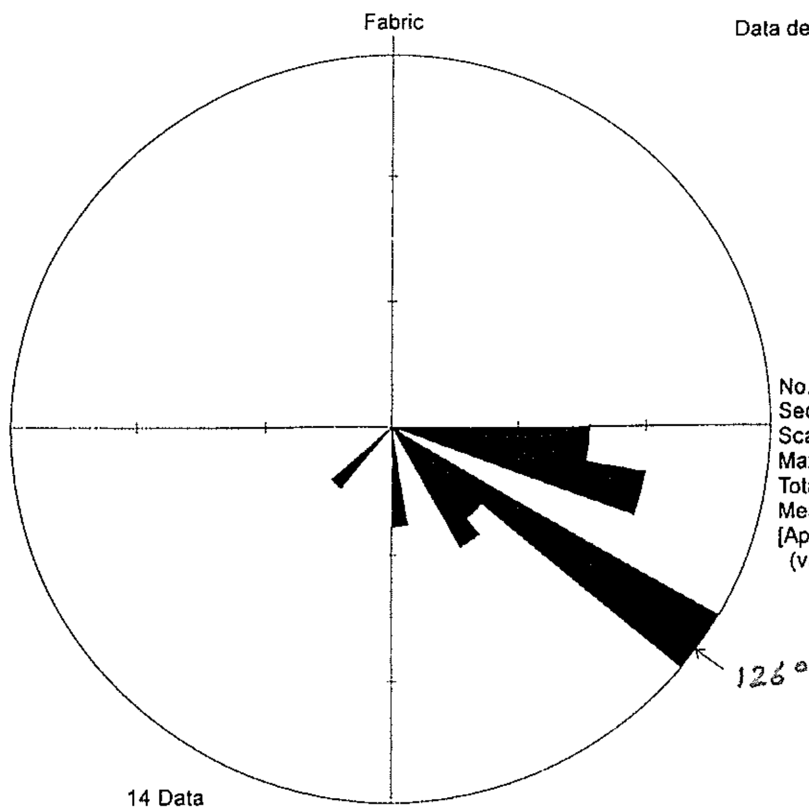
Fabric
Data description CV146
length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.20]
Maximum = 50% [length: 6]
Total length = 12
Mean Resultant dir'n = 106
106°
3 Data

CV147
7



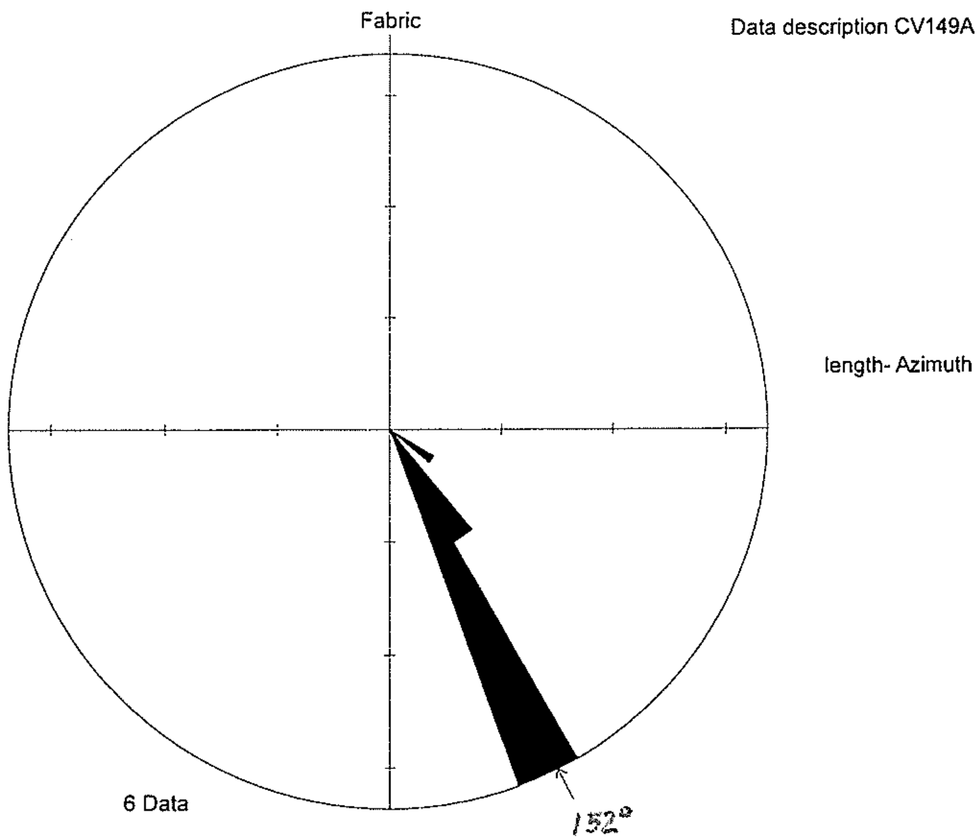
CV148
14

Data description CV148



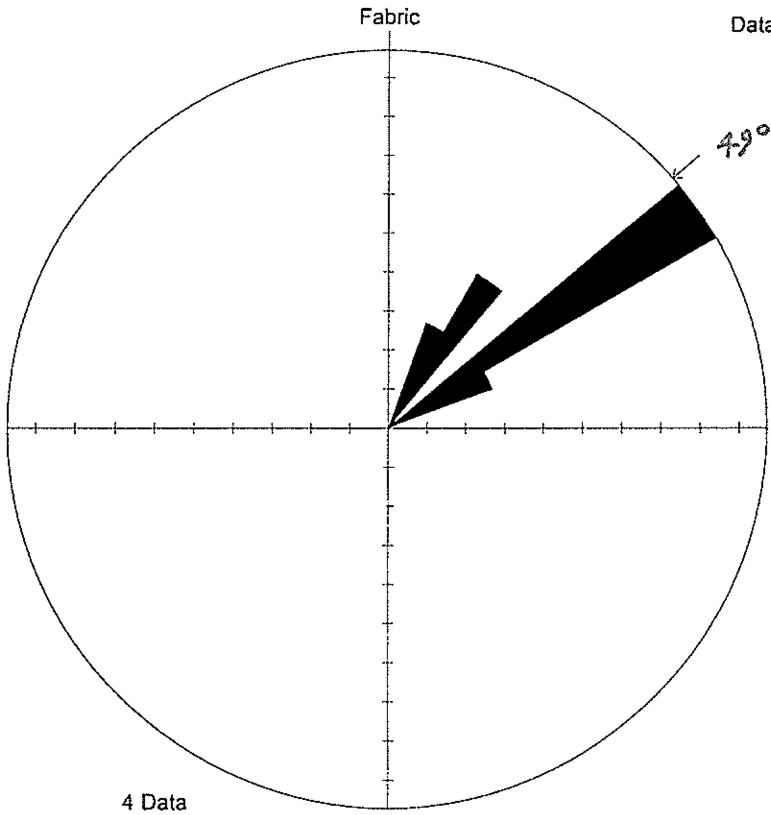
length- Azimuth
No. of Data = 14
Sector angle = 10°
Scale: tick interval = 10% [length: 6.40]
Maximum = 29.7% [length: 19]
Total length = 64
Mean Resultant dir'n = 126
[Approx. 95% Confidence interval = ±15
(valid only for unimodal data)

CV149A
6



CV149B

4

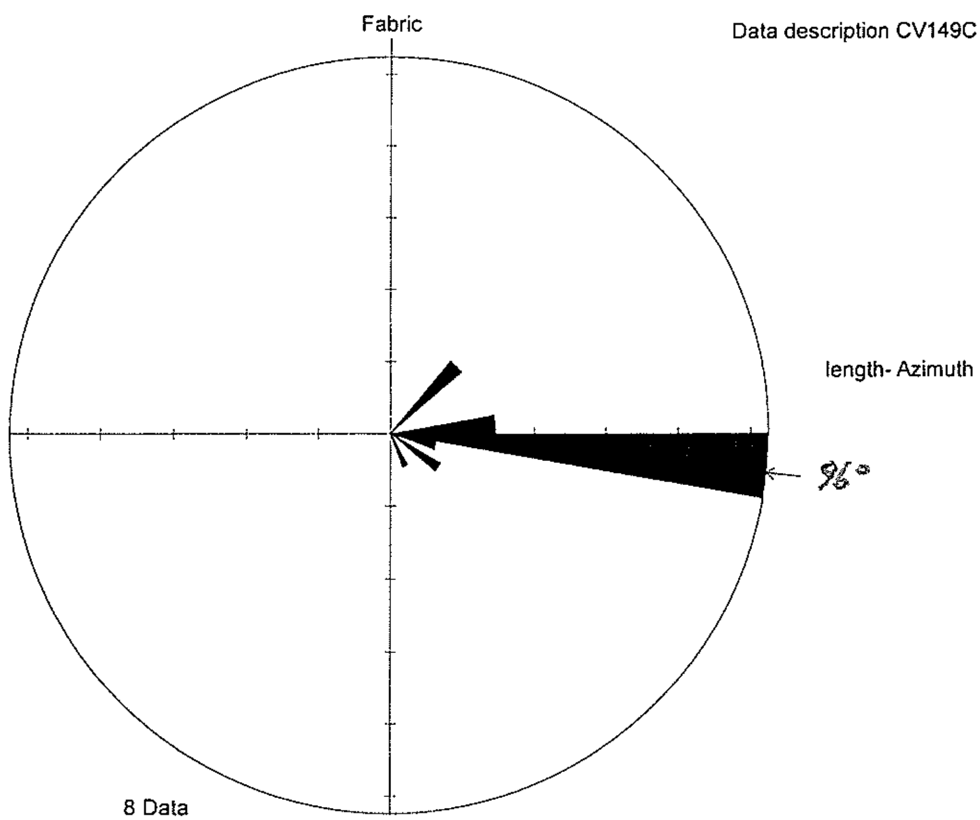


Data description CV149B

length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 1.75]
Maximum = 48.6% [length: 17]
Total length = 35
Mean Resultant dir'n = 049
[Approx. 95% Confidence interval = ±13.:
(valid only for unimodal data)

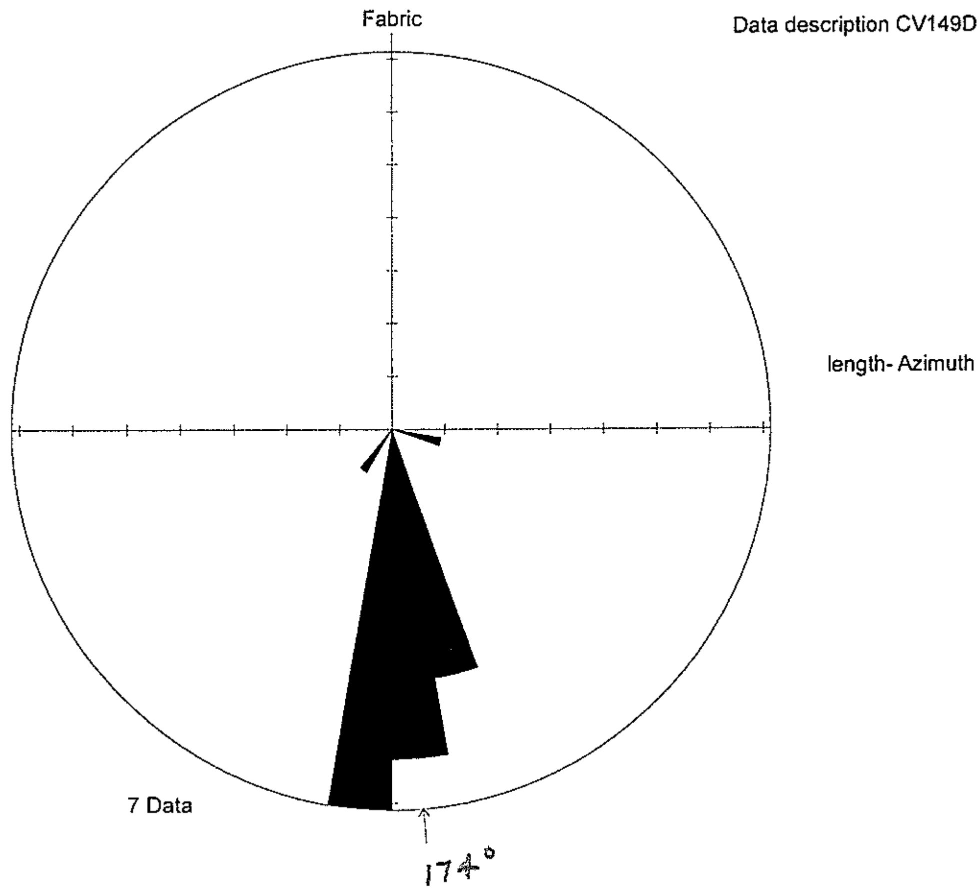
CV149C

8

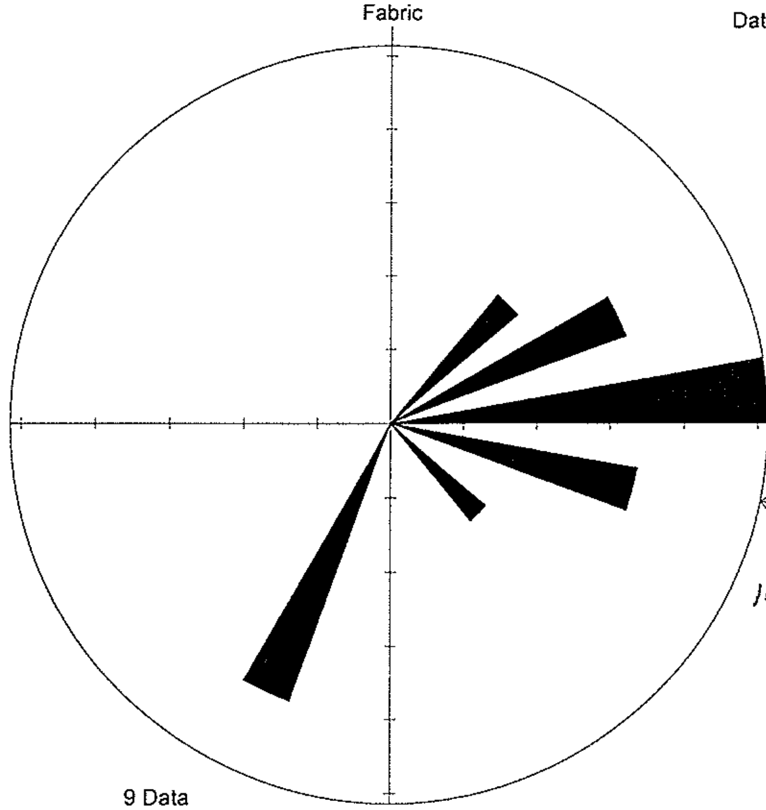


C149D

7



CV149E
9



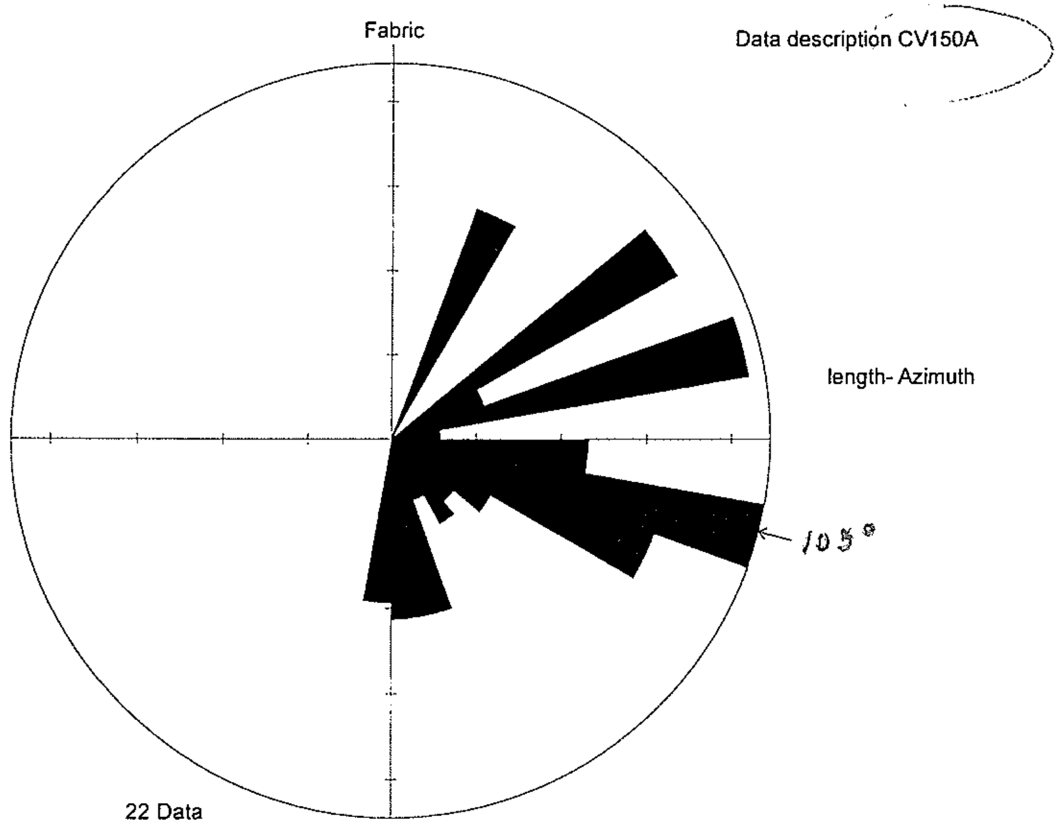
Data description CV149E

length- Azimuth
No. of Data = 9
Sector angle = 10°
Scale: tick interval = 5% [length: 1.75]
Maximum = 25.7% [length: 9]
Total length = 35
Mean Resultant dir'n = 102
[Approx. 95% Confidence interval = ±32
(valid only for unimodal data)

102°

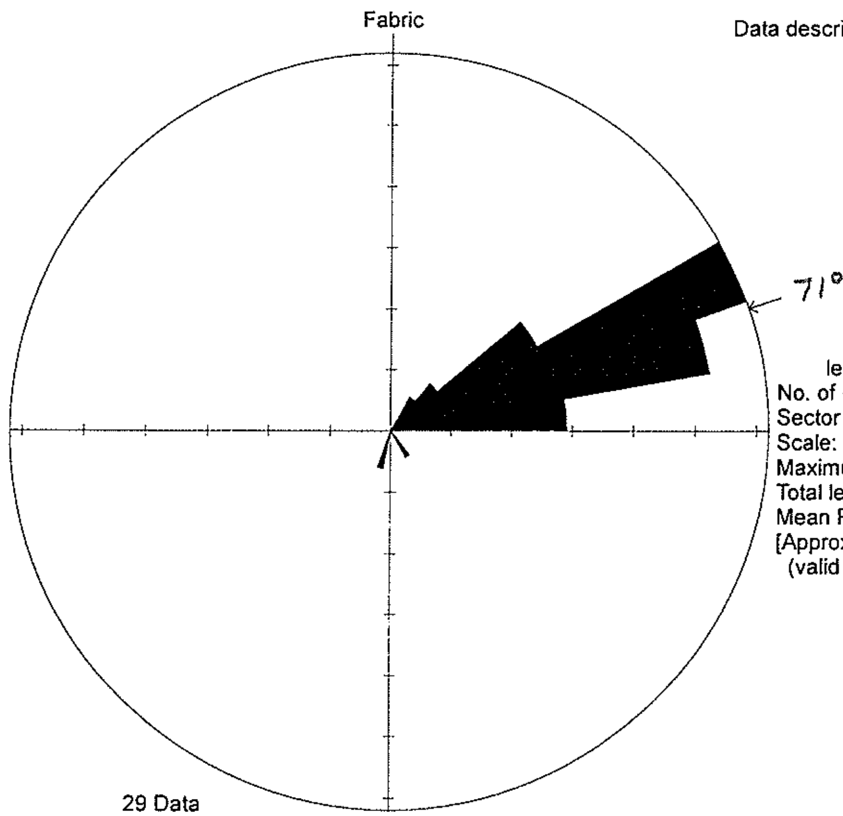
CV150A

22



CV150B
29

Data description CV150B

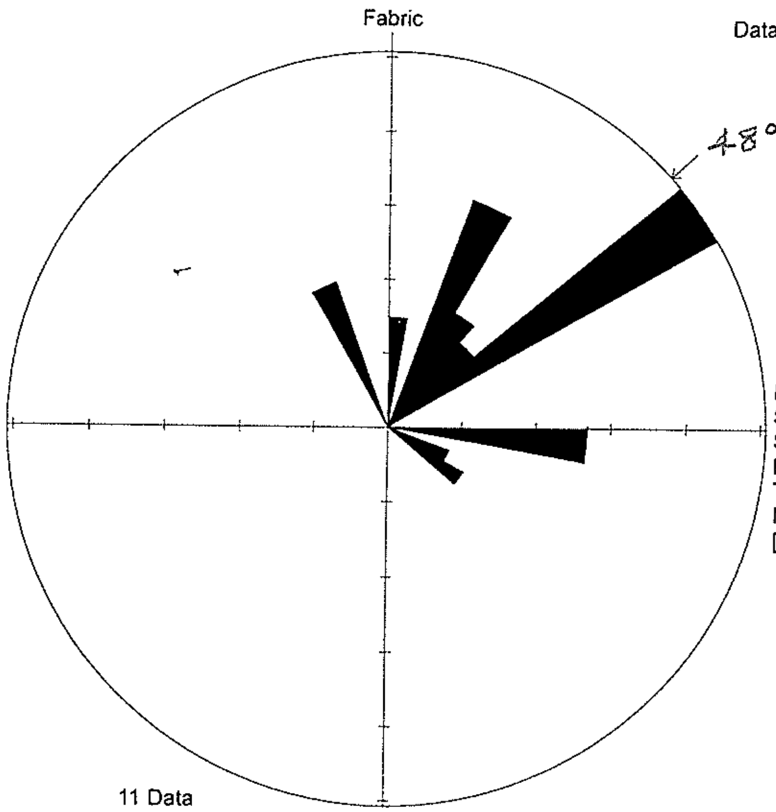


length- Azimuth
No. of Data = 29
Sector angle = 10°
Scale: tick interval = 5% [length: 7.90]
Maximum = 31.0% [length: 49]
Total length = 158
Mean Resultant dir'n = 071
[Approx. 95% Confidence interval = ±6.(
(valid only for unimodal data)

RG151A (rvsd)

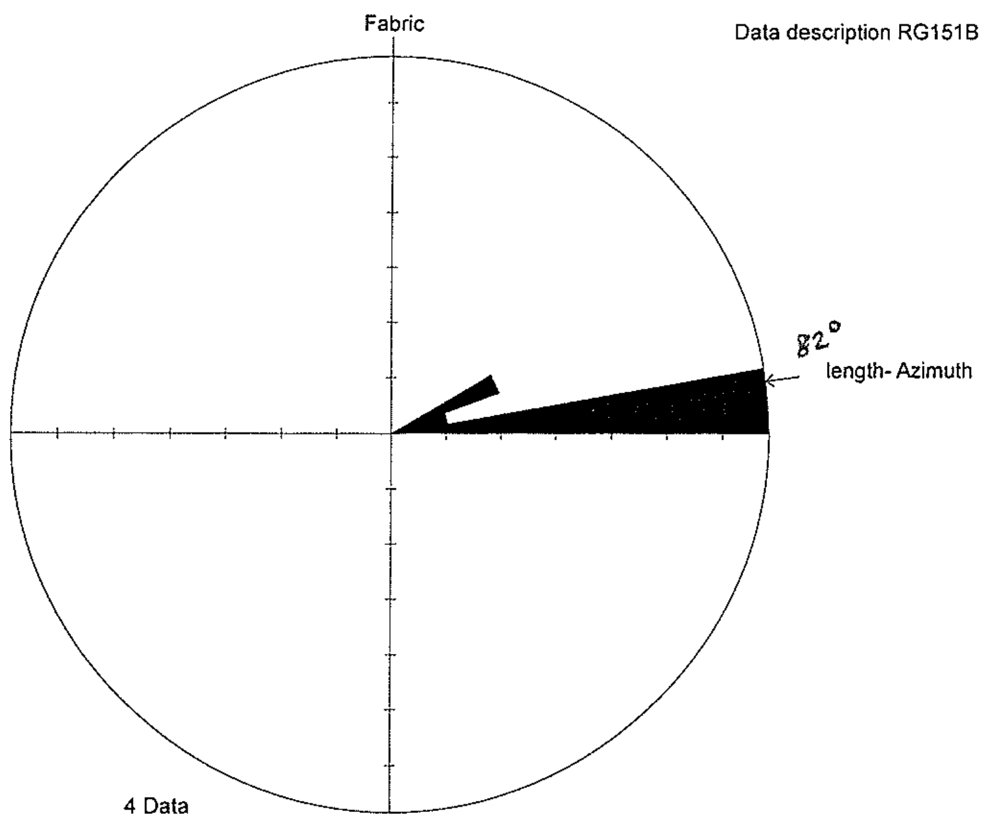
11

Data description RG151A

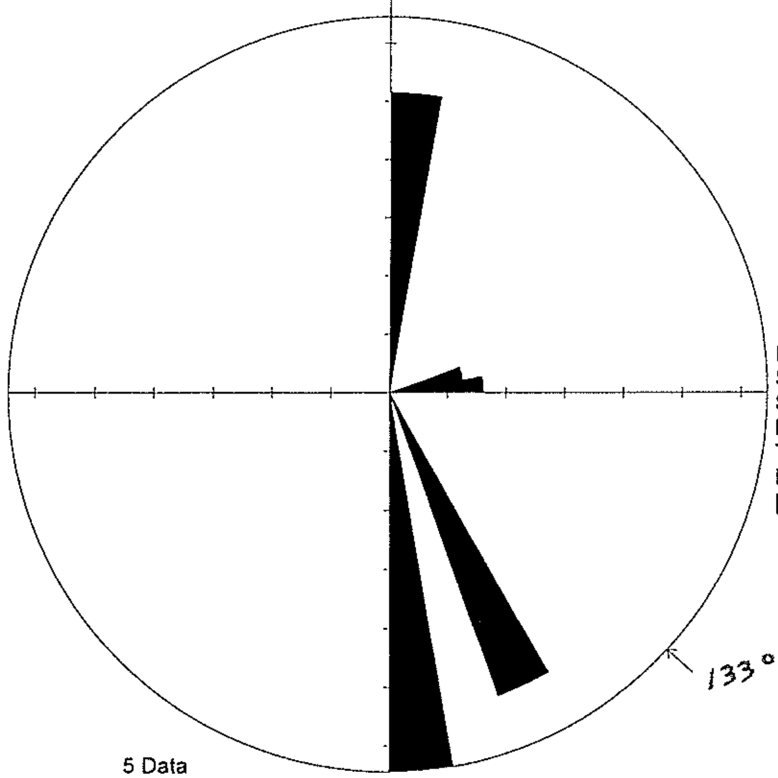


length- Azimuth
No. of Data = 11
Sector angle = 10°
Scale: tick interval = 5% [length: 3.35]
Maximum = 25.4% [length: 17]
Total length = 67
Mean Resultant dir'n = 048
[Approx. 95% Confidence interval = ±2
(valid only for unimodal data)

RG151B
4



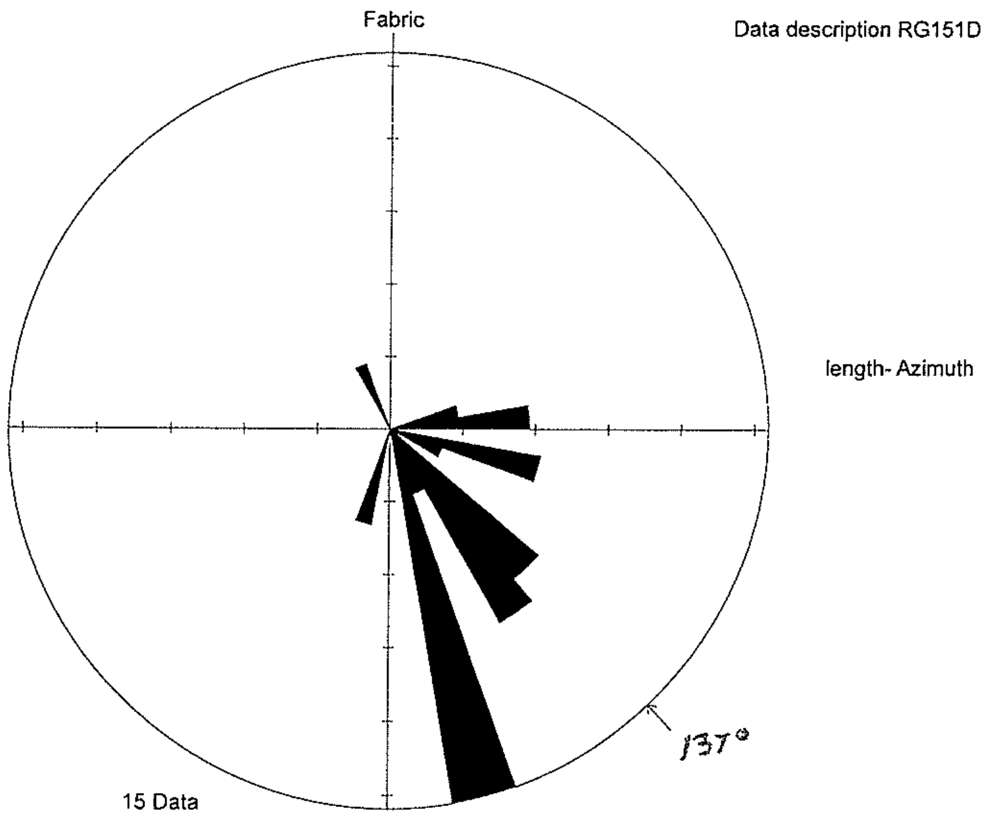
RG151C
5



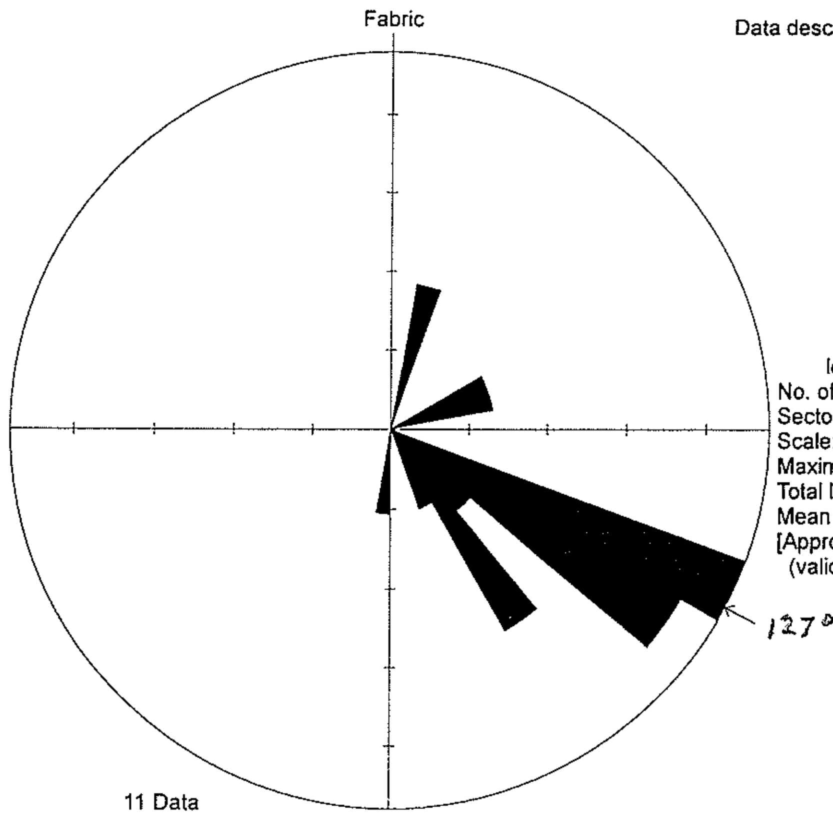
Data description RG151C

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 5% [length: 3.10]
Maximum = 32.3% [length: 20]
Total length = 62
Mean Resultant dir'n = 133
[Approx. 95% Confidence interval = ±59
(valid only for unimodal data)

RG151D
15



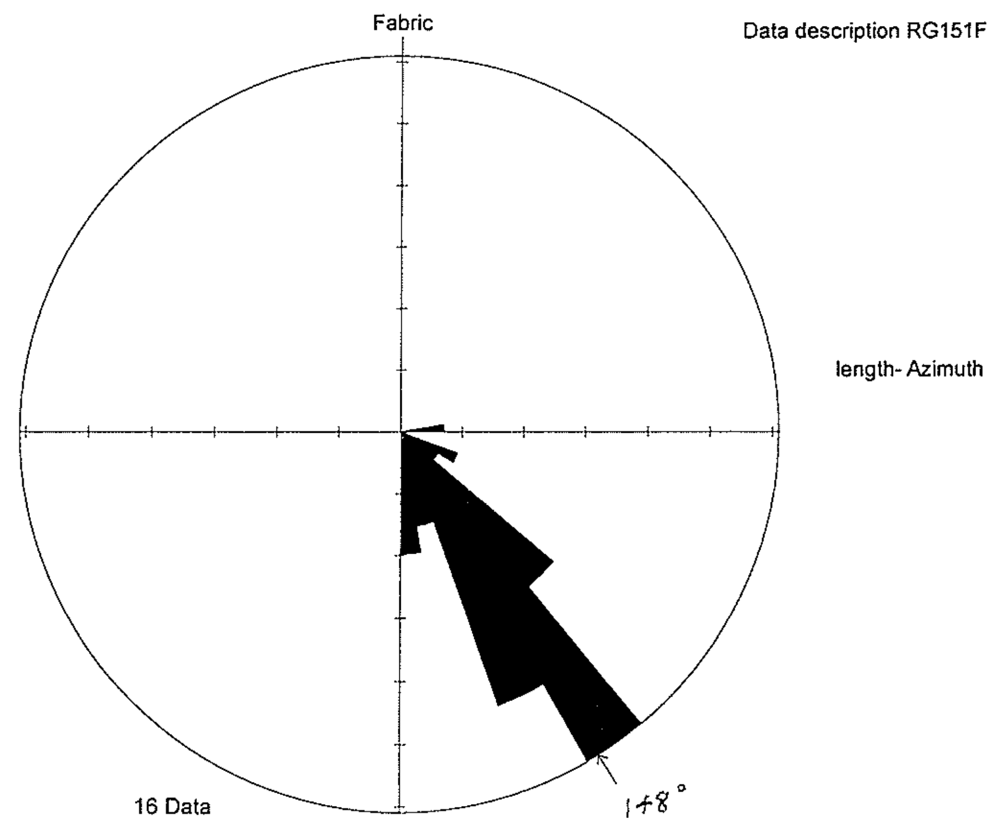
RG151E
11



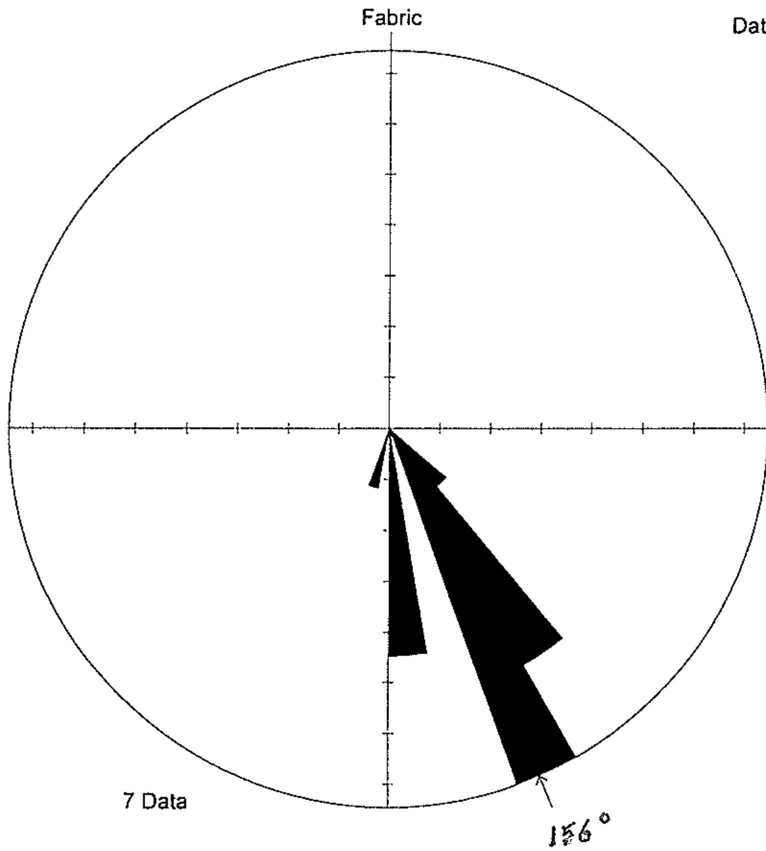
Data description RG151E

length- Azimuth
No. of Data = 11
Sector angle = 10°
Scale: tick interval = 5% [length: 3.75]
Maximum = 24% [length: 18]
Total length = 75
Mean Resultant dir'n = 118
[Approx. 95% Confidence interval = ±2
(valid only for unimodal data)

RG151F
16



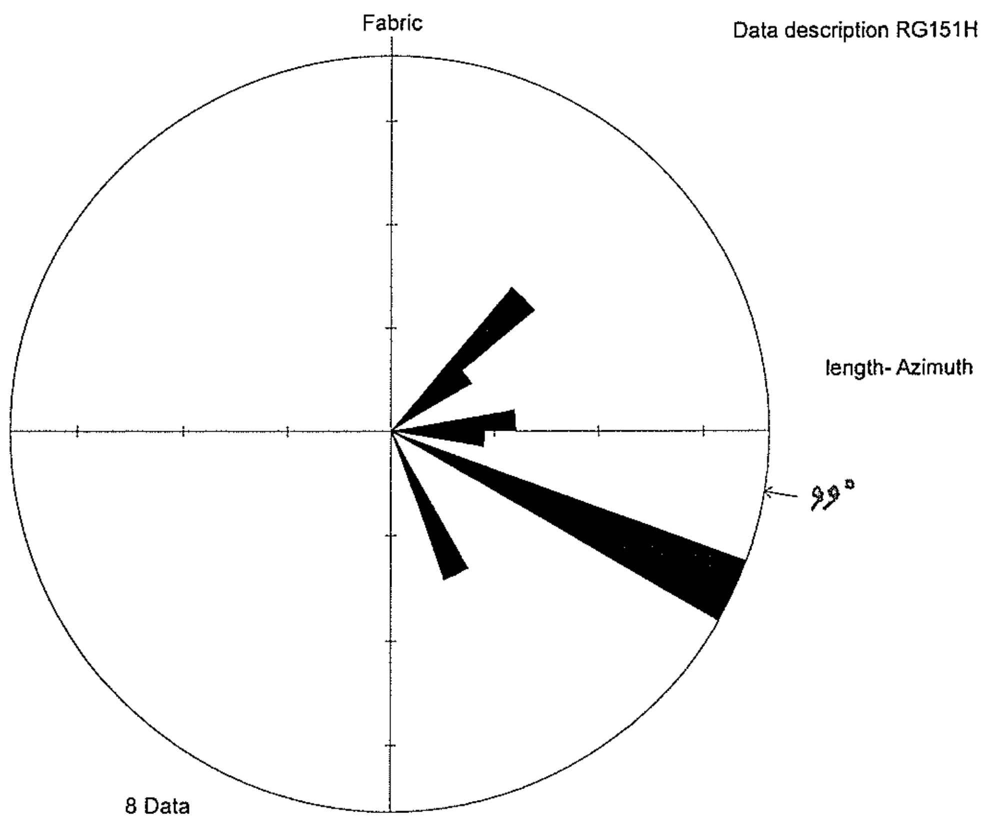
RG151G
7



Data description RG151G

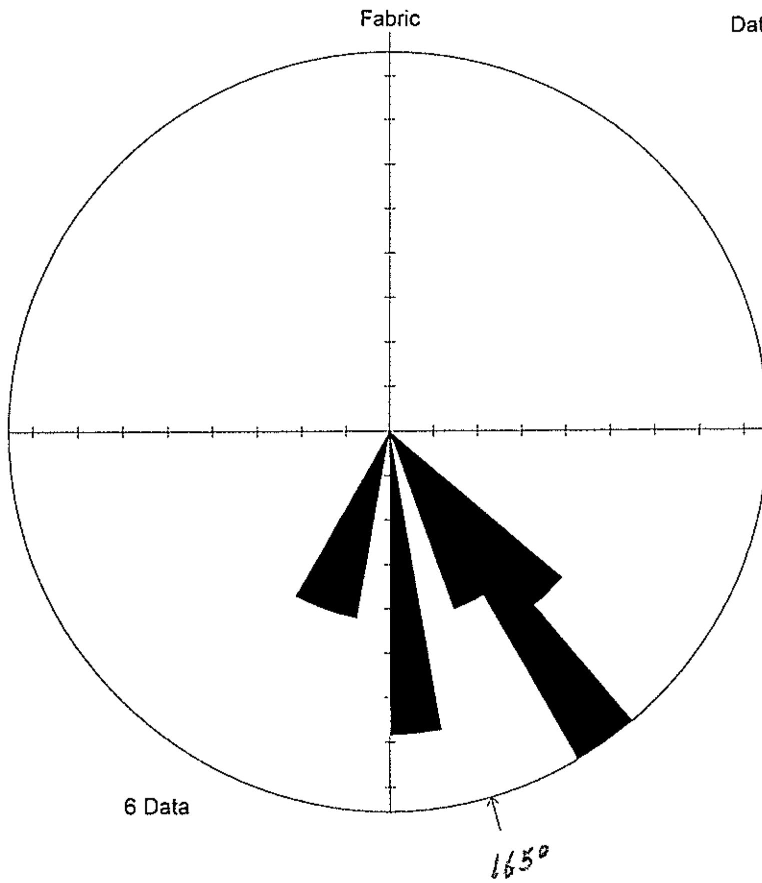
length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 5% [length: 3.35]
Maximum = 37.3% [length: 25]
Total length = 67
Mean Resultant dir'n = 156
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

RG151H
8



RG151I

6

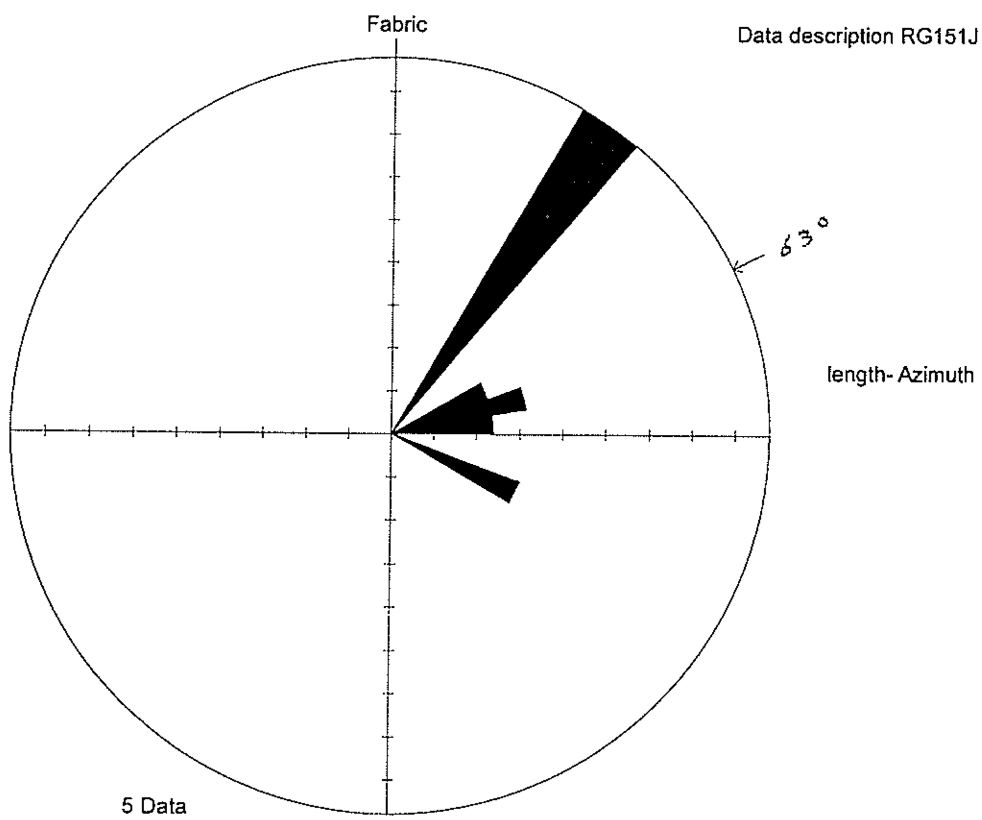


Data description RG151I

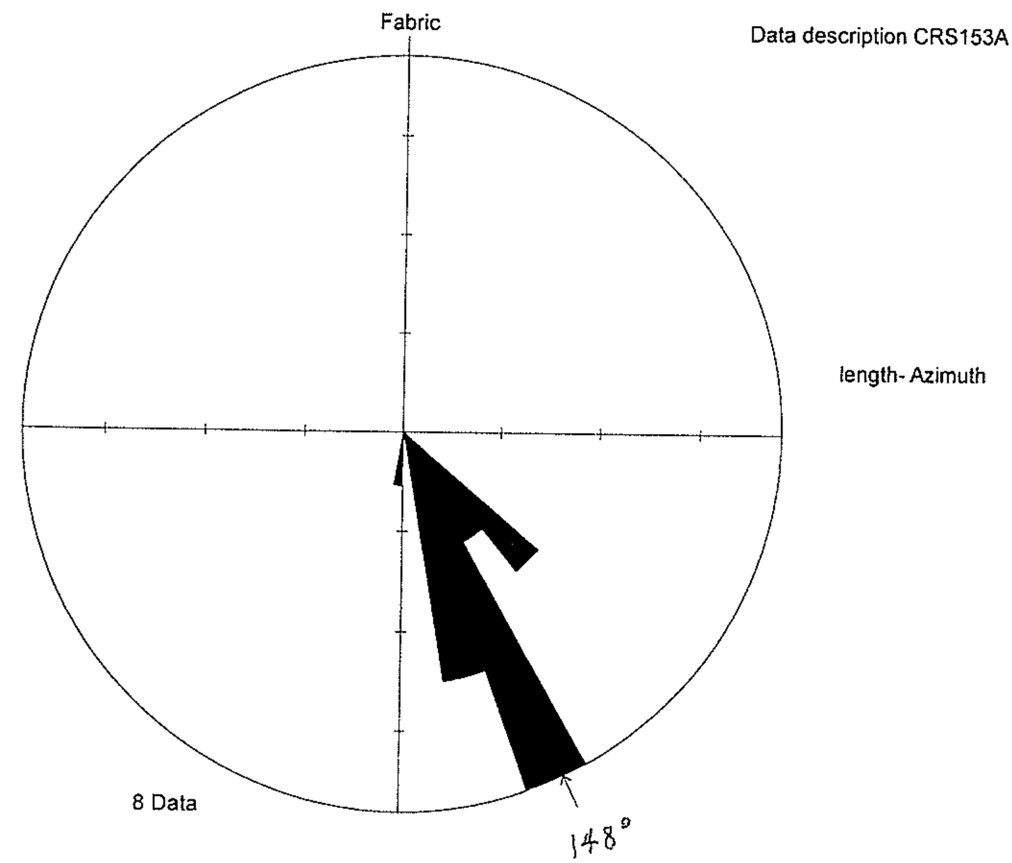
length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 3% [length: 1.17
Maximum = 25.6% [length: 10]
Total length = 39
Mean Resultant dir'n = 164
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

RG151J

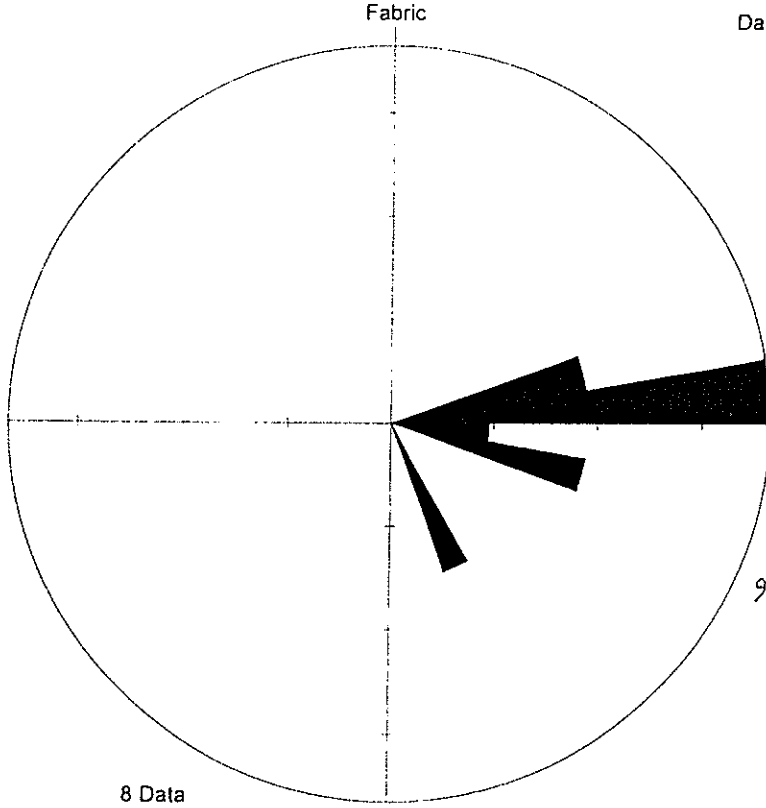
5



CRS153A (rvsd)
8



RG154 (rvsd)
8

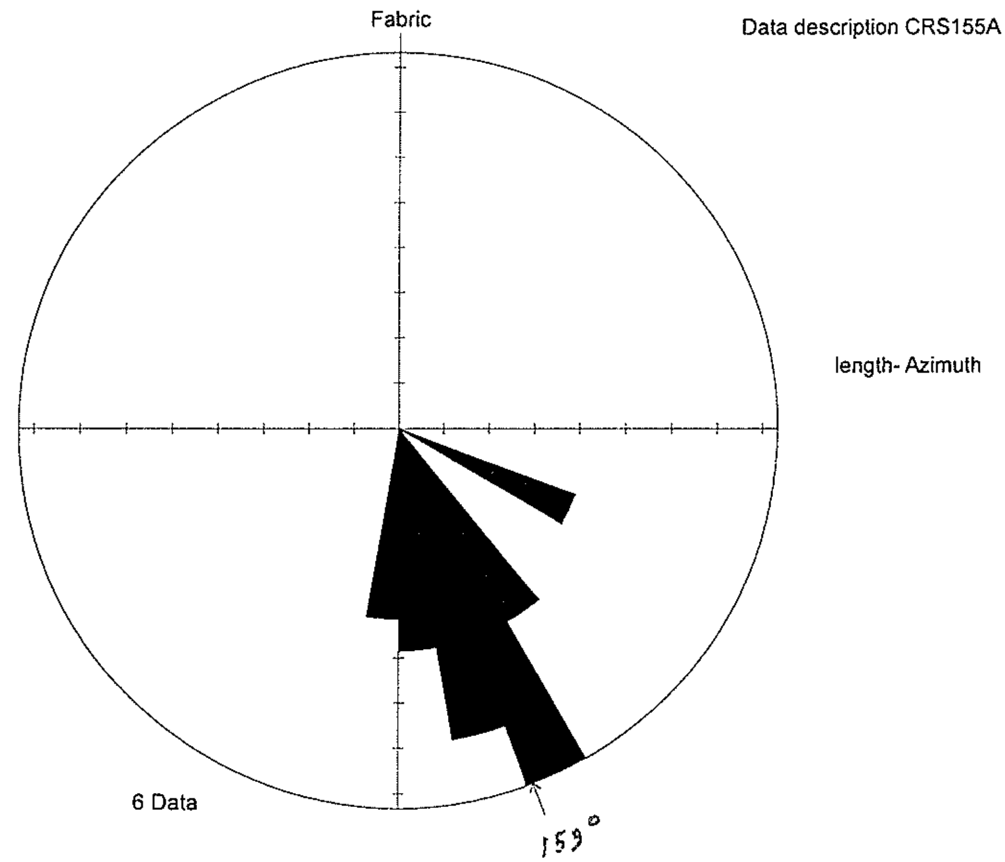


Data description RG154

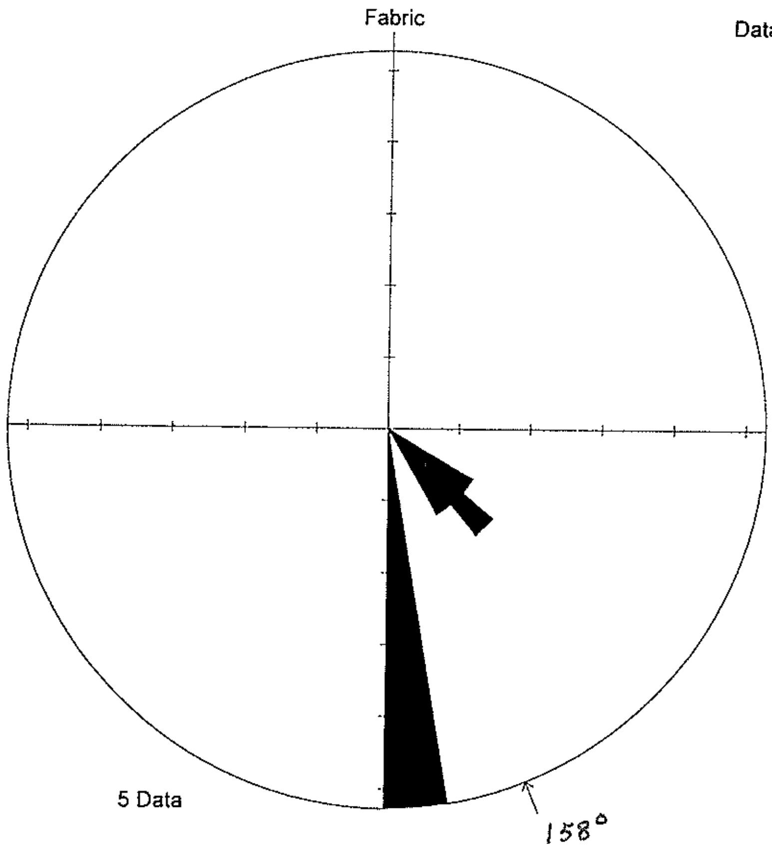
length- Azimuth
No. of Data = 8
Sector angle = 10°
Scale: tick interval = 10% [length: 5.20]
Maximum = 36.5% [length: 19]
Total length = 52
Mean Resultant dir'n = 097
[Approx. 95% Confidence interval = ±18.
(valid only for unimodal data)

97°

CRS155A
6



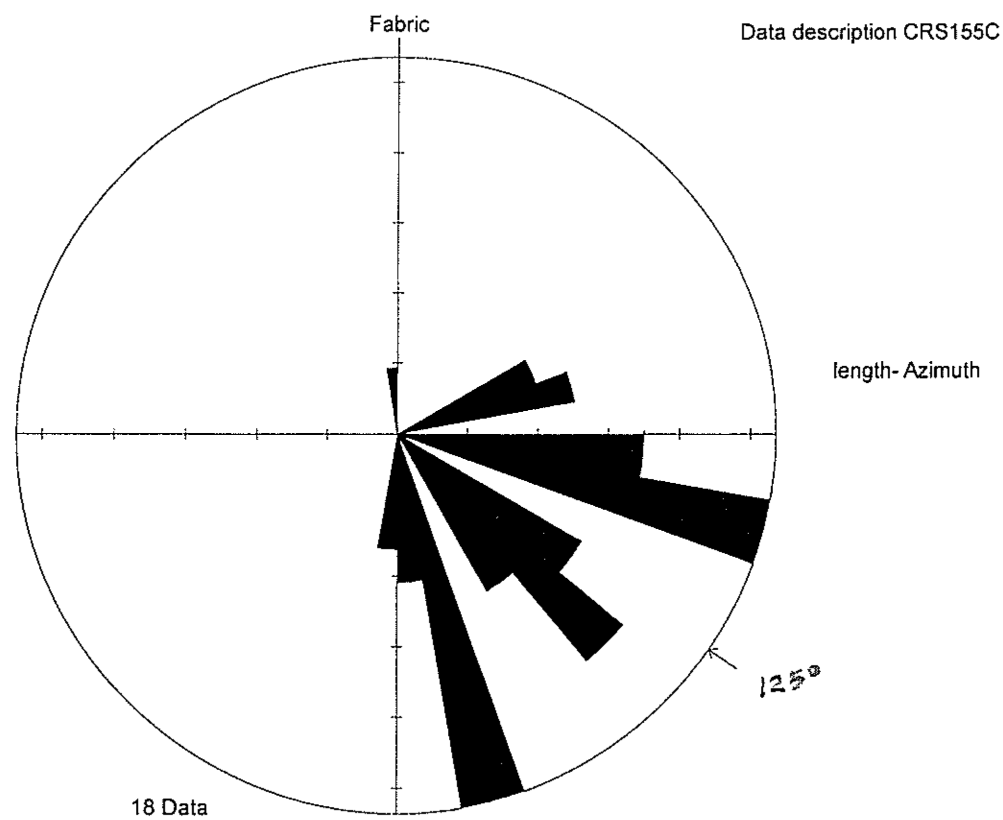
CRS155B
5



Data description CRS155B

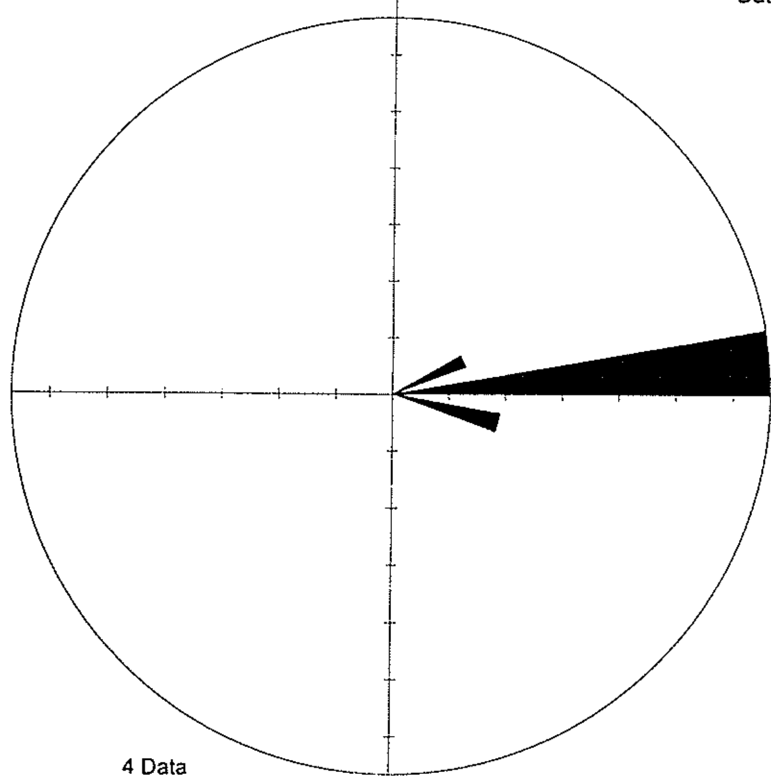
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 3.6C
Maximum = 52.8% [length: 19]
Total length = 36
Mean Resultant dir'n = 158
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

CRS155C
18



Fabric
Data description CRS155C
length- Azimuth
125°
18 Data

CRS155D
4

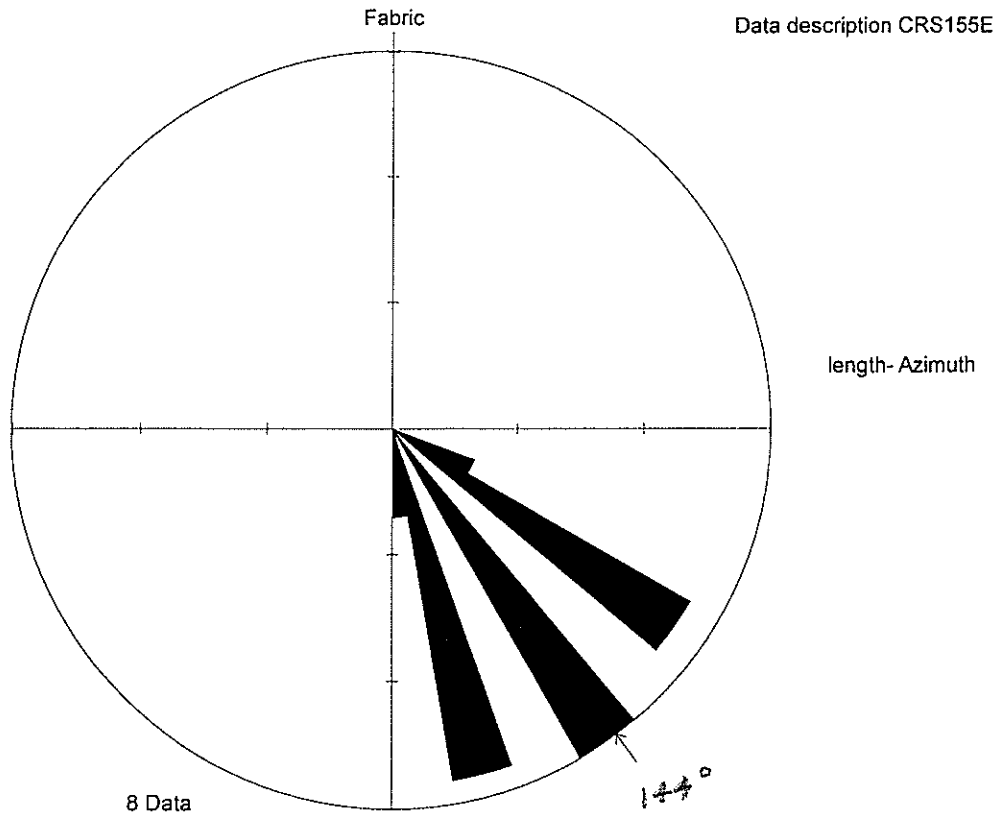


Data description CRS155D

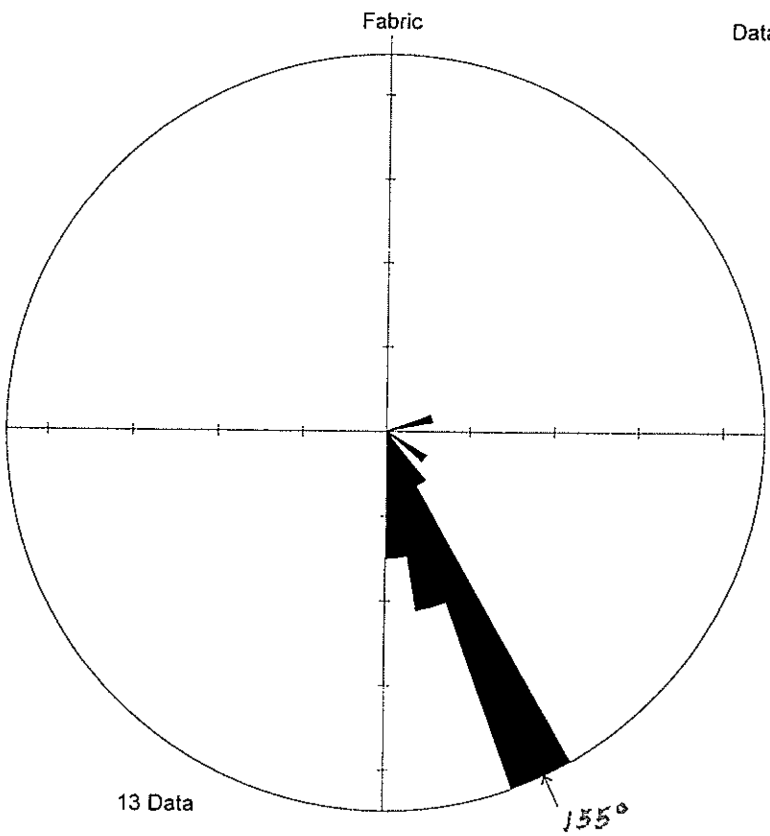
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 3.60]
Maximum = 66.7% [length: 24]
Total length = 36
Mean Resultant dir'n = 087
[Approx. 95% Confidence interval = ±11
(valid only for unimodal data)

CRS155E

8



CRS155F
13

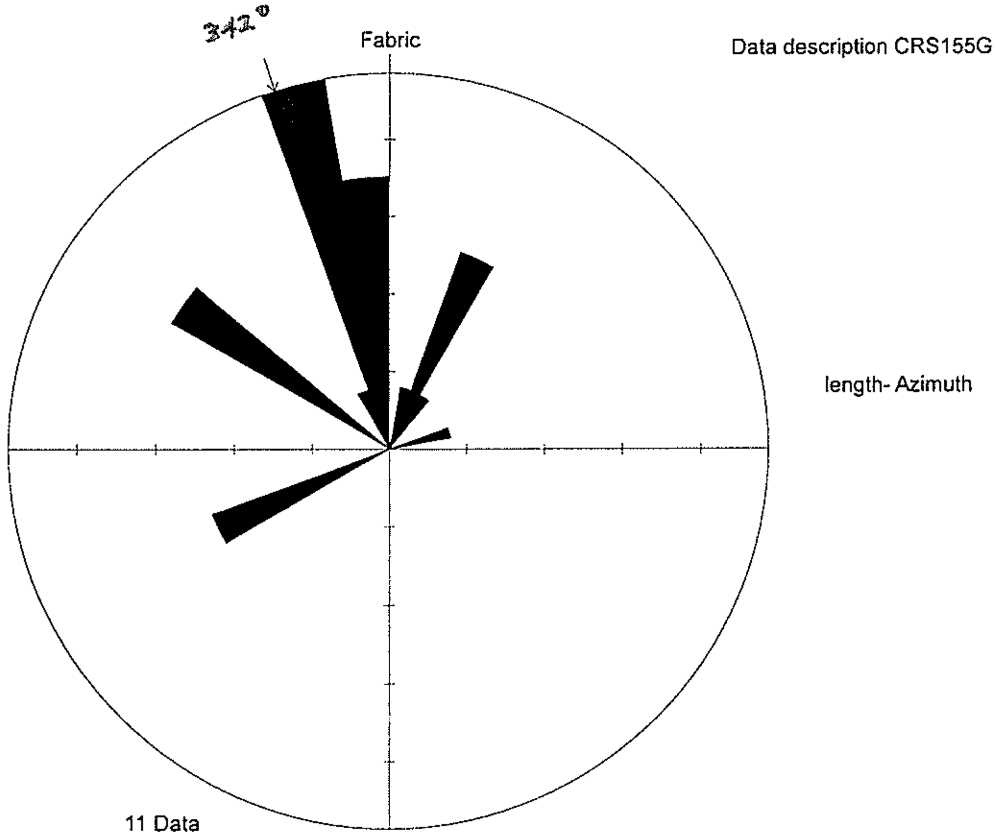


Data description CRS155F

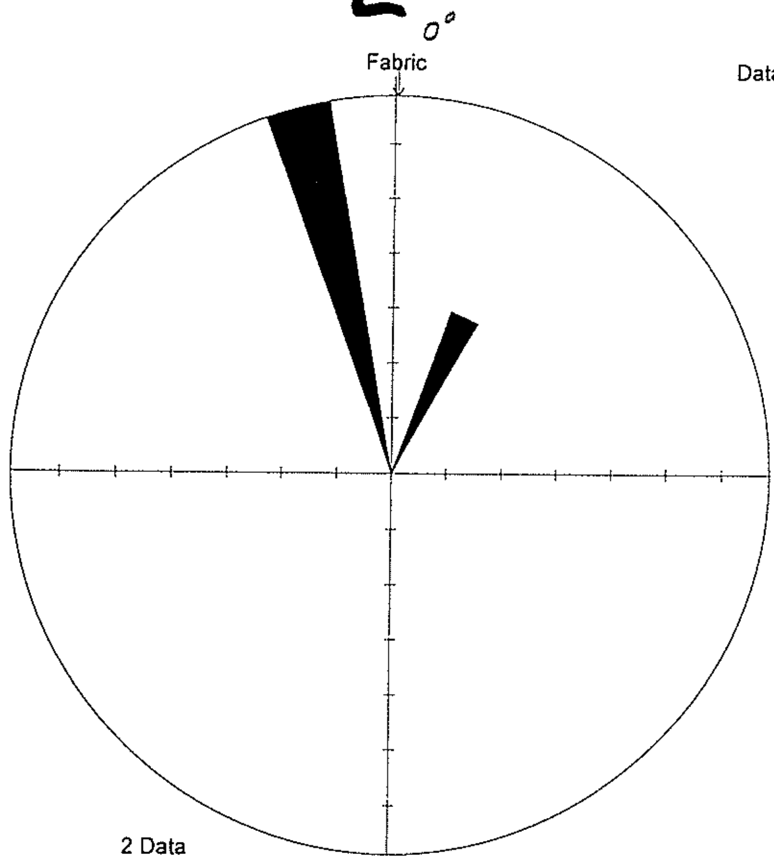
length- Azimuth
No. of Data = 13
Sector angle = 10°
Scale: tick interval = 10% [length: 10.7
Maximum = 44.9% [length: 48]
Total length = 107
Mean Resultant dir'n = 155
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

CRS155G

11


342°
Fabric
Data description CRS155G
length- Azimuth
11 Data

CRS155H
2

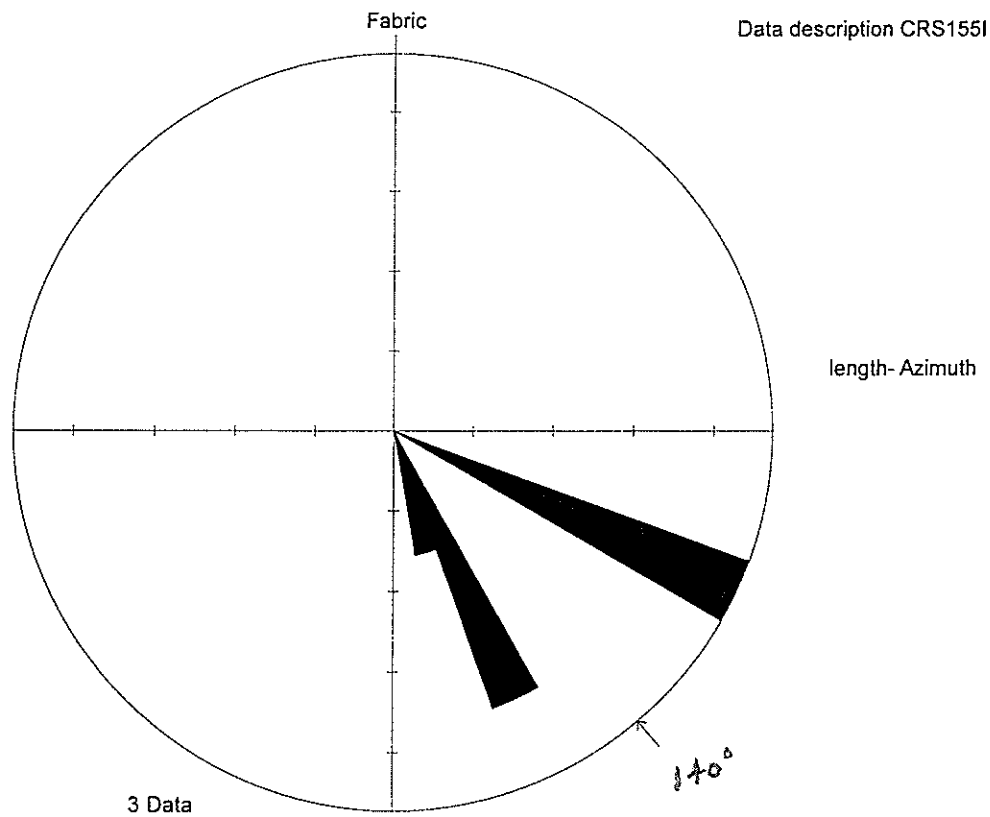


Data description CRS155H

length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.60]
Maximum = 68.8% [length: 11]
Total length = 16
Mean Resultant dir'n = 000

CRS155I

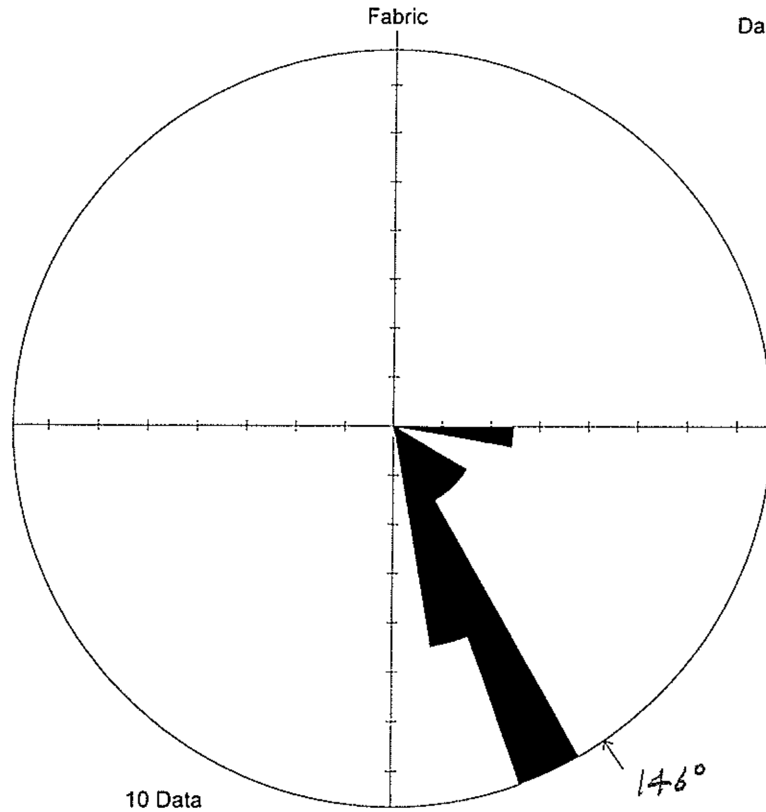
3



CR5155J

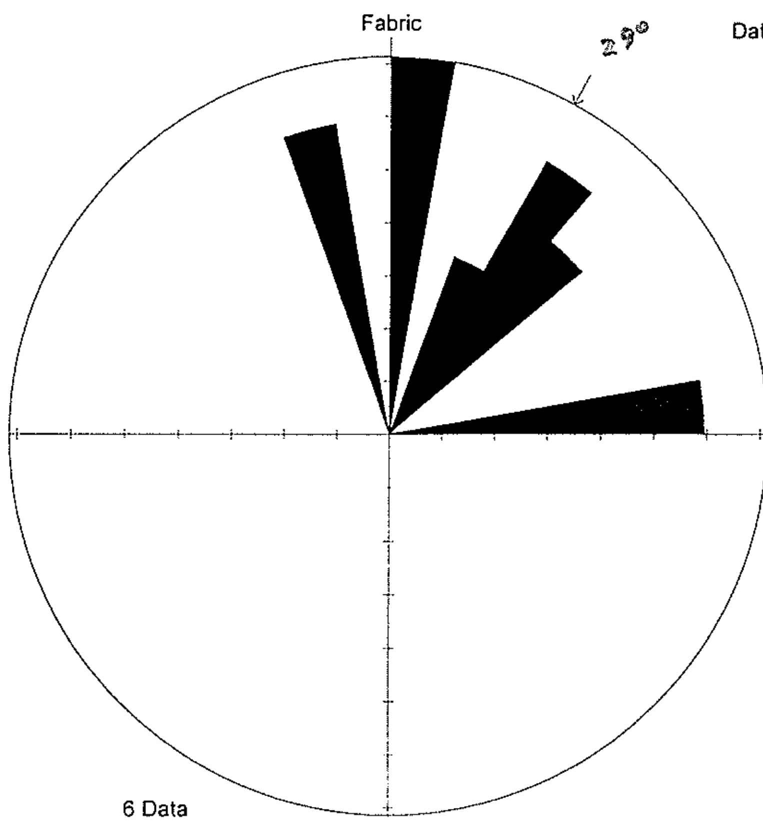
10

Data description CRS155J



length- Azimuth
No. of Data = 10
Sector angle = 10°
Scale: tick interval = 5% [length: 2.85
Maximum = 38.6% [length: 22]
Total length = 57
Mean Resultant dir'n = 146
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

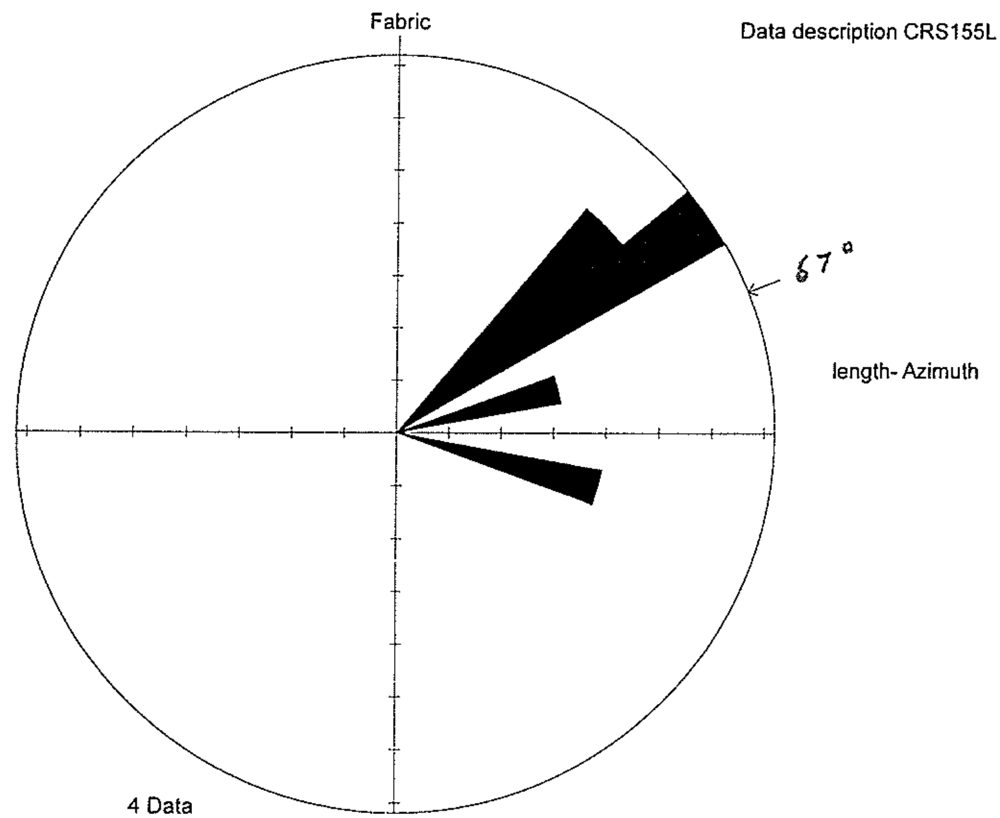
CRS155K
6



Data description CRS155K

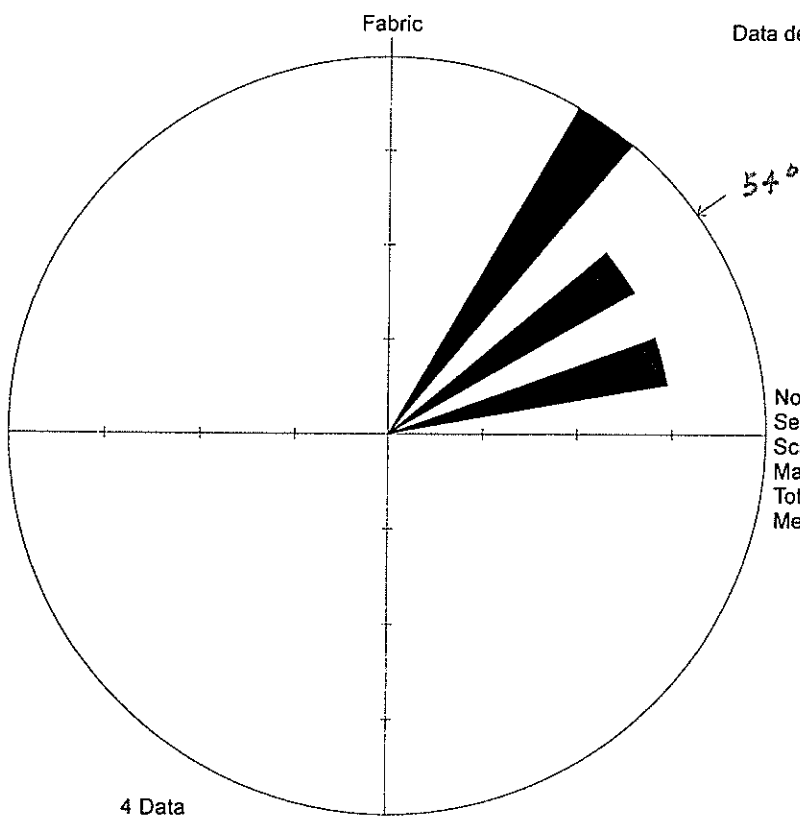
length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 3% [length: 0.84
Maximum = 21.4% [length: 6]
Total length = 28
Mean Resultant dir'n = 029
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

CRS155L
4



CRS155M
4

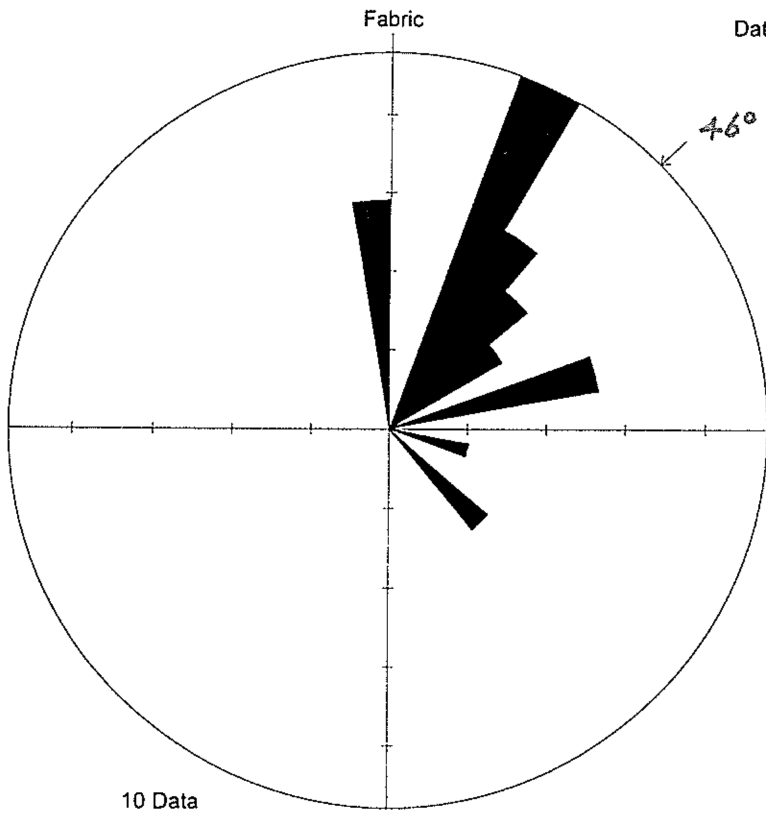
Data description CRS155M



length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 2.0
Maximum = 40% [length: 8]
Total length = 20
Mean Resultant dir'n = 054

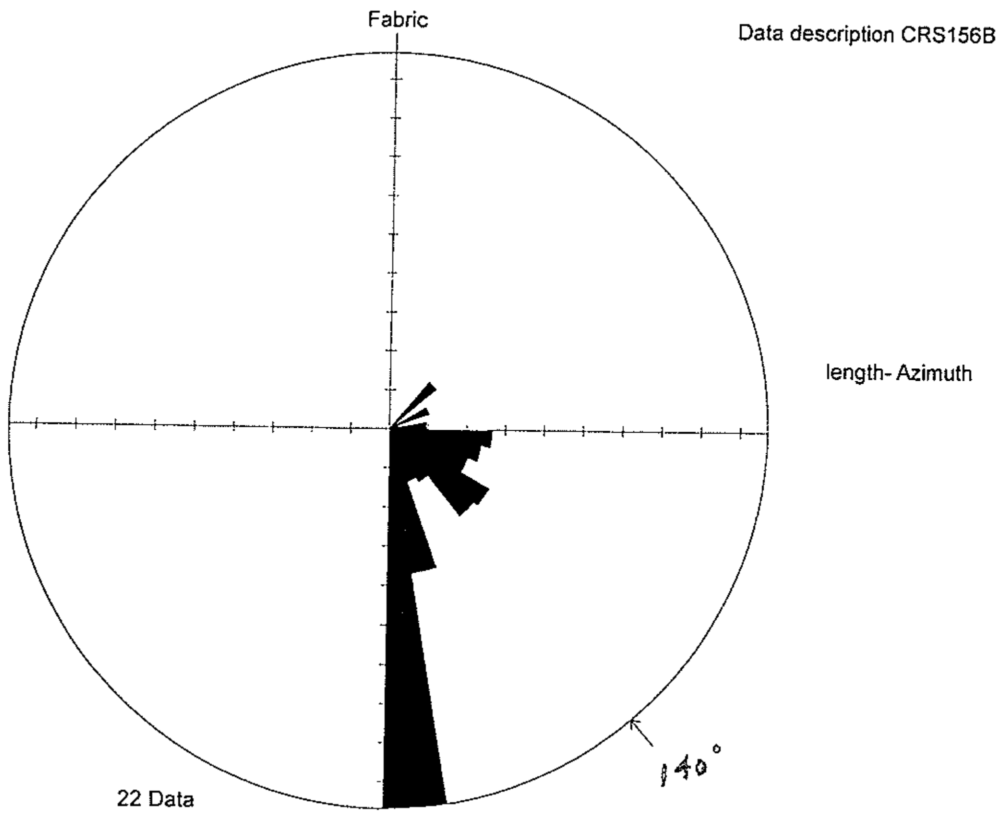
CRS156A
10

Data description CRS156A



length- Azimuth
No. of Data = 10
Sector angle = 10°
Scale: tick interval = 5% [length: 4.80]
Maximum = 24.0% [length: 23]
Total length = 96
Mean Resultant dir'n = 046
[Approx. 95% Confidence interval = ±2
(valid only for unimodal data)

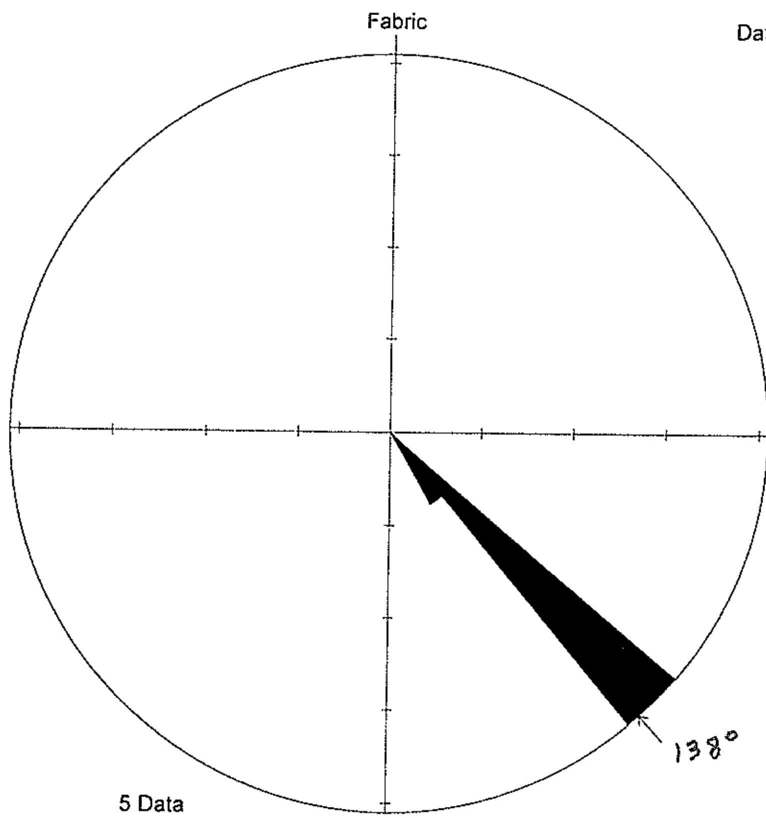
CRS156B
22



Fabric
Data description CRS156B
length- Azimuth
140°
22 Data

CRS156C
5

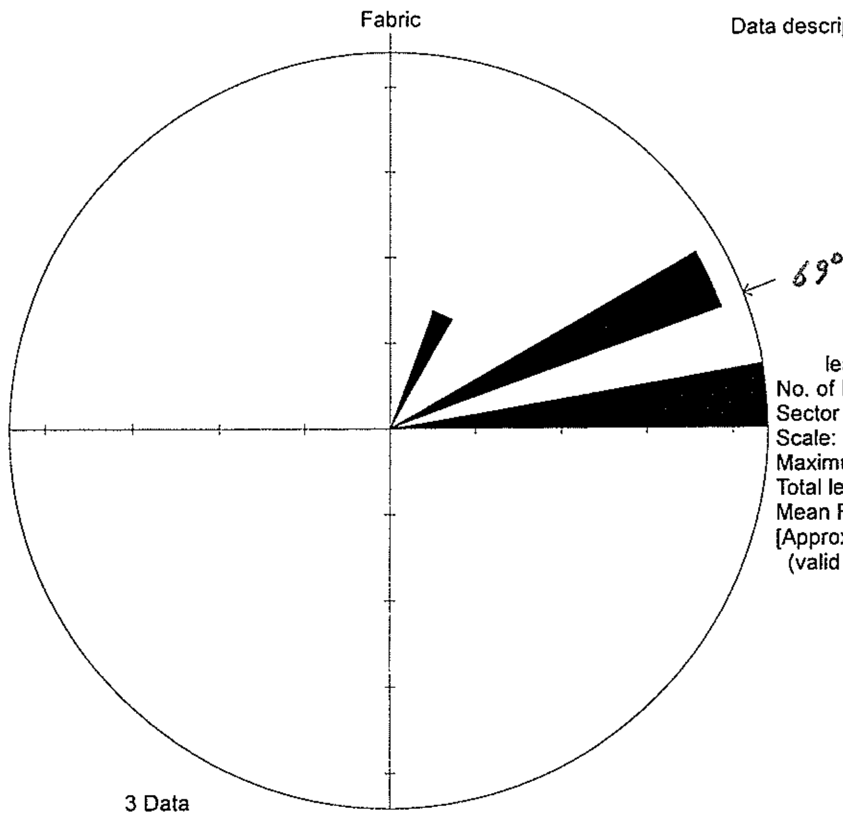
Data description CRS156C



length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 20% [length: 10.0
Maximum = 82% [length: 41]
Total length = 50
Mean Resultant dir'n = 138
[Approx. 95% Confidence interval = ±3
(valid only for unimodal data)

CRS156D

3

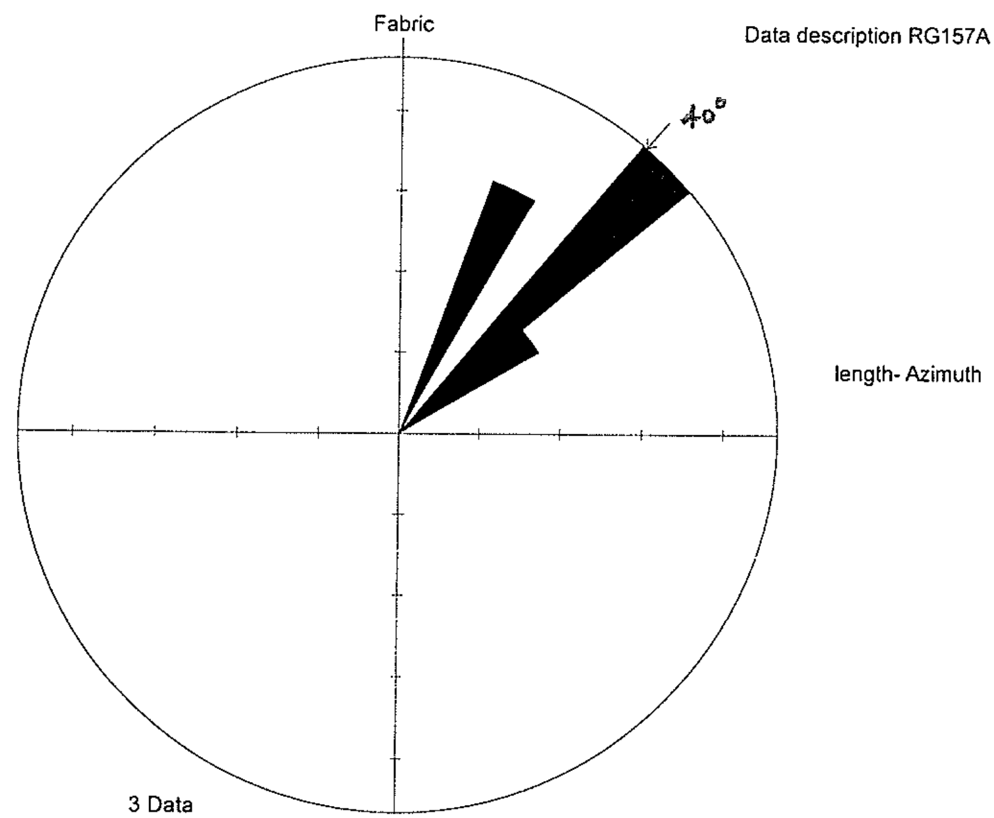


Data description CRS156D

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 3.40]
Maximum = 44.1% [length: 15]
Total length = 34
Mean Resultant dir'n = 069
[Approx. 95% Confidence interval = ±2
(valid only for unimodal data)

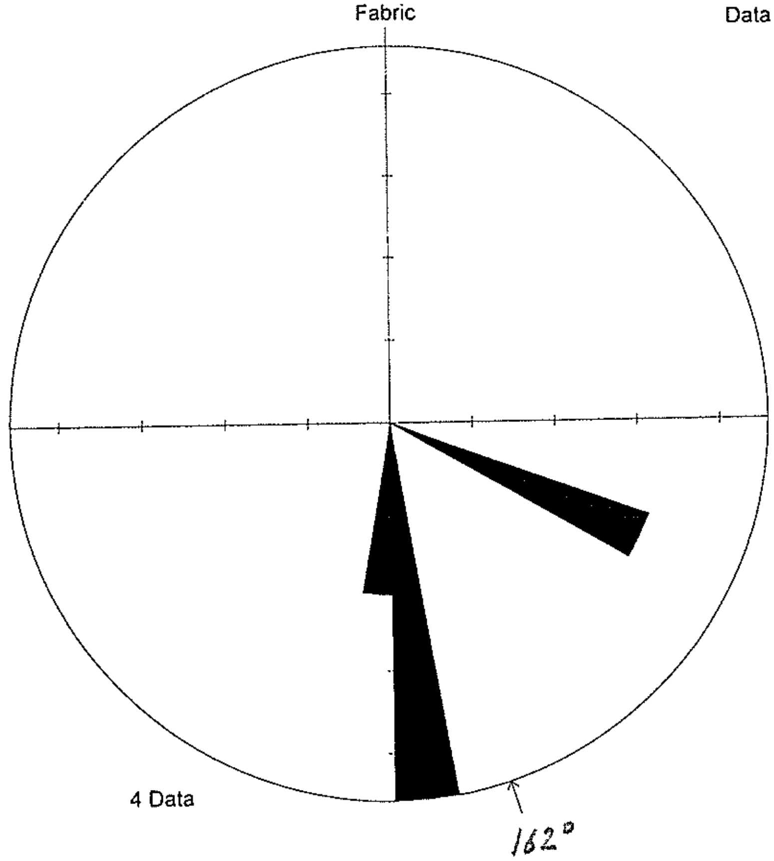
RG157A

3



RG157B

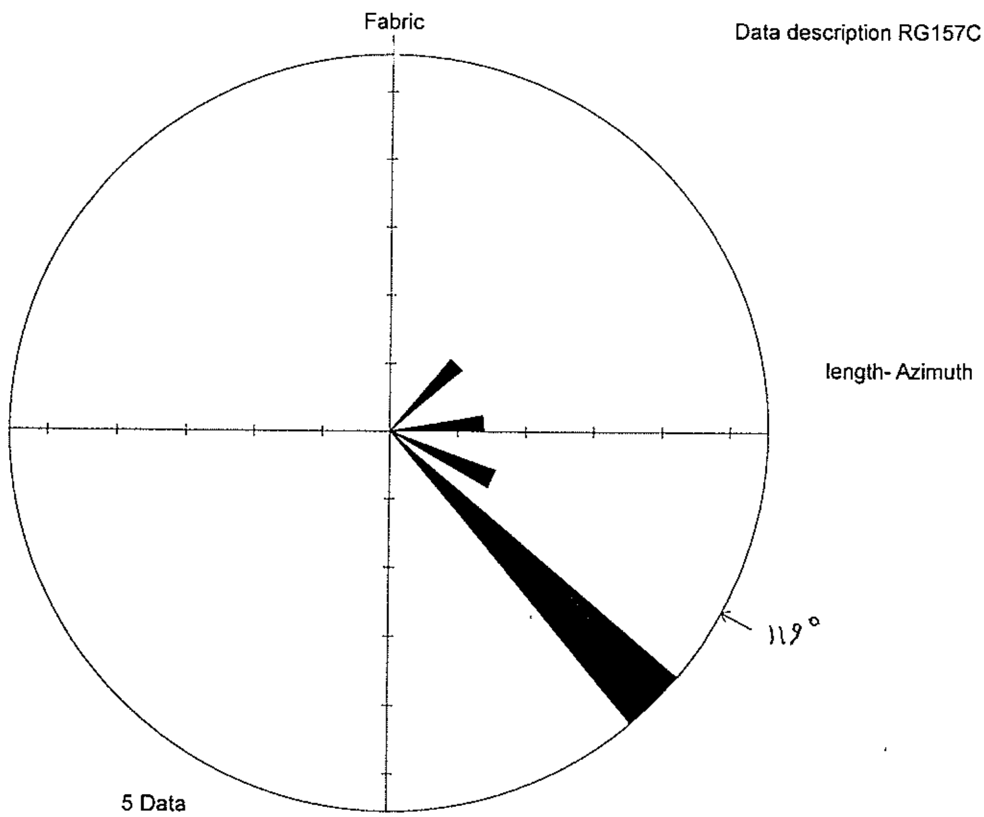
4



Data description RG157B

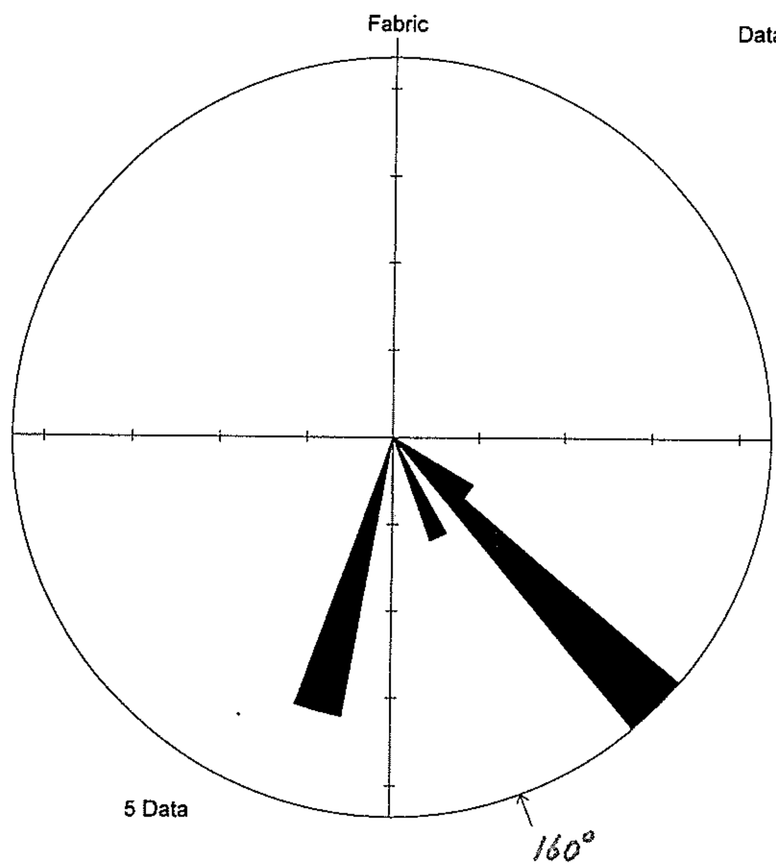
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 2.40]
Maximum = 45.8% [length: 11]
Total length = 24
Mean Resultant dir'n = 162

RG157C (rvsd)
5



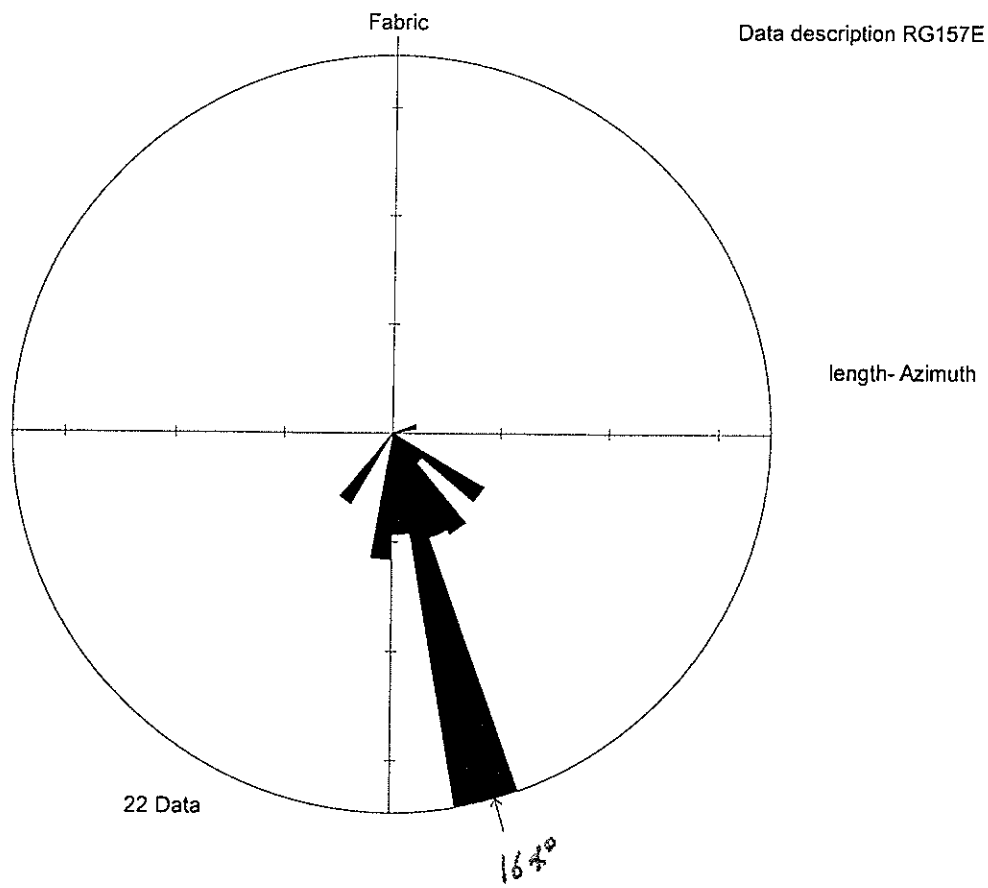
RG157D (rvsd)
5

Data description RG157D



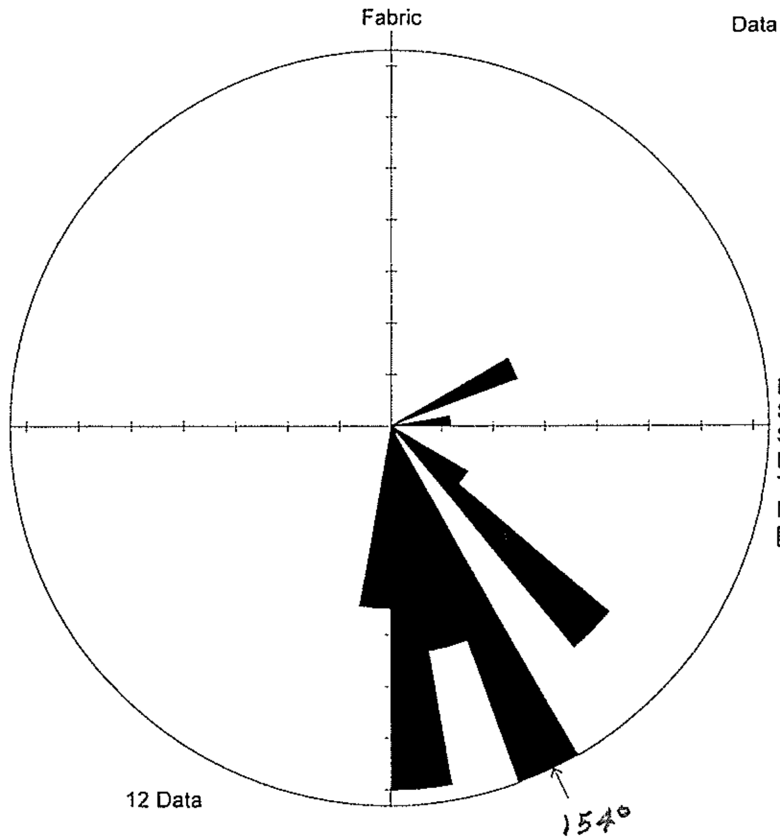
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 5.50]
Maximum = 43.6% [length: 24]
Total length = 55
Mean Resultant dir'n = 160
[Approx. 95% Confidence interval = ±27.
(valid only for unimodal data)

RG157E
22



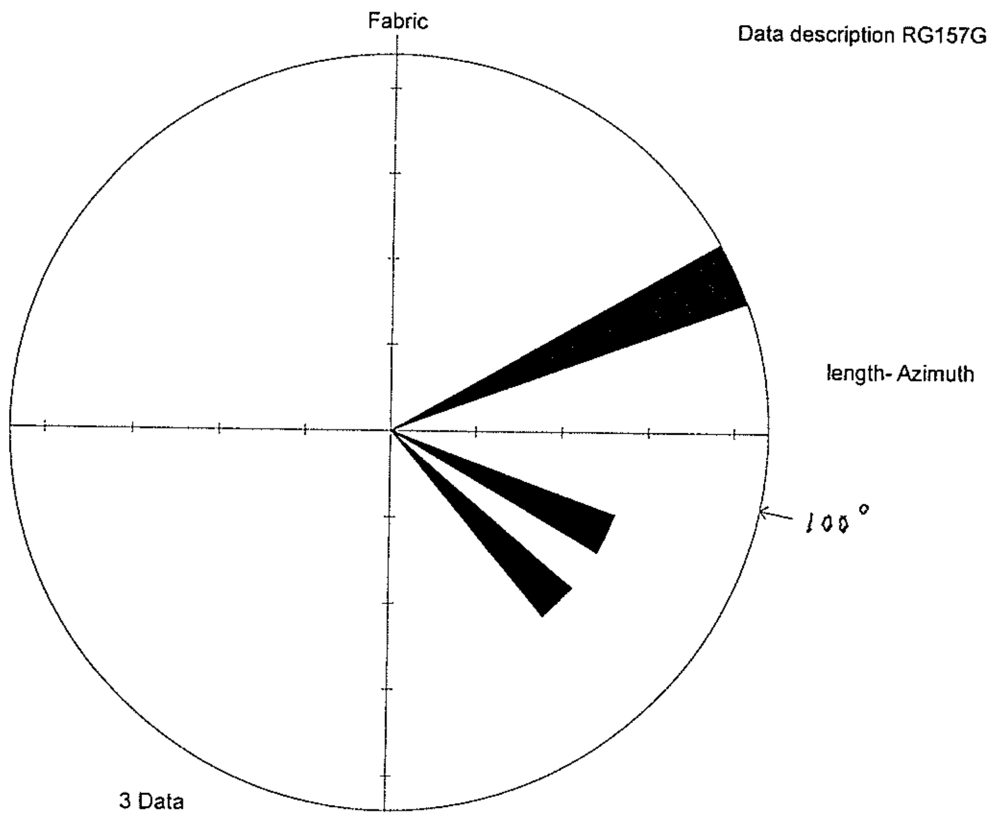
RG157F
12

Data description RG157F

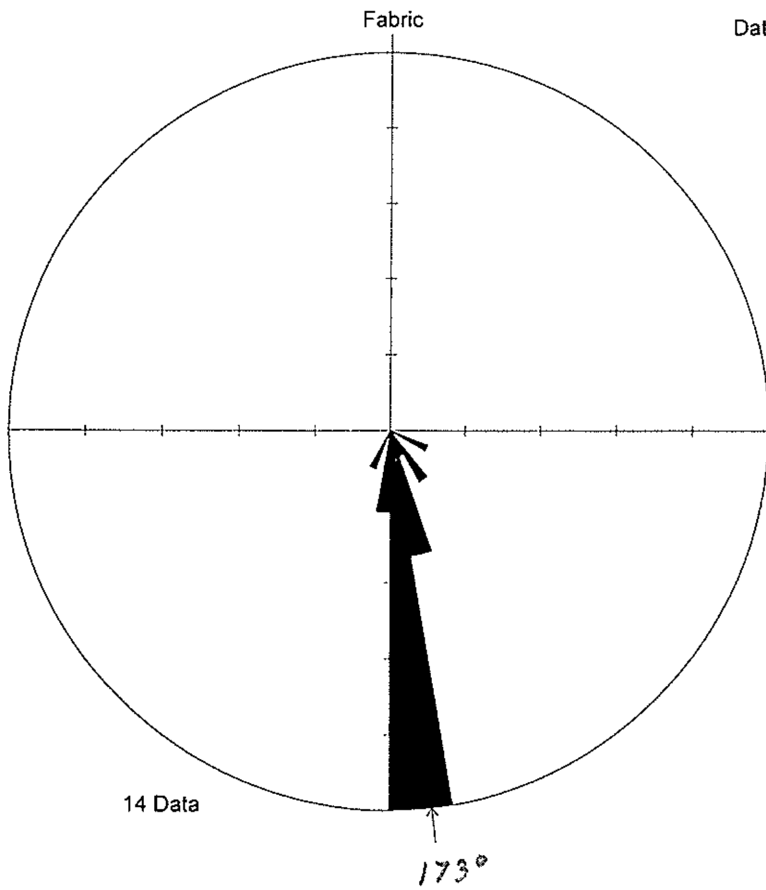


length- Azimuth
No. of Data = 12
Sector angle = 10°
Scale: tick interval = 3% [length: 3.42]
Maximum = 21.9% [length: 25]
Total length = 114
Mean Resultant dir'n = 154
[Approx. 95% Confidence interval = ±16
(valid only for unimodal data)

RG157G
3



RG157H
14

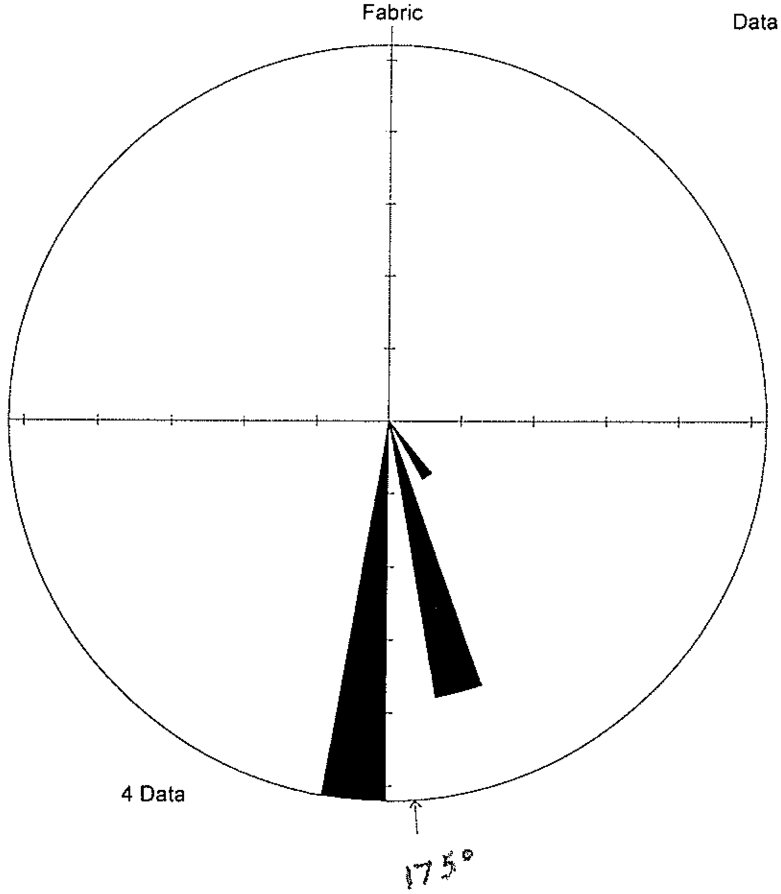


Data description RG157H

length- Azimuth
No. of Data = 14
Sector angle = 10°
Scale: tick interval = 10% [length: 16.60
Maximum = 50% [length: 83]
Total length = 166
Mean Resultant dir'n = 173
[Approx. 95% Confidence interval = ±9.6
(valid only for unimodal data)

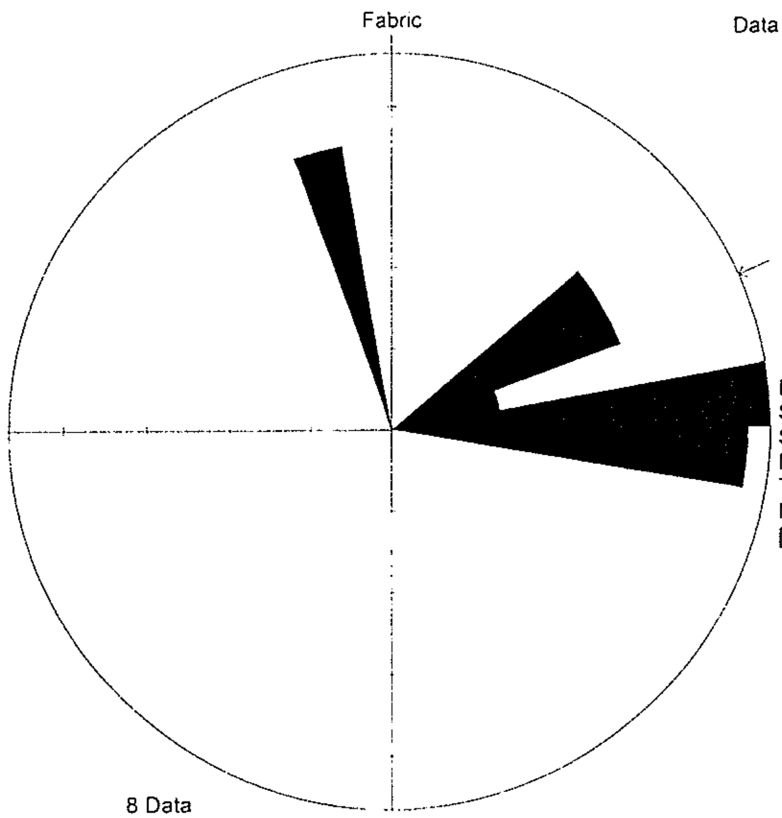
RG157I

4



RG157J

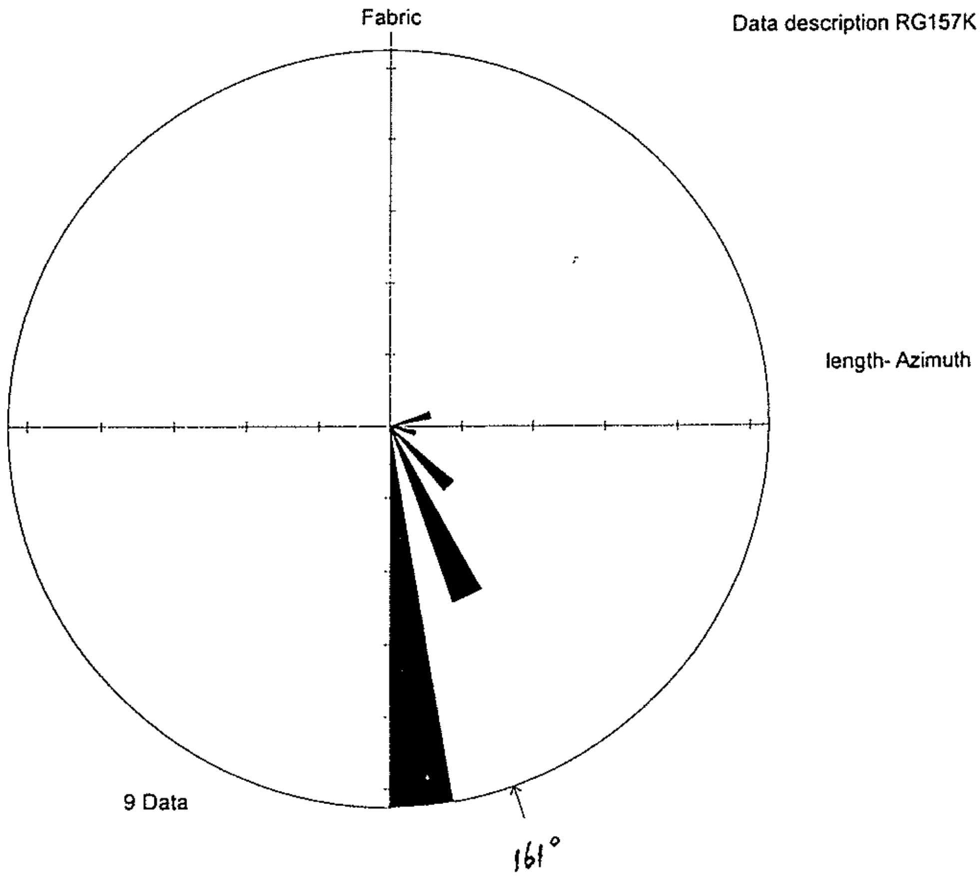
8



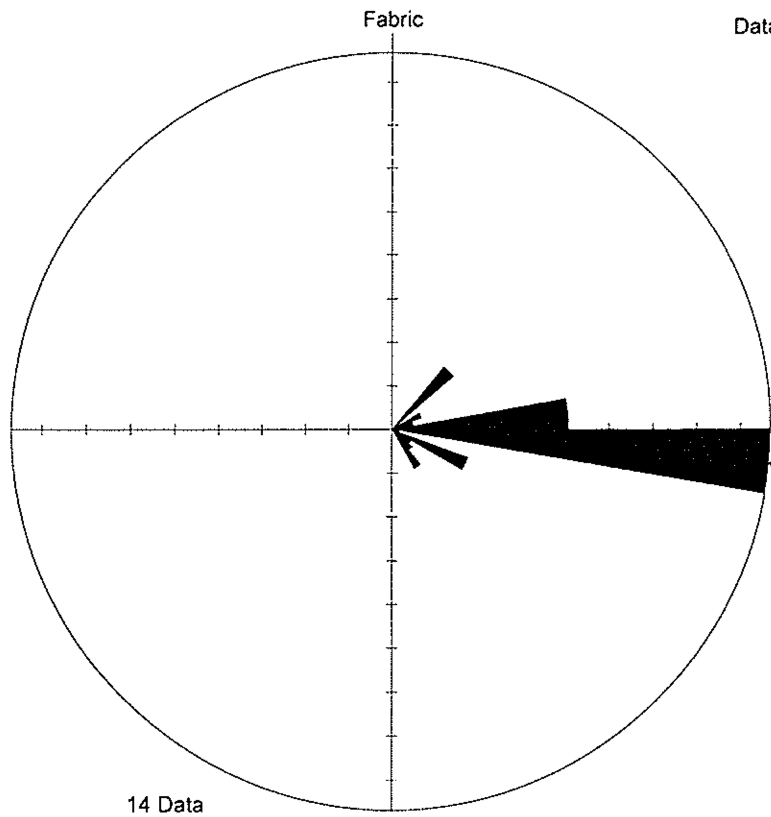
Data description RG157J

length- Azimuth
No. of Data = 8
Sector angle = 10°
Scale: tick interval = 5% [length: 3.65]
Maximum = 23.3% [length: 17]
Total length = 73
Mean Resultant dir'n = 066
[Approx. 95% Confidence interval = ±25
(valid only for unimodal data)

RG157K
9



RG157L
14

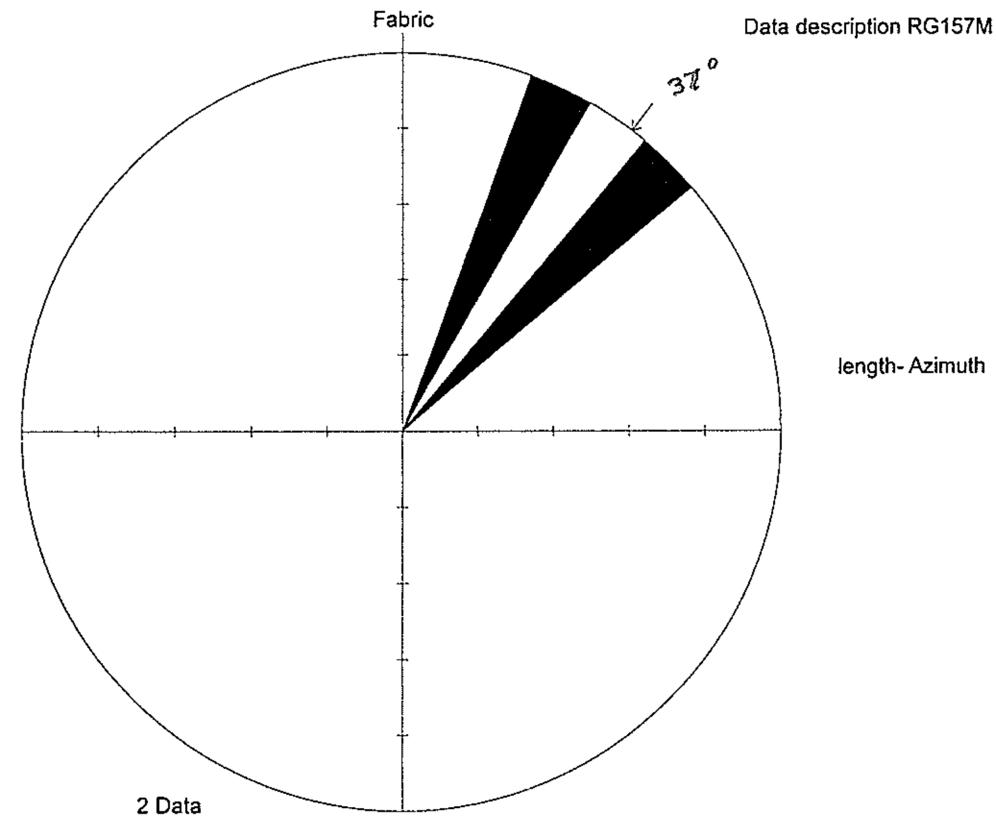


Data description RG157L

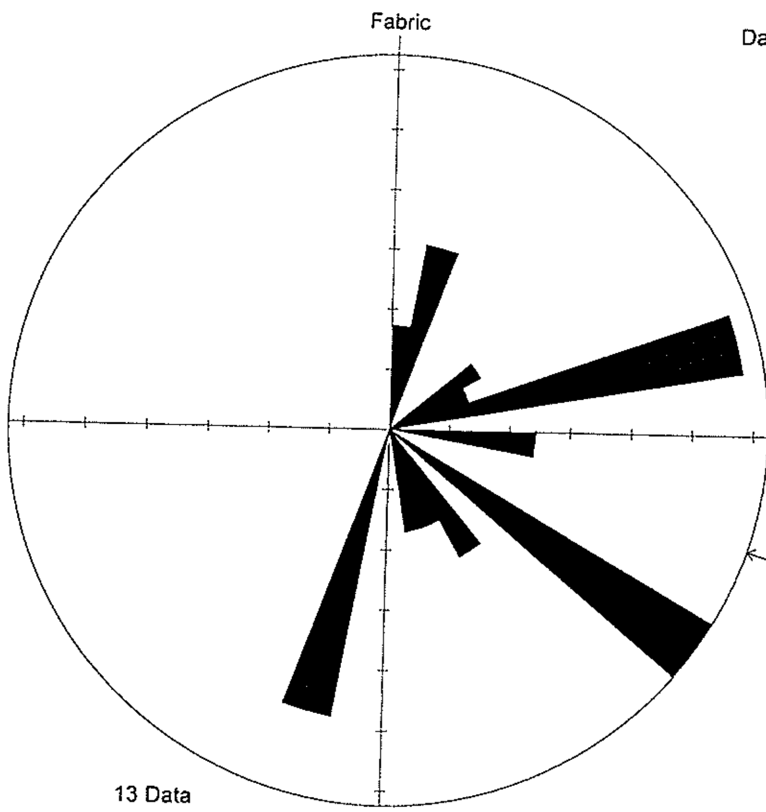
95°

length- Azimuth
No. of Data = 14
Sector angle = 10°
Scale: tick interval = 5% [length: 9.55]
Maximum = 43.5% [length: 83]
Total length = 191
Mean Resultant dir'n = 095
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

RG157M (new)
2



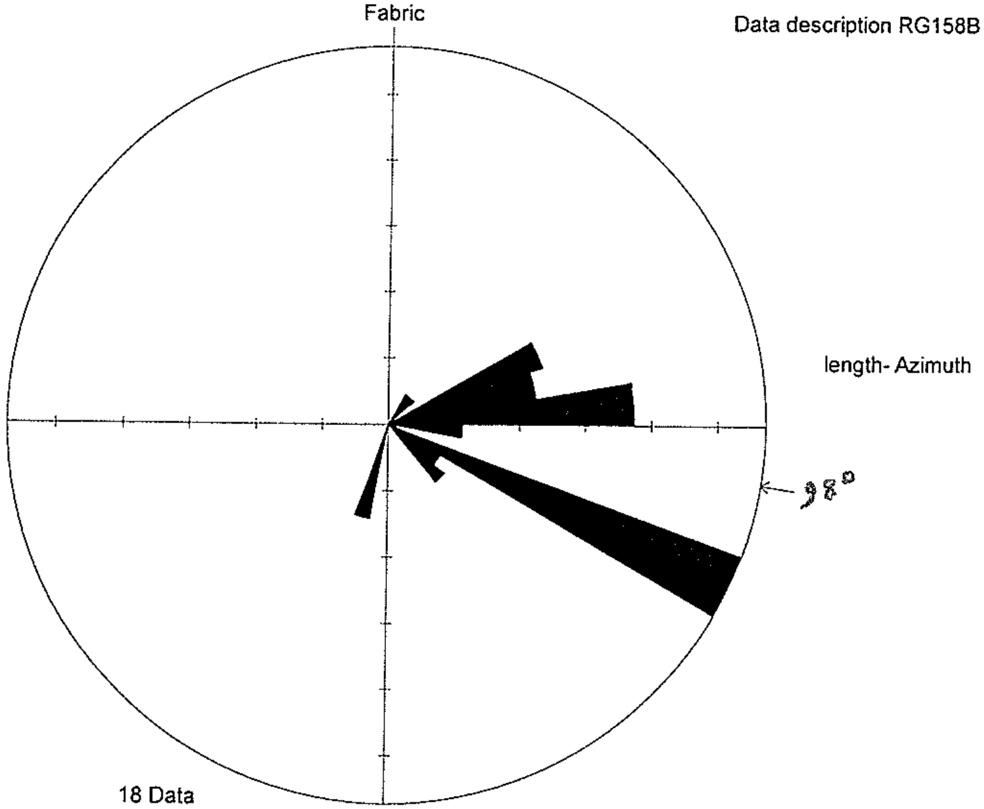
RG158A
13



Data description RG158A

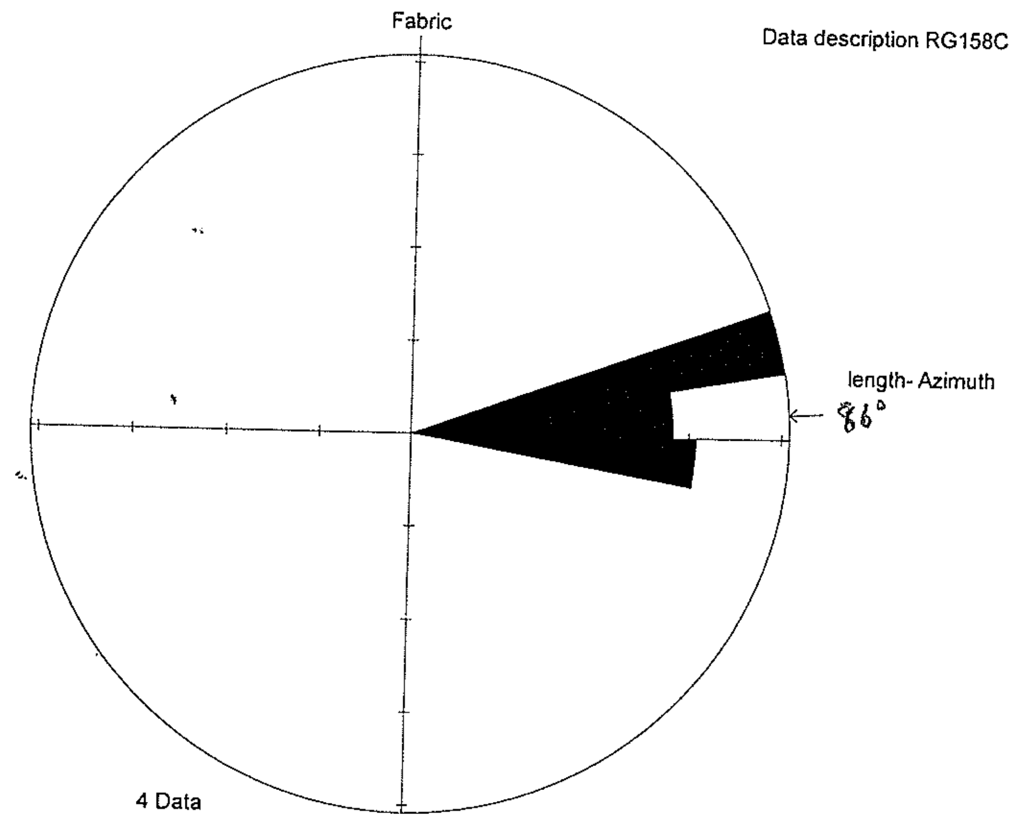
length- Azimuth
No. of Data = 13
Sector angle = 10°
Scale: tick interval = 3% [length: 2.88]
Maximum = 18.8% [length: 18]
Total length = 96
Mean Resultant dir'n = 108
[Approx. 95% Confidence interval = ±4
(valid only for unimodal data)
108°

RG158B
18



RG158C (rvsd)

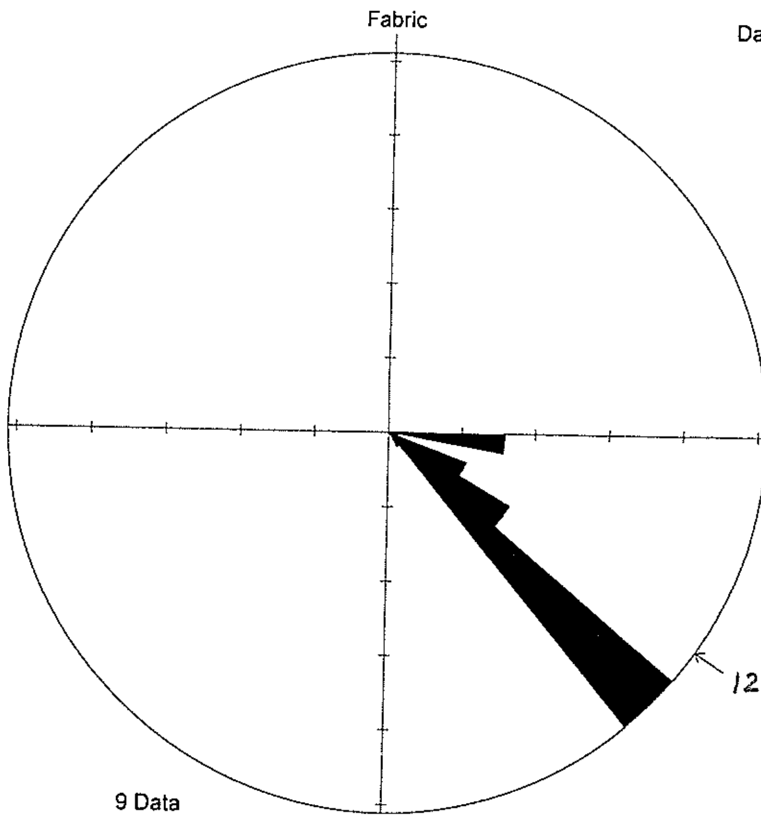
4



RG158D (new)

9

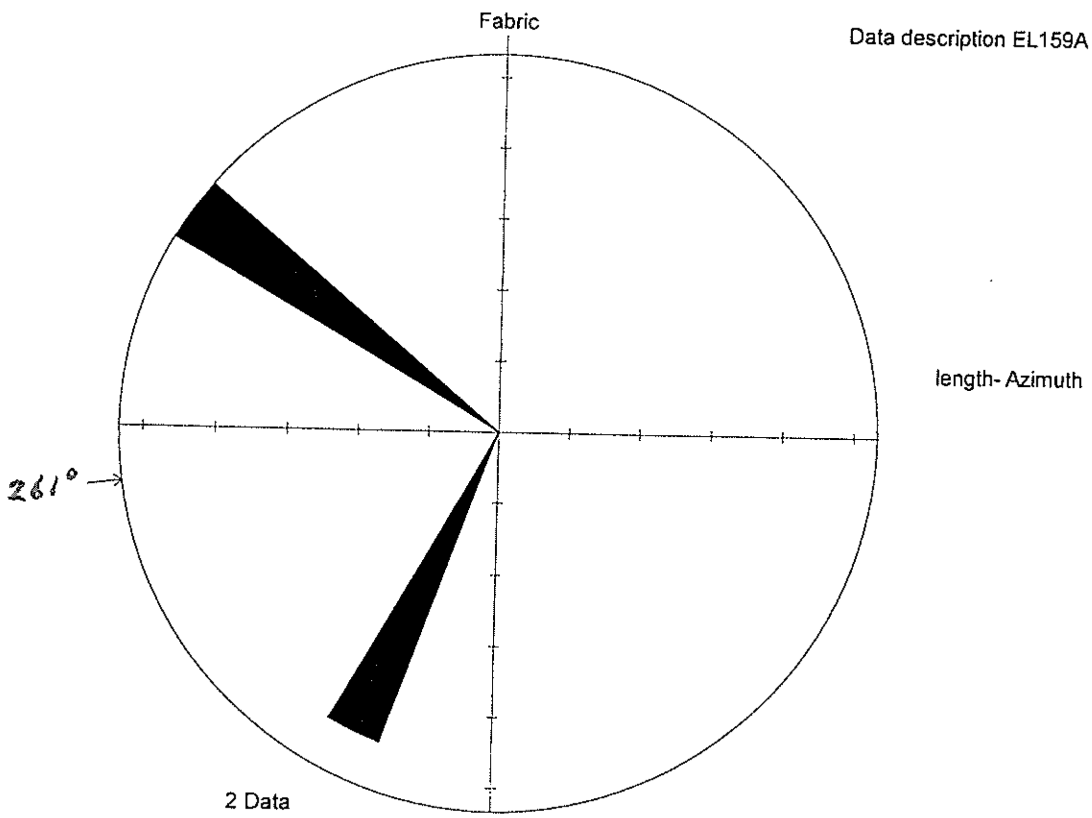
Data description RG158D



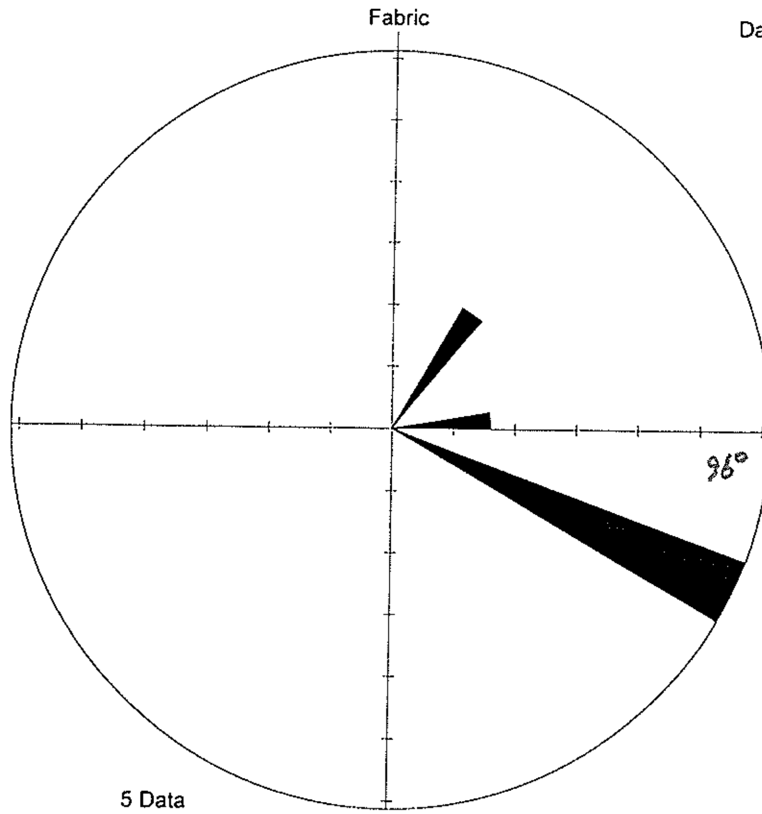
length- Azimuth
No. of Data = 9
Sector angle = 10°
Scale: tick interval = 10% [length: 8.80]
Maximum = 51.1% [length: 45]
Total length = 88
Mean Resultant dir'n = 125
[Approx. 95% Confidence interval = ±9.
(valid only for unimodal data)

EL159A

2



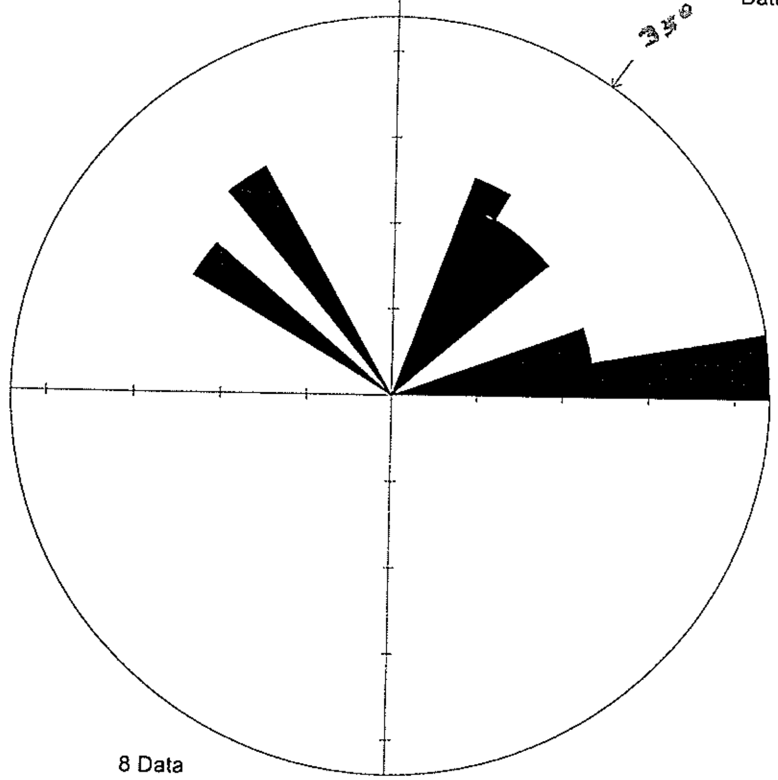
EL159B
5



Data description EL159B

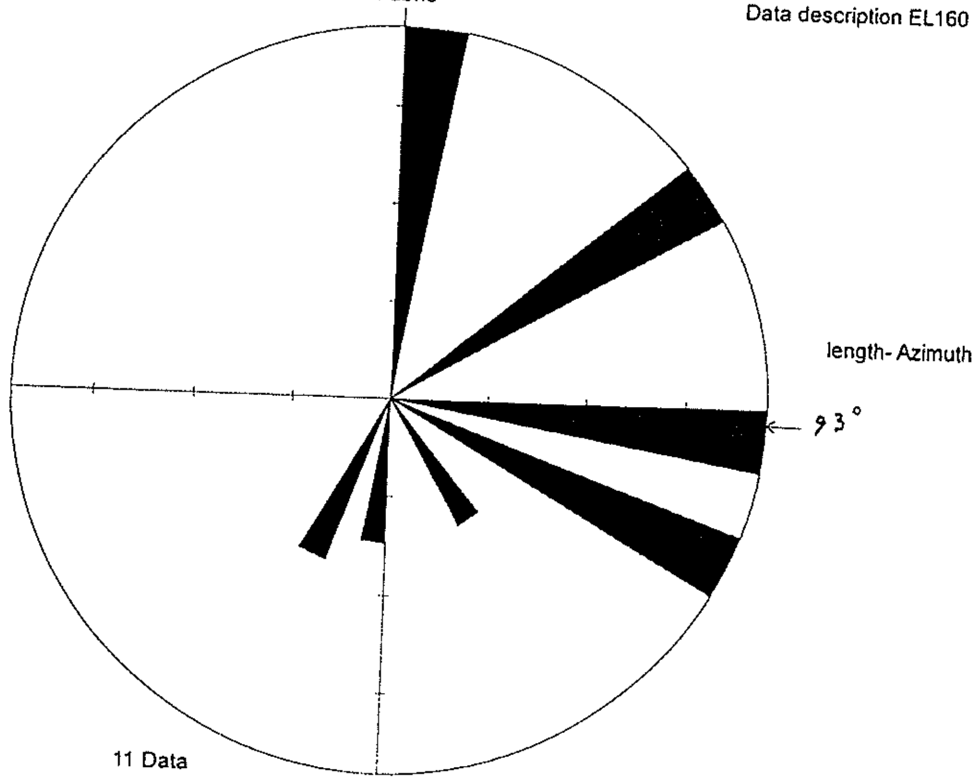
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 3.10]
Maximum = 61.3% [length: 19]
Total length = 31
Mean Resultant dir'n = 096
[Approx. 95% Confidence interval = ±27
(valid only for unimodal data)

EL159C
8

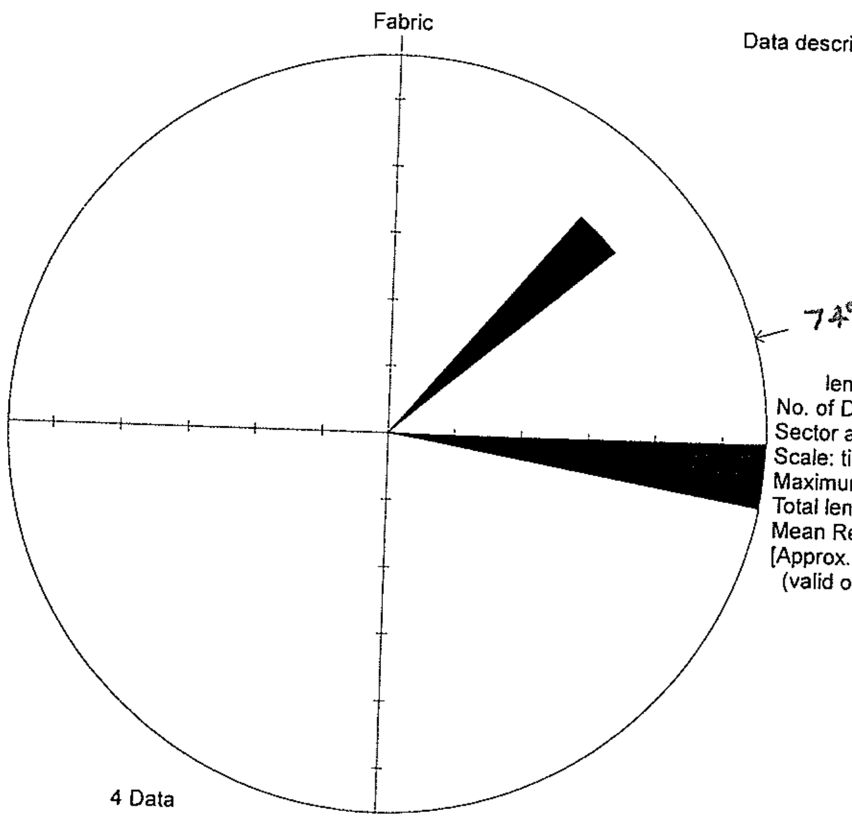


EL160

11



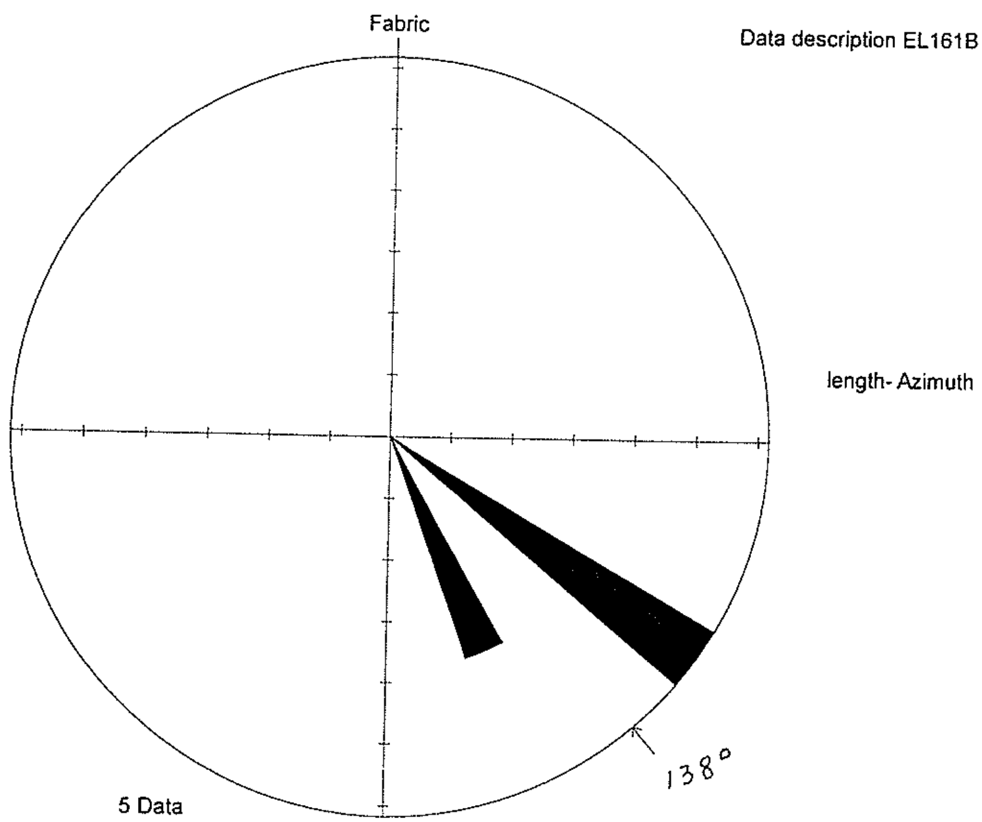
EL161A (rvsd)
4



Data description EL161A

length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 3.00
Maximum = 56.7% [length: 17]
Total length = 30
Mean Resultant dir'n = 074
[Approx. 95% Confidence interval = ±27
(valid only for unimodal data)

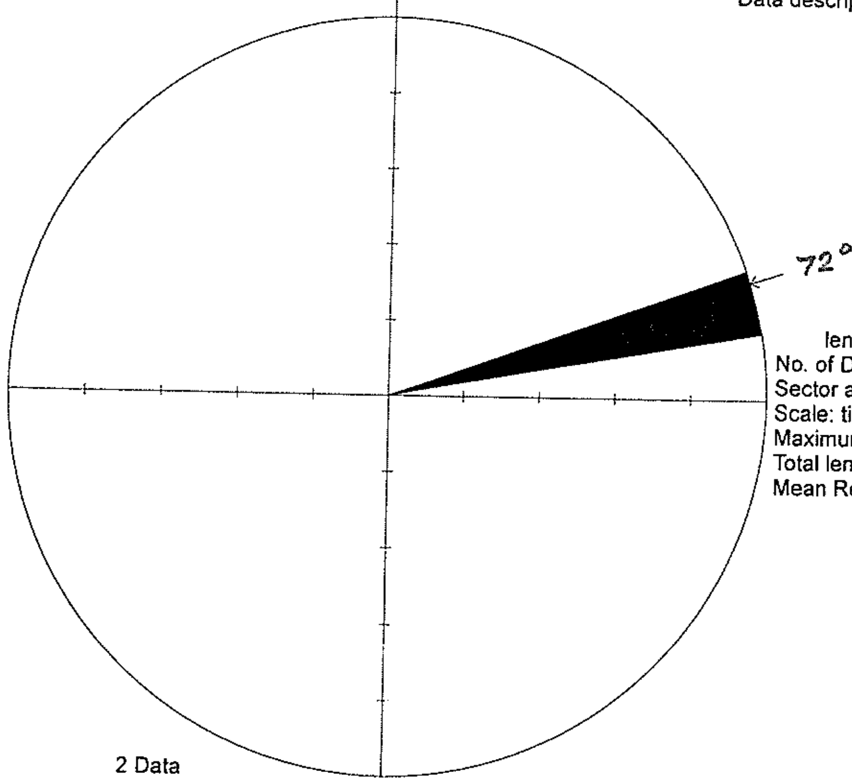
EL161B (rvsd)
5



EL161C (new)
2

Fabric

Data description EL161C

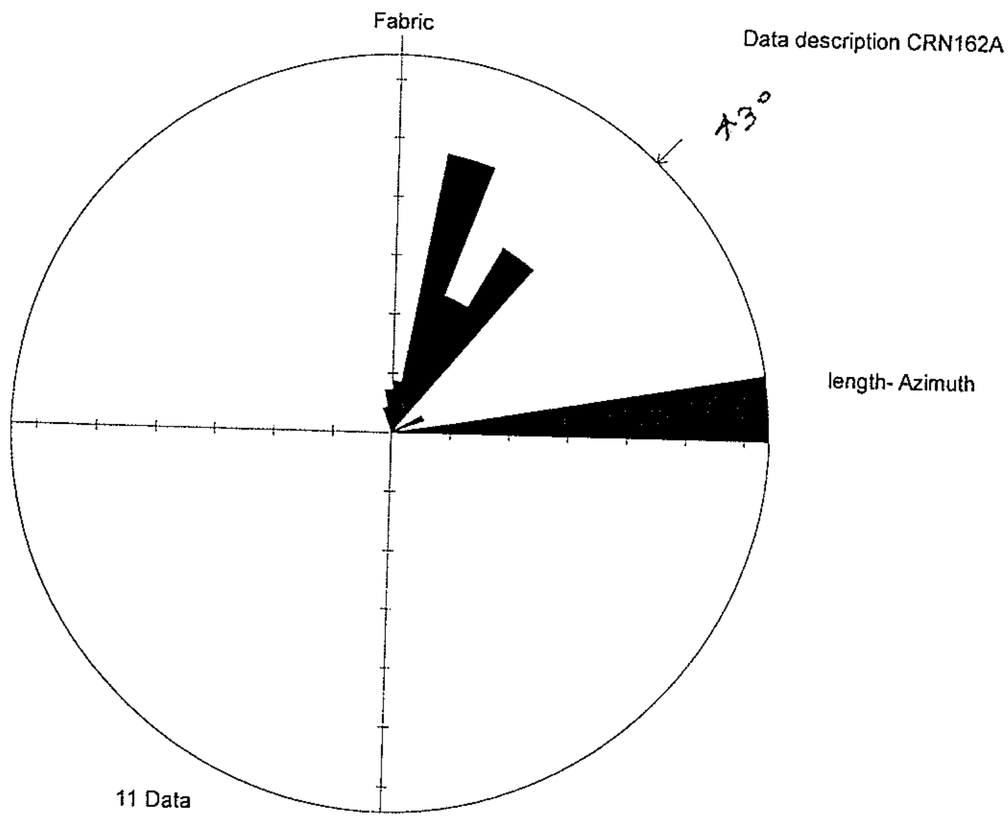


length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 20% [length: 3.00]
Maximum = 100% [length: 15]
Total length = 15
Mean Resultant dir'n = 072

2 Data

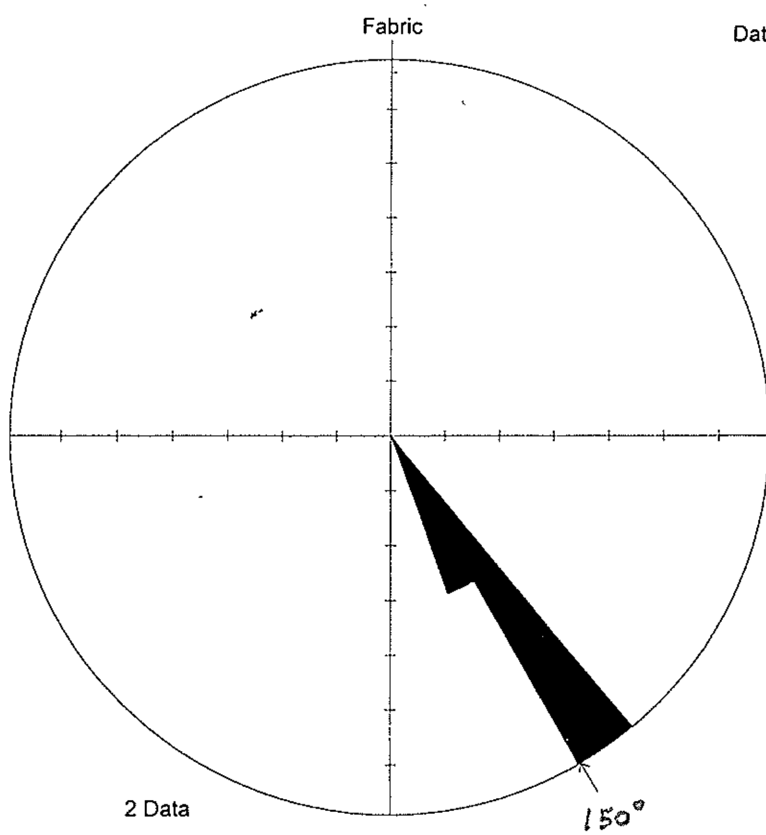
CRN162A (rvsd)

11



CRN162B

2

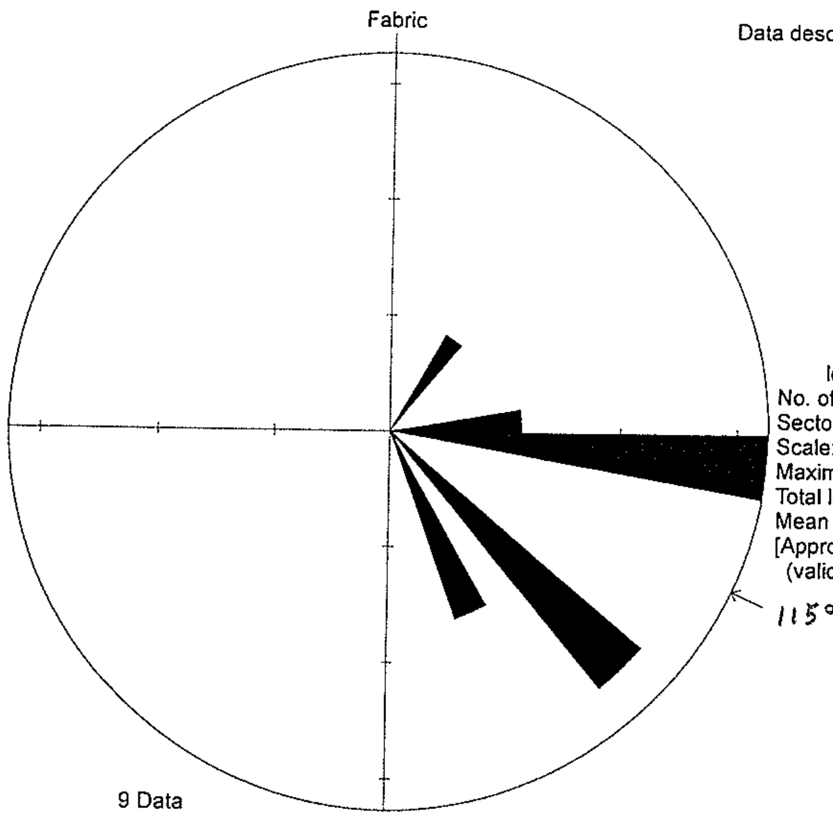


Data description CRN162B

length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.30]
Maximum = 69.2% [length: 9]
Total length = 13
Mean Resultant dir'n = 150

EB163A

9

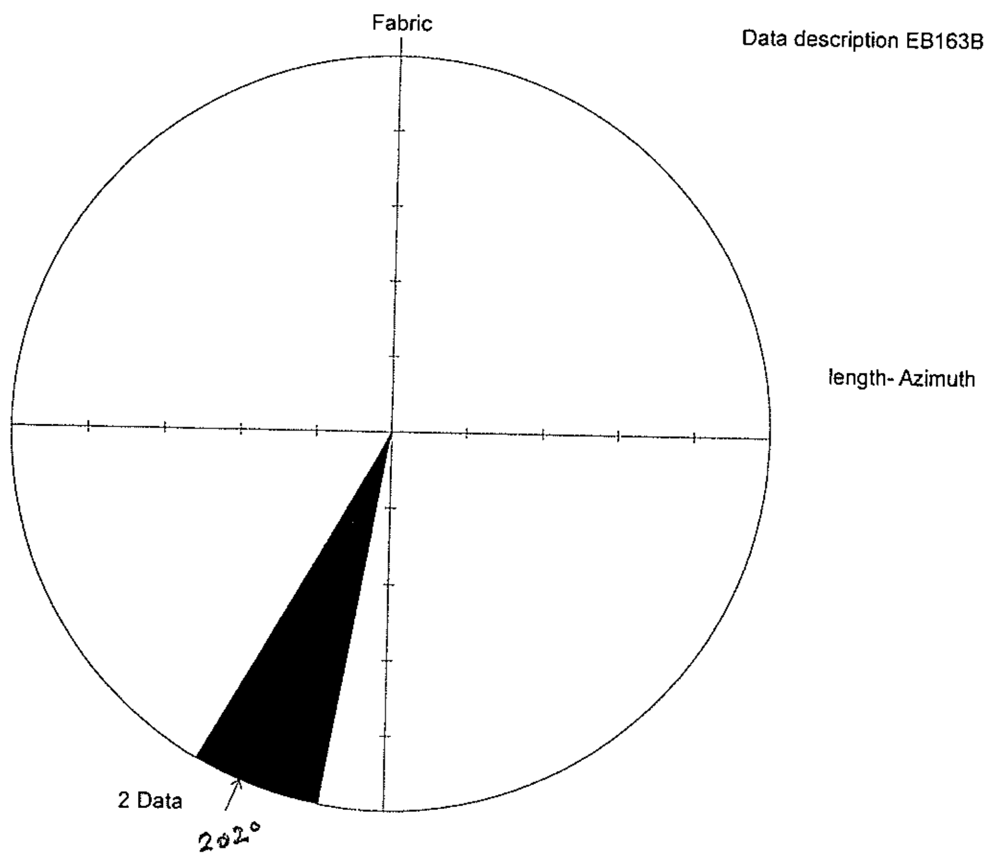


Data description EB163A

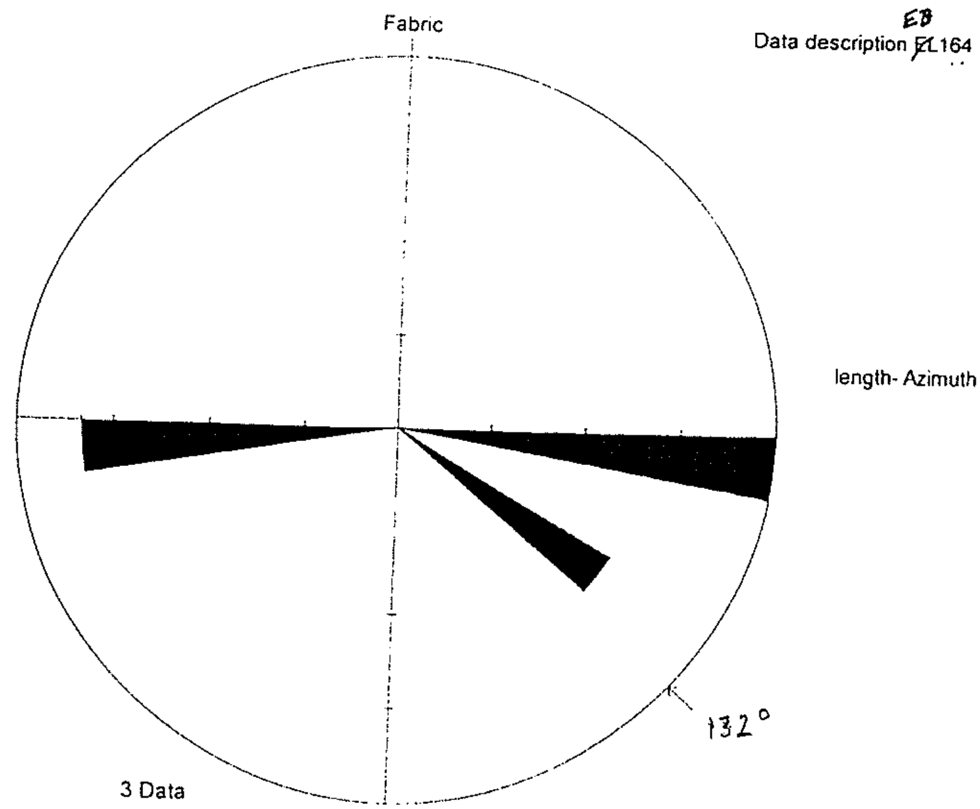
length- Azimuth
No. of Data = 9
Sector angle = 10°
Scale: tick interval = 10% [length: 5.20]
Maximum = 32.7% [length: 17]
Total length = 52
Mean Resultant dir'n = 115
[Approx. 95% Confidence interval = ±24
(valid only for unimodal data)

EB163B

2



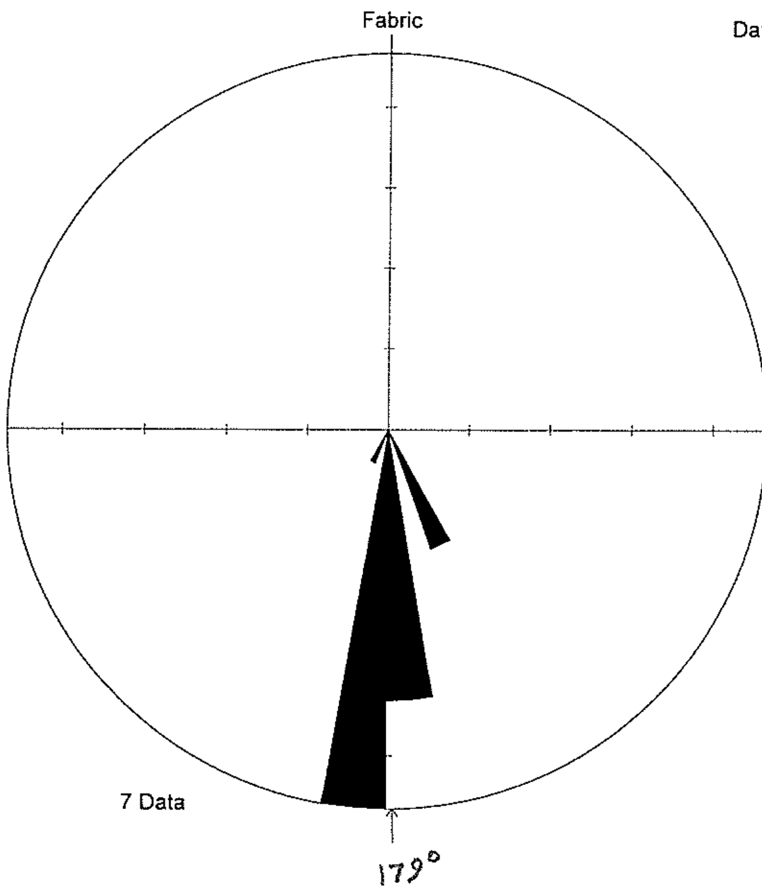
EB164
3



EB165A

7

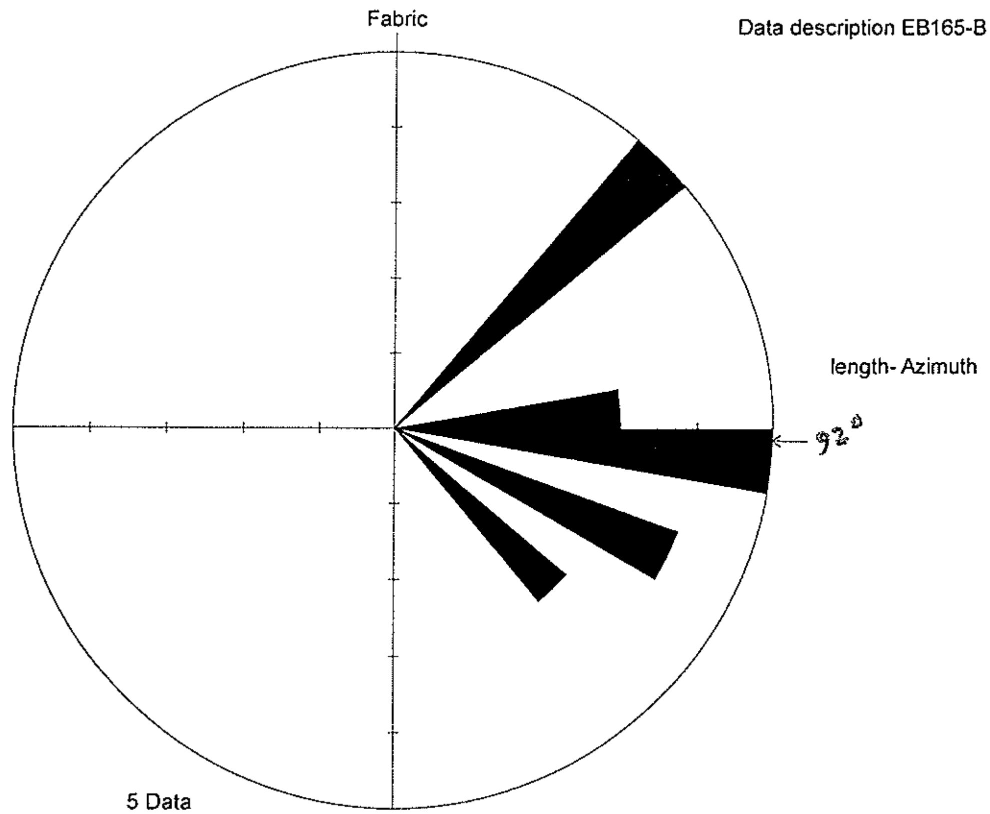
Data description EB165-A



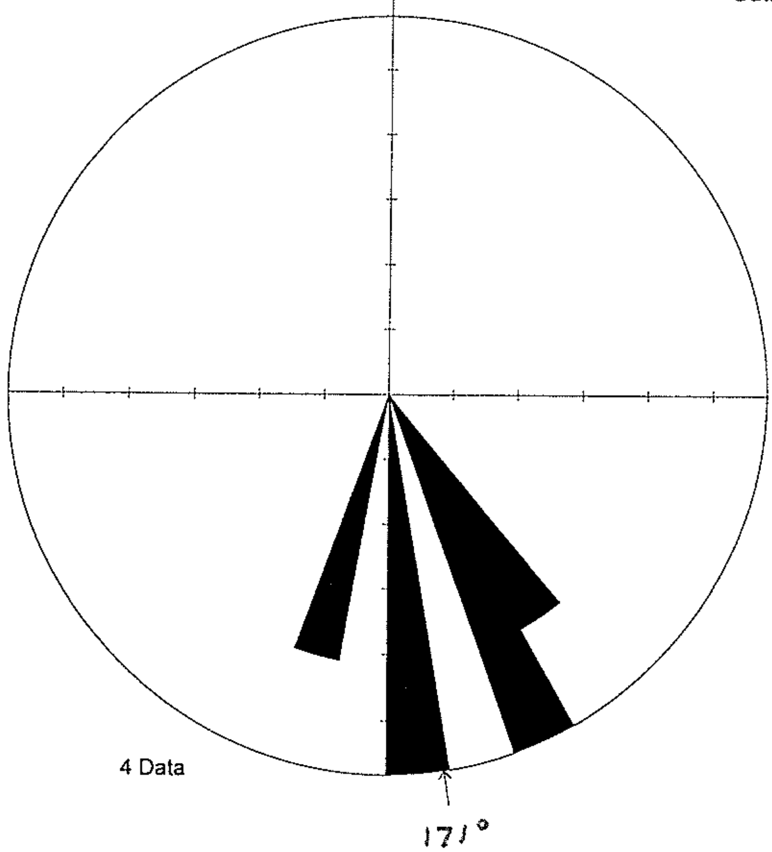
length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 10% [length: 4.50]
Maximum = 46.7% [length: 21]
Total length = 45
Mean Resultant dir'n = 179
[Approx. 95% Confidence interval = ±9.7
(valid only for unimodal data)

EB165B

5



EB165C
4

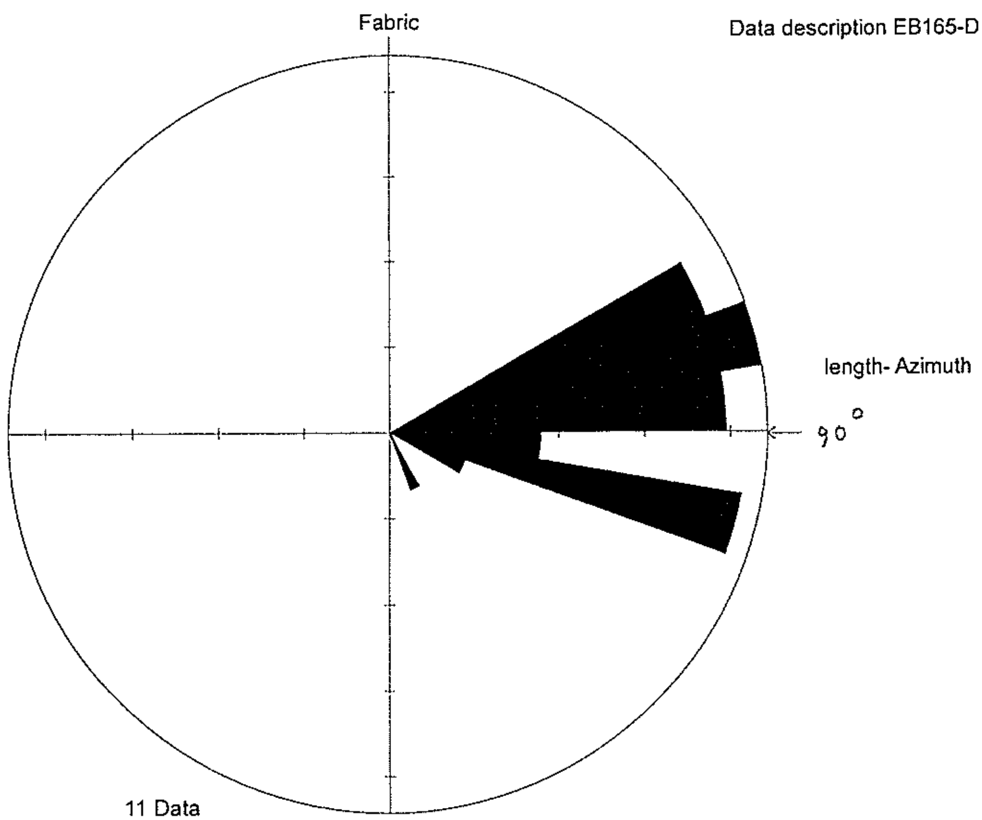


Data description EB165-C

length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 1.20]
Maximum = 29.2% [length: 7]
Total length = 24
Mean Resultant dir'n = 171

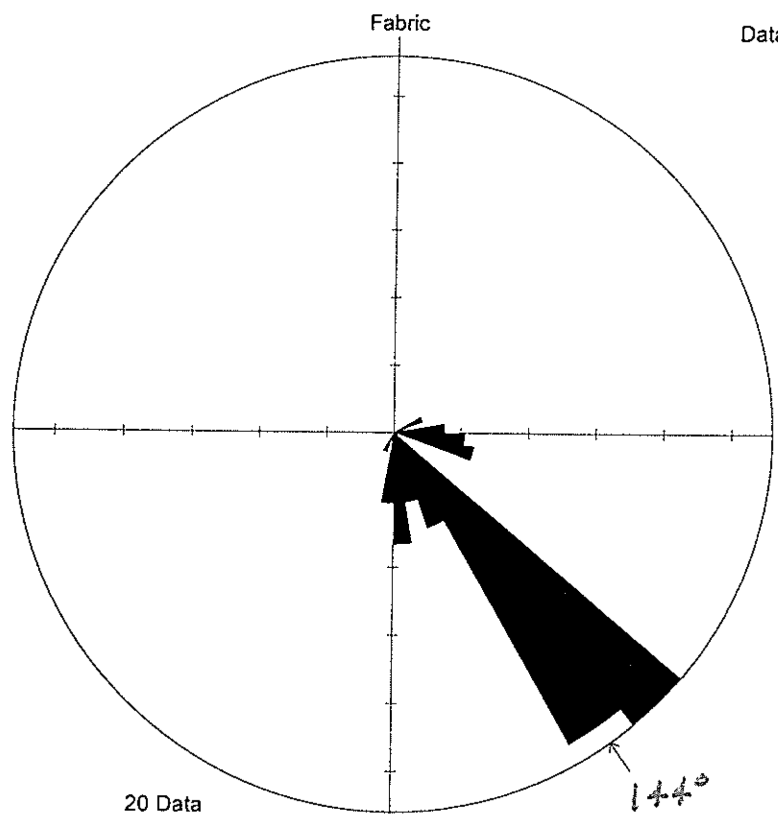
EB165D

11



EB-165E

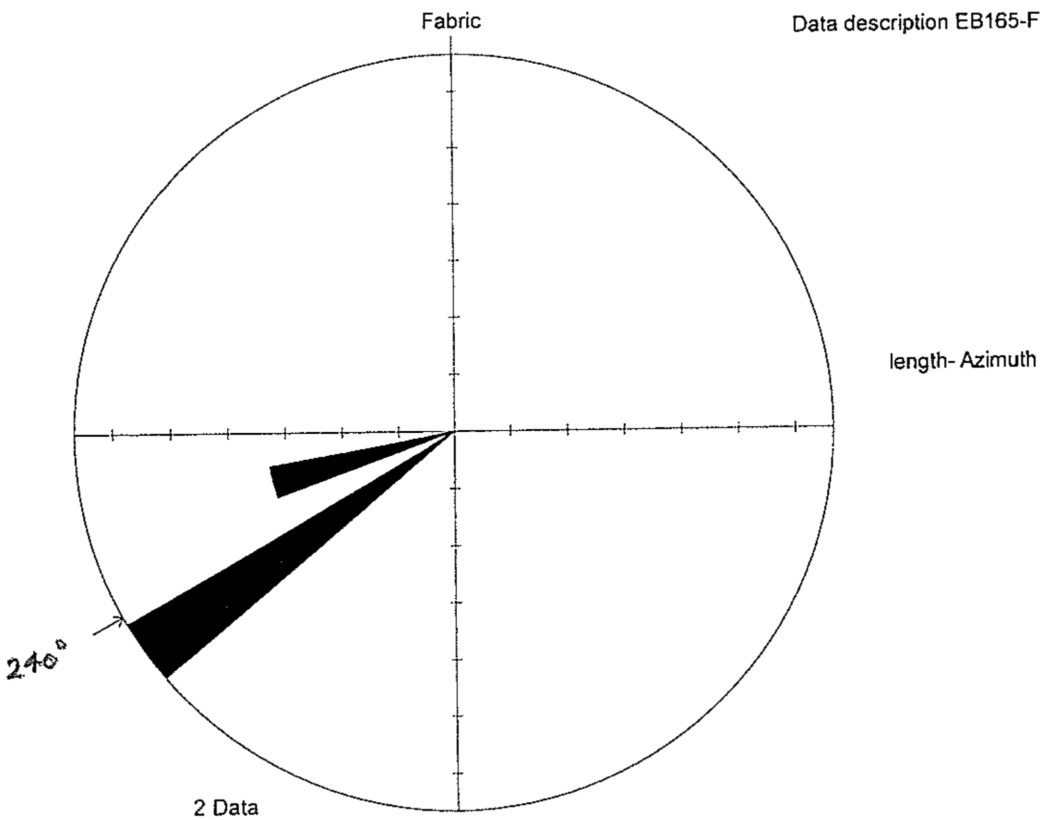
20



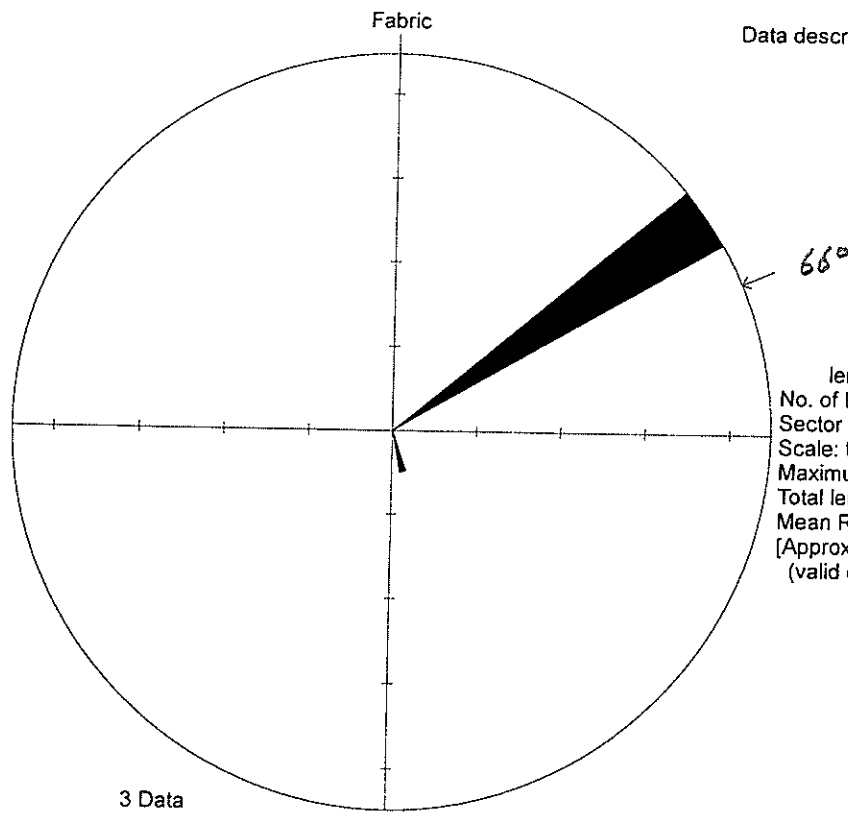
Data description EB165-E

length- Azimuth
No. of Data = 20
Sector angle = 10°
Scale: tick interval = 5% [length: 6.60]
Maximum = 28.0% [length: 37]
Total length = 132
Mean Resultant dir'n = 144
[Approx. 95% Confidence interval = ±1:
(valid only for unimodal data)

EB165F
2



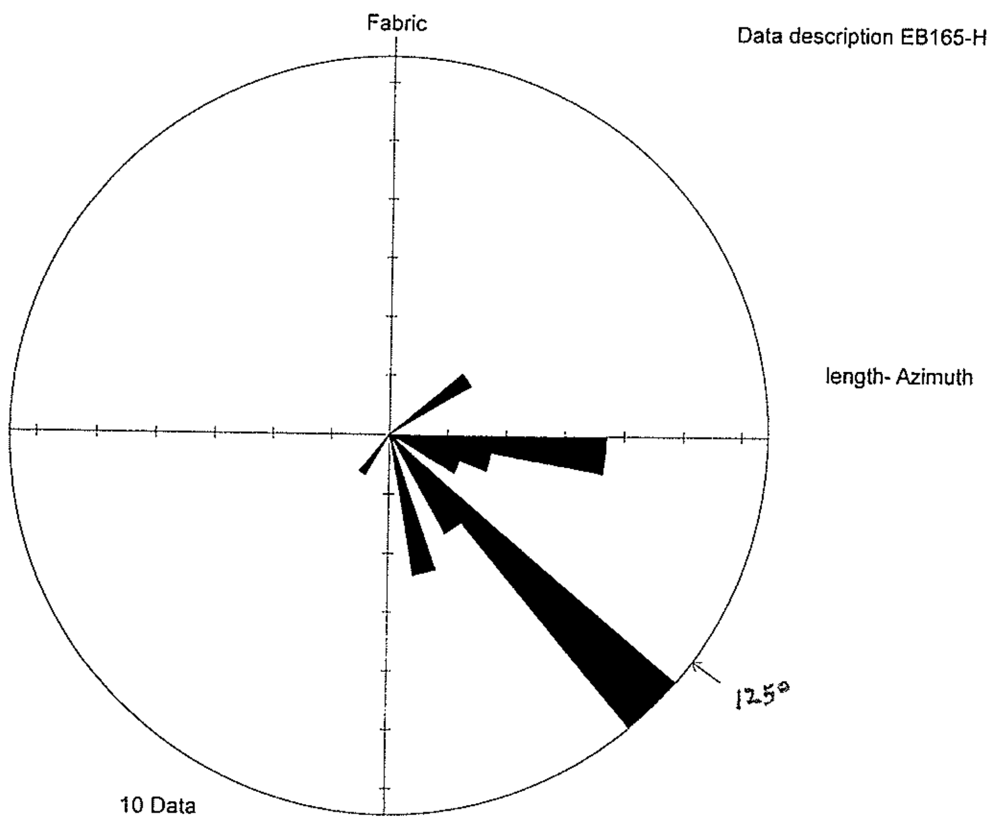
EB165G
3



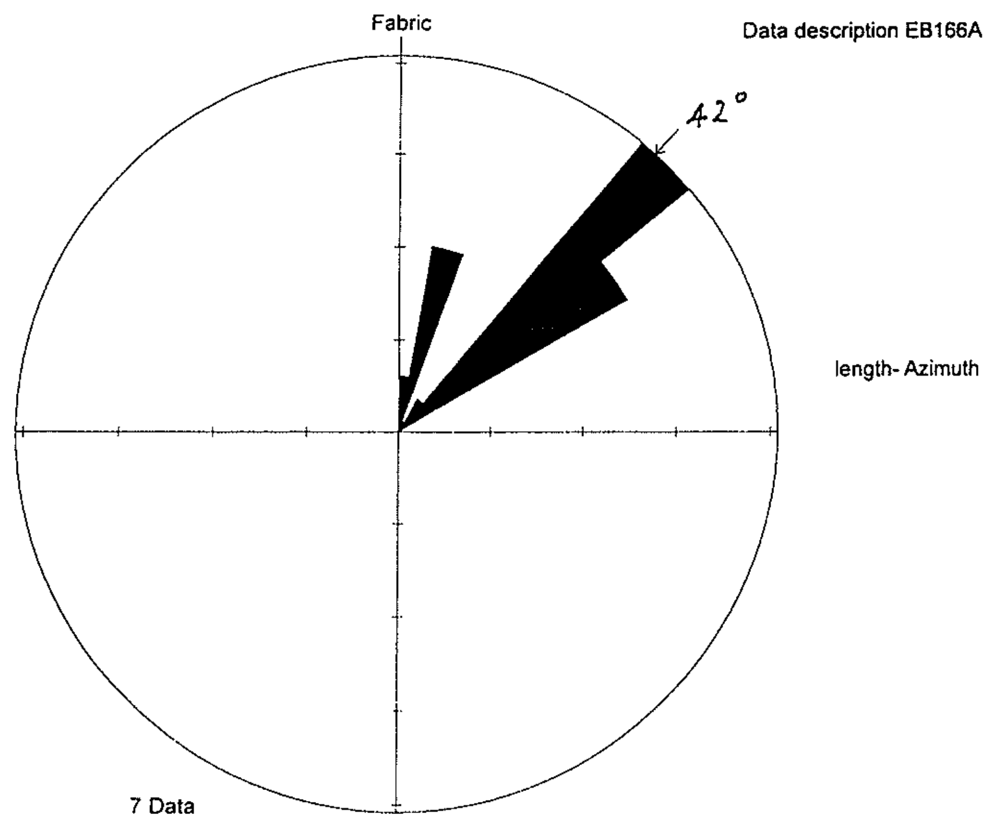
Data description EB165-G

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 20% [length: 7.8
Maximum = 89.7% [length: 35]
Total length = 39
Mean Resultant dir'n = 066
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

EB165-H
10

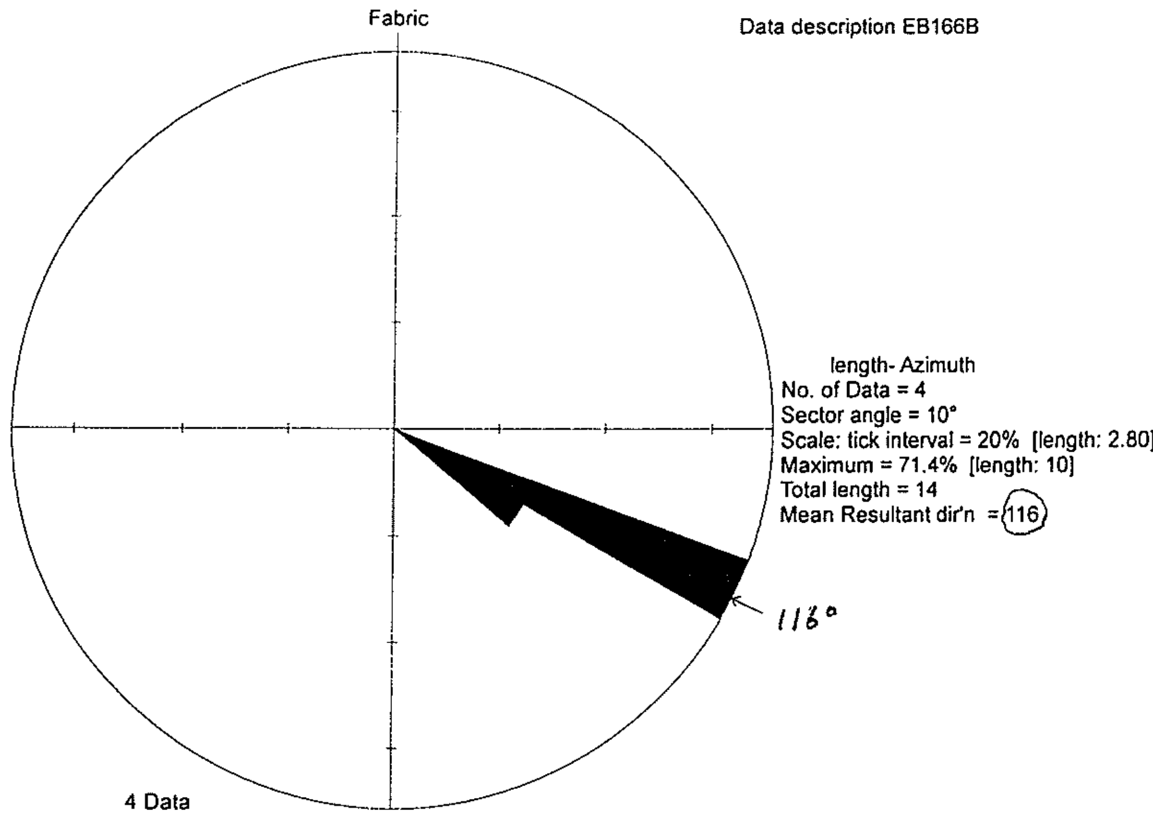


EB166A (new)
7

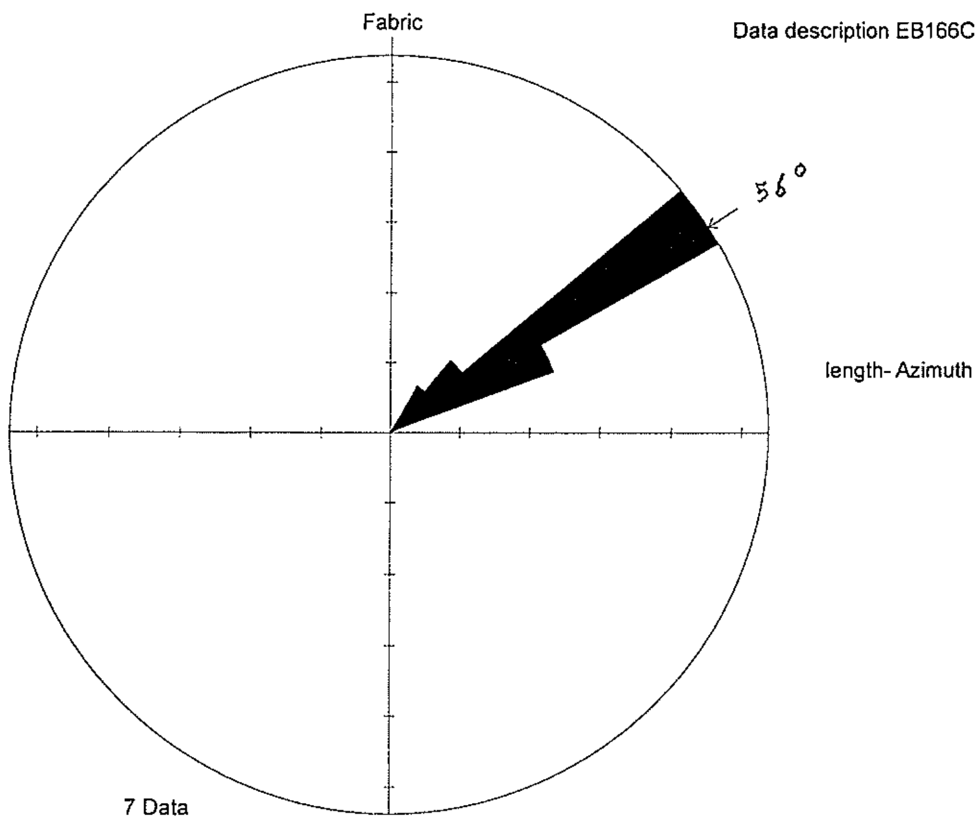


EB166B (new)

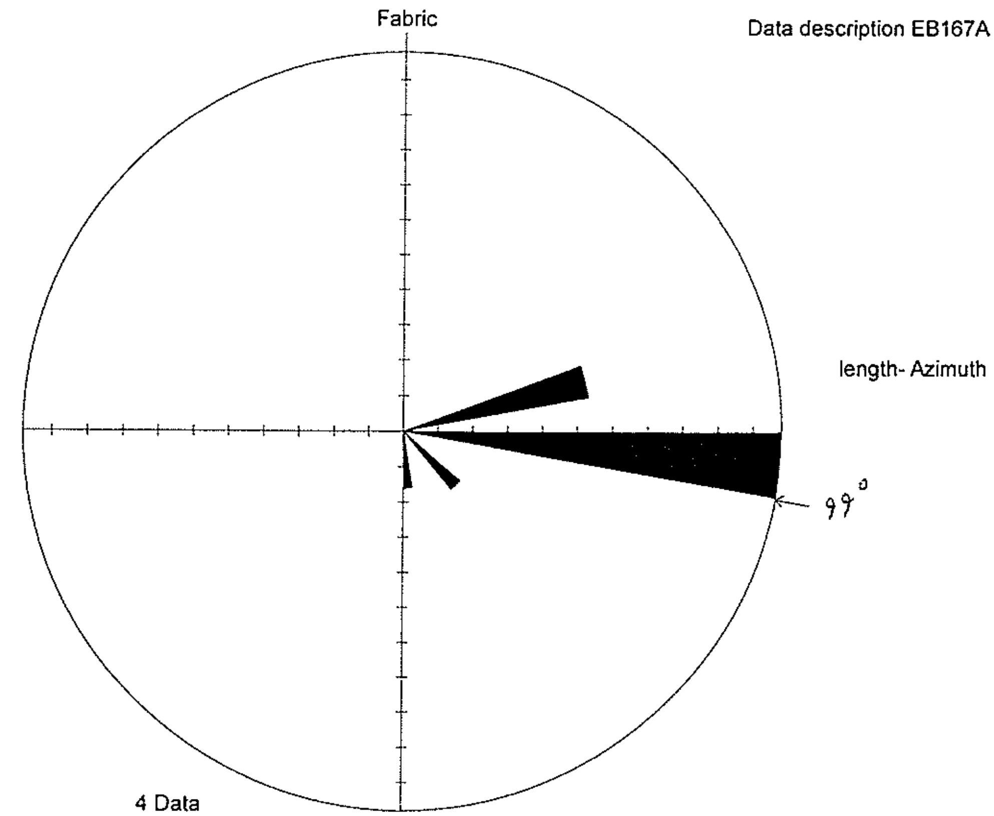
4


Fabric
Data description EB166B
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 20% [length: 2.80]
Maximum = 71.4% [length: 10]
Total length = 14
Mean Resultant dir'n = 116
116°
4 Data

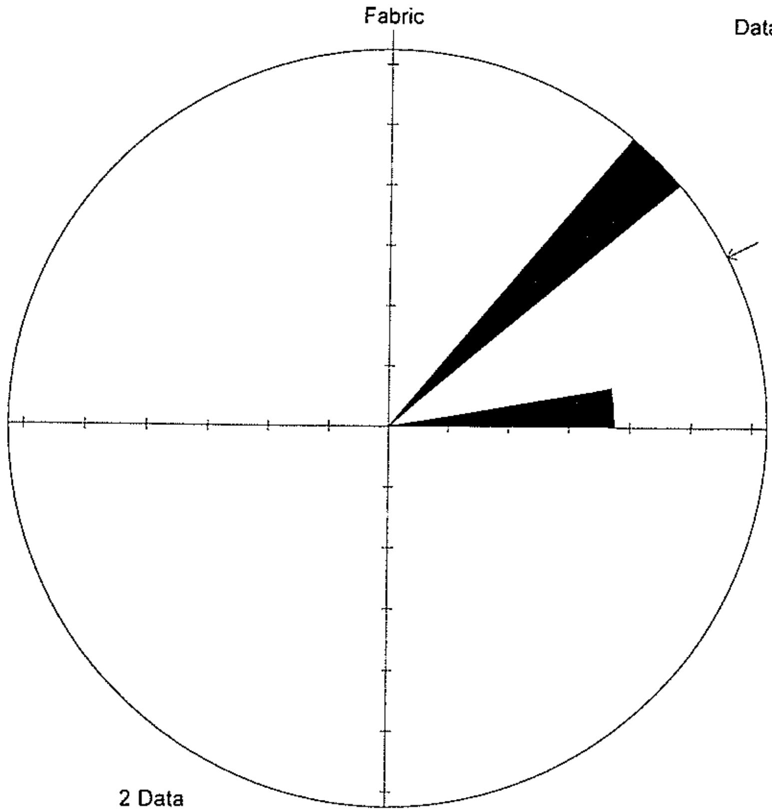
EB166C (new)
7



EB167A (new)
4



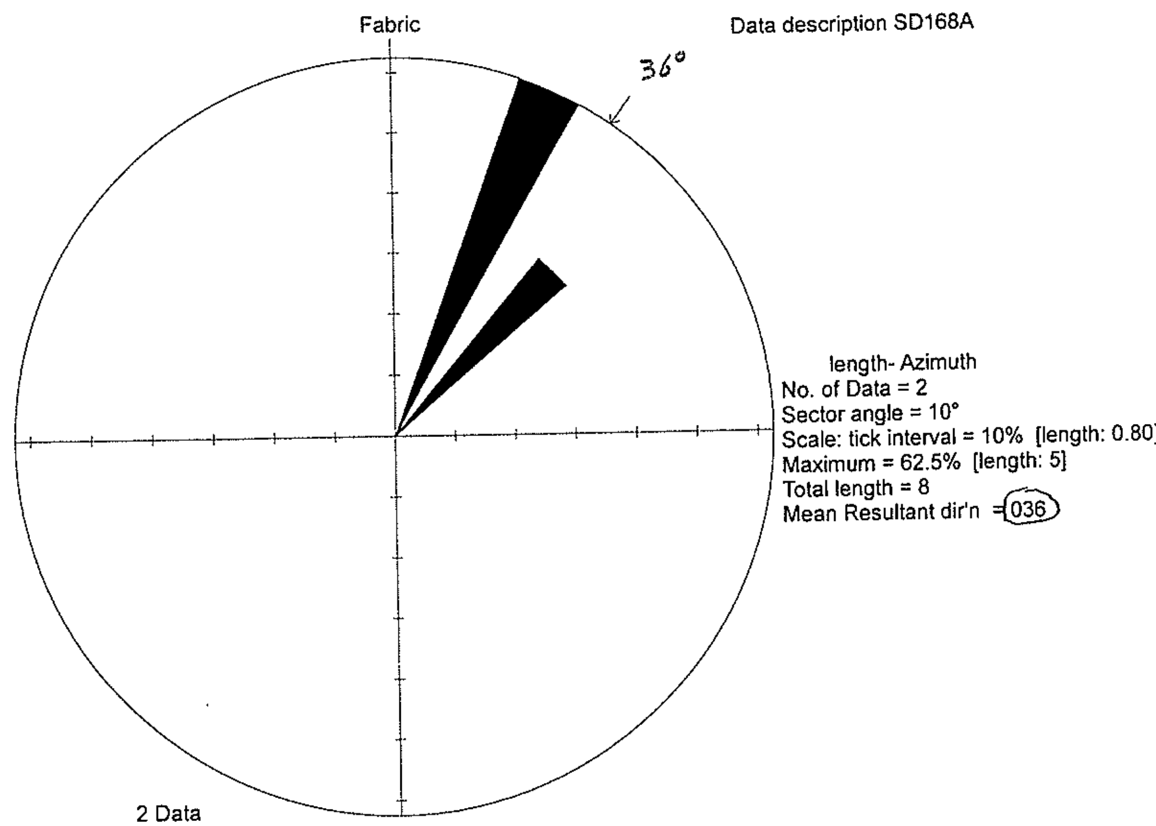
EB167C (new)
2



Data description EB167C

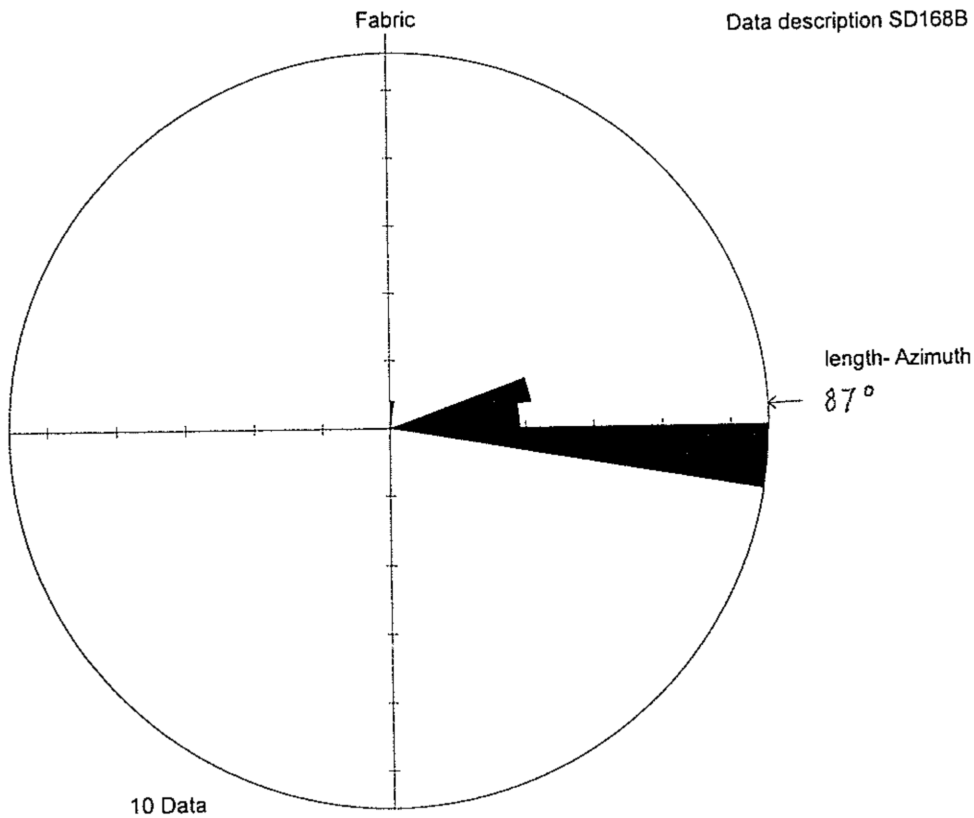
length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 0.80]
Maximum = 62.5% [length: 5]
Total length = 8
Mean Resultant dir'n = 063

SD168A (rvsd)
2

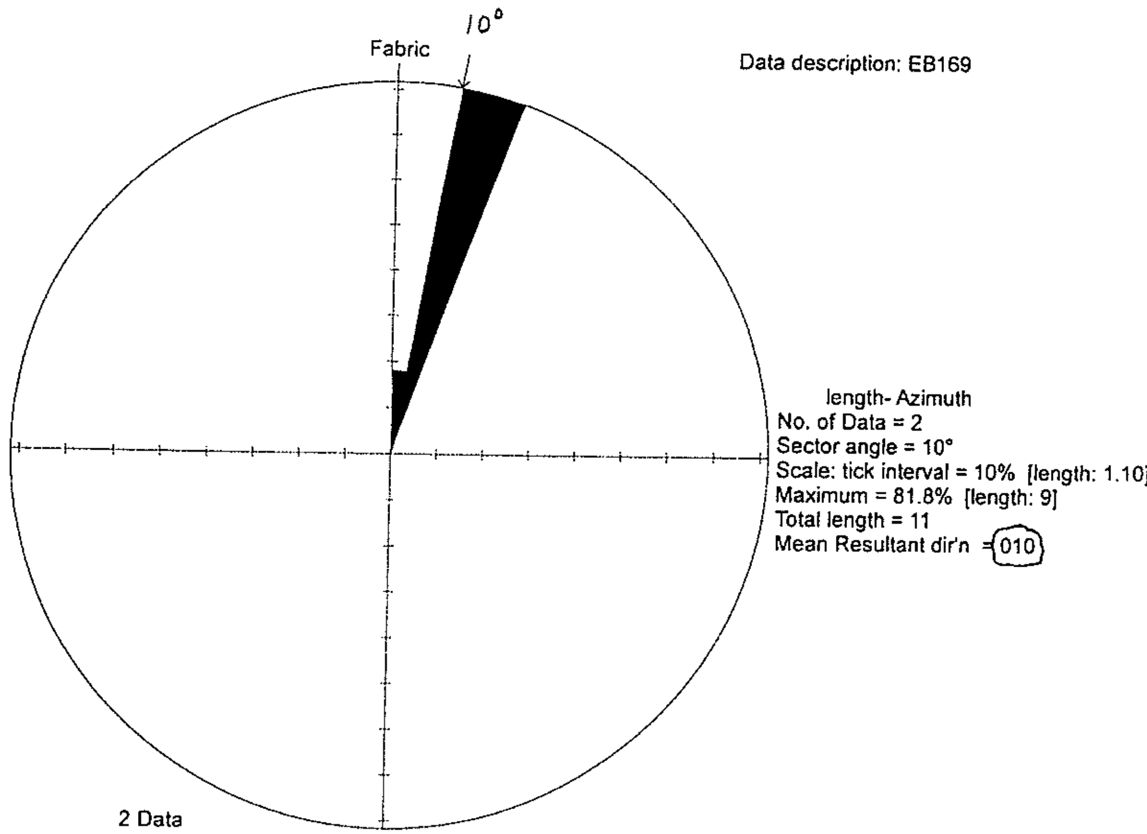


SD 168 B (rvsd)

10

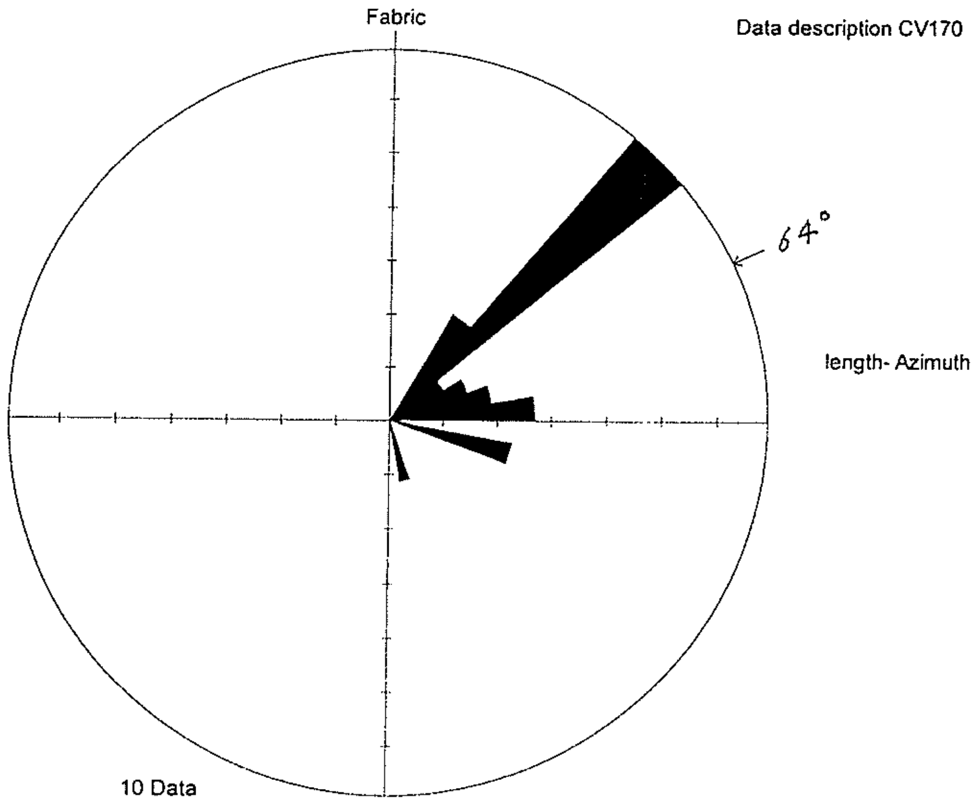


EB169
2

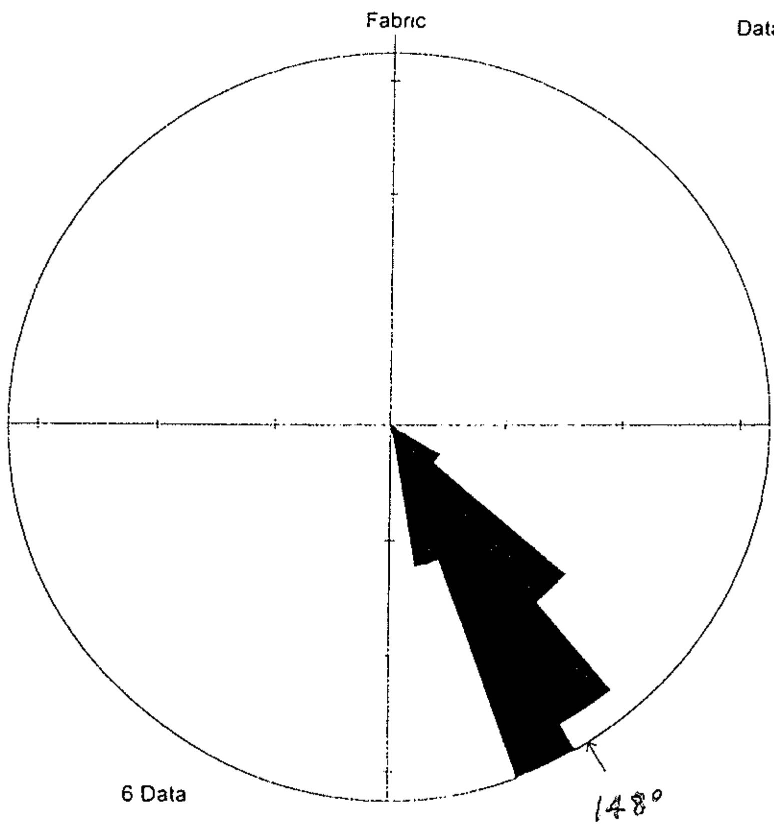

10°
Fabric
Data description: EB169
length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.10]
Maximum = 81.8% [length: 9]
Total length = 11
Mean Resultant dir'n = 010
2 Data

CV170

10



RG171
6



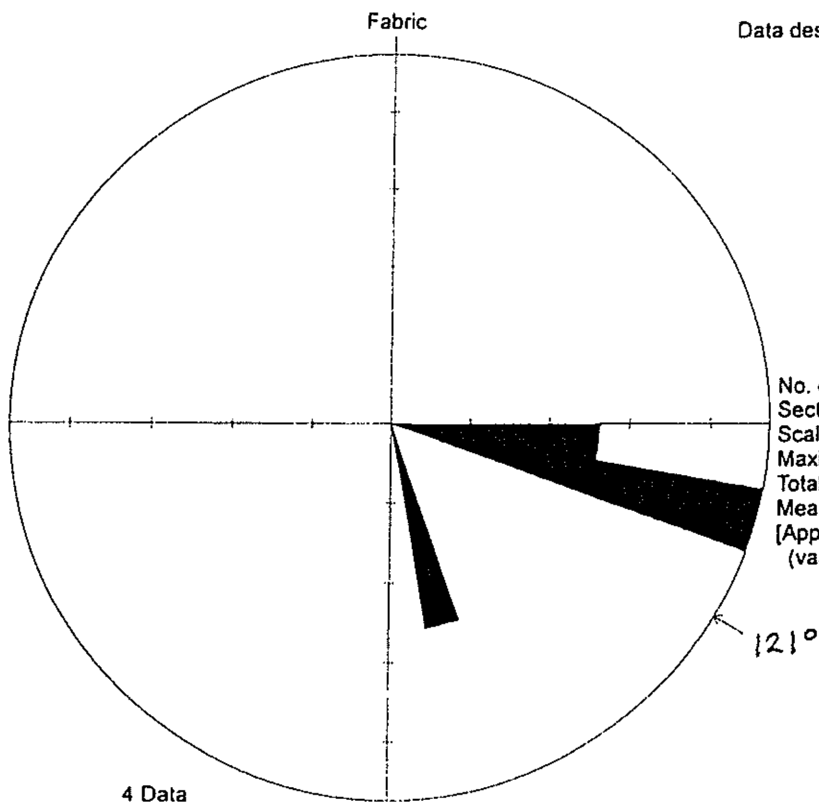
Data description RG171

length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 10% [length: 4.00]
Maximum = 32.5% [length: 13]
Total length = 40
Mean Resultant dir'n = 148
[Approx. 95% Confidence interval = ±7.6
(valid only for unimodal data)

EA171 X

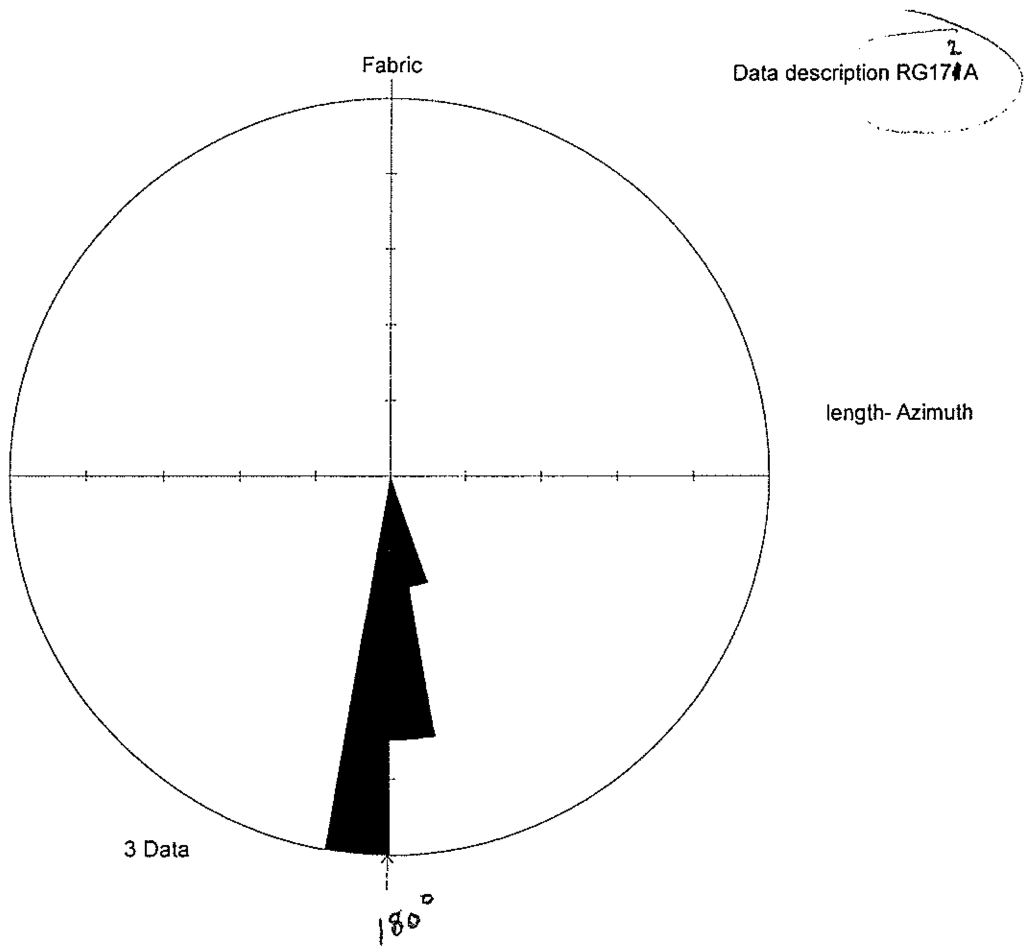
4

Data description EA171X

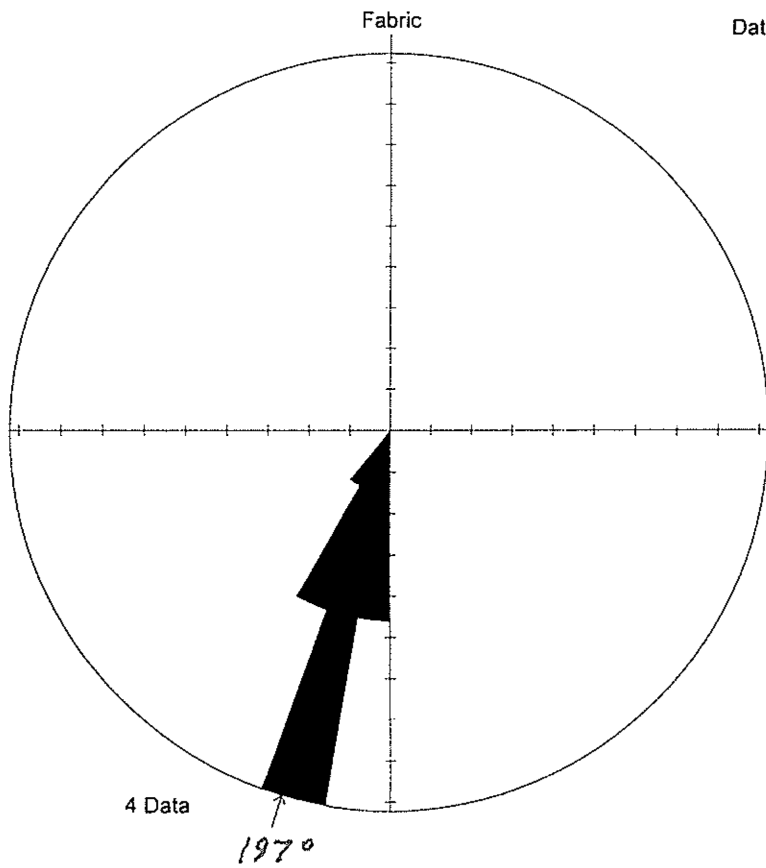


length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 3.80]
Maximum = 47.4% [length: 18]
Total length = 38
Mean Resultant dir'n = 121
[Approx. 95% Confidence interval = ±30
(valid only for unimodal data)

RG172A
3



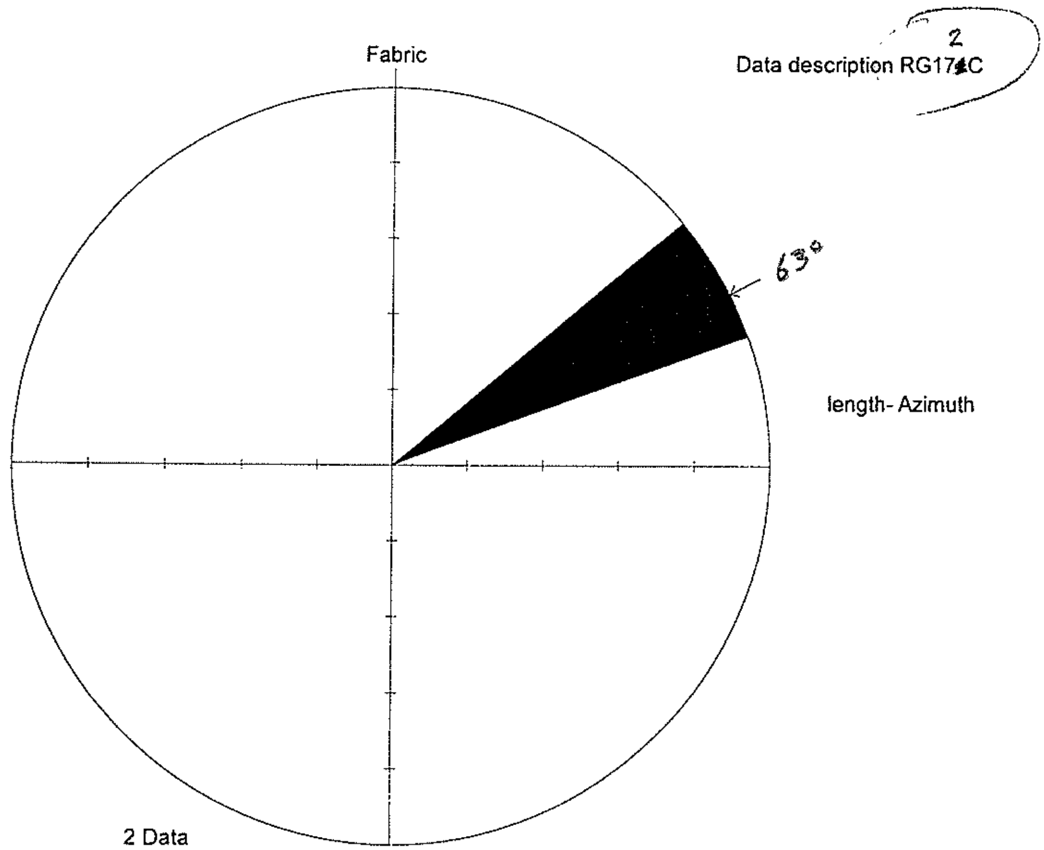
RG172B
4



Data description RG172B

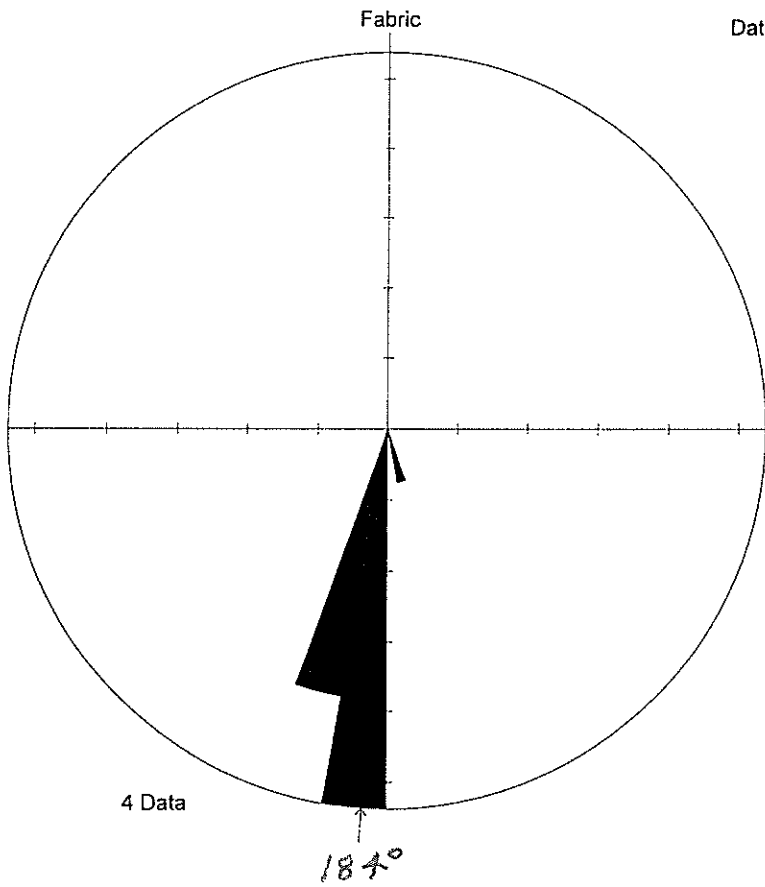
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 0.65]
Maximum = 46.2% [length: 6]
Total length = 13
Mean Resultant dir'n = 197

RG172C
2



RG172D
4

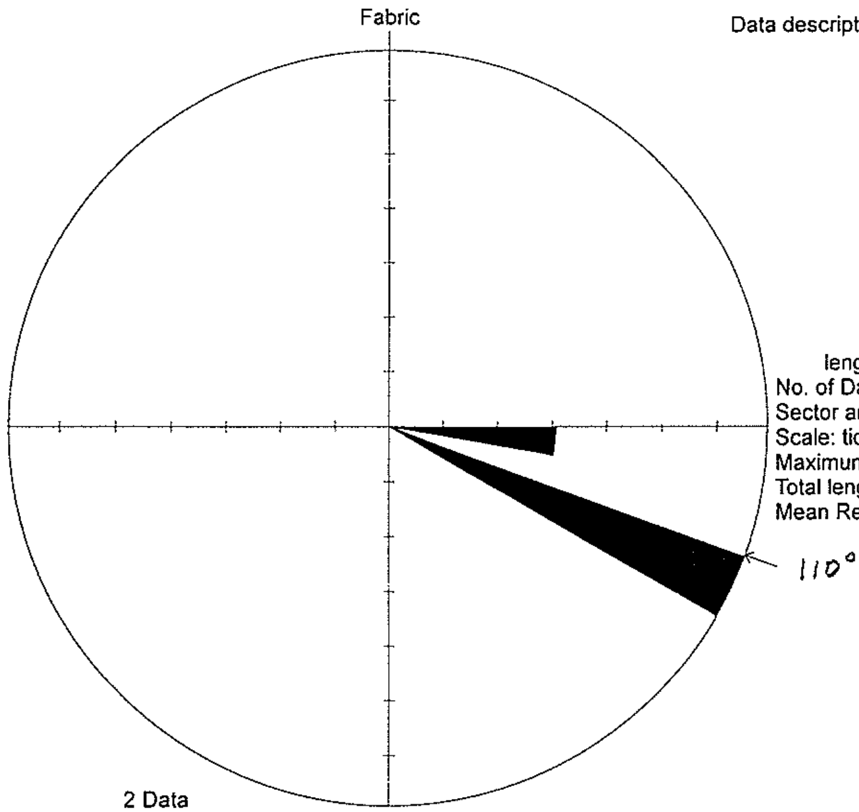
Data description RG172D



length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 2.6
Maximum = 53.8% [length: 14]
Total length = 26
Mean Resultant dir'n = 184
[Approx. 95% Confidence interval = ±
(valid only for unimodal data)

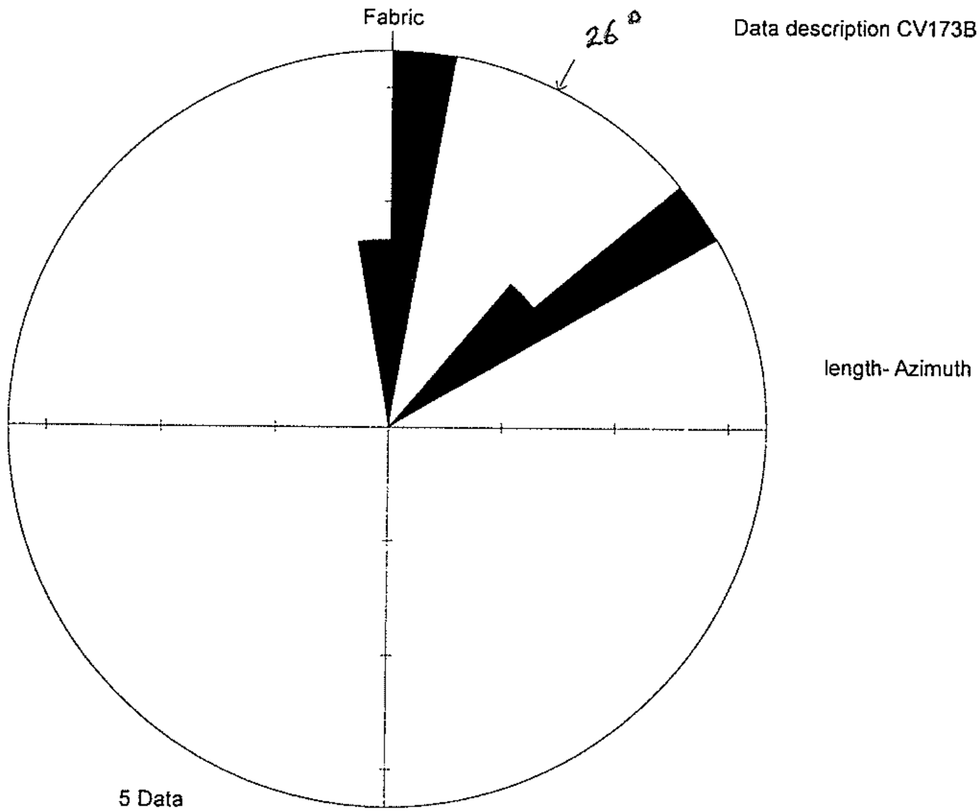
CV173A (rvsd)
2

Data description CV173A

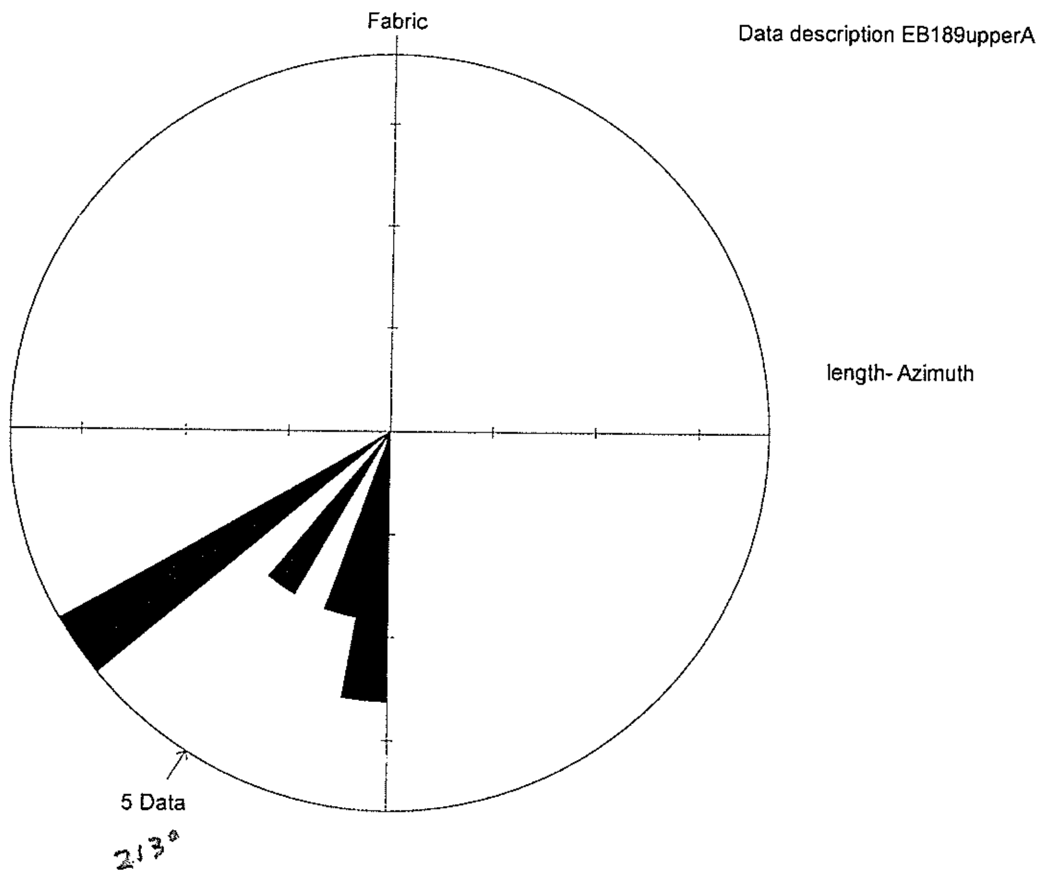


length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.30]
Maximum = 69.2% [length: 9]
Total length = 13
Mean Resultant dir'n = 110

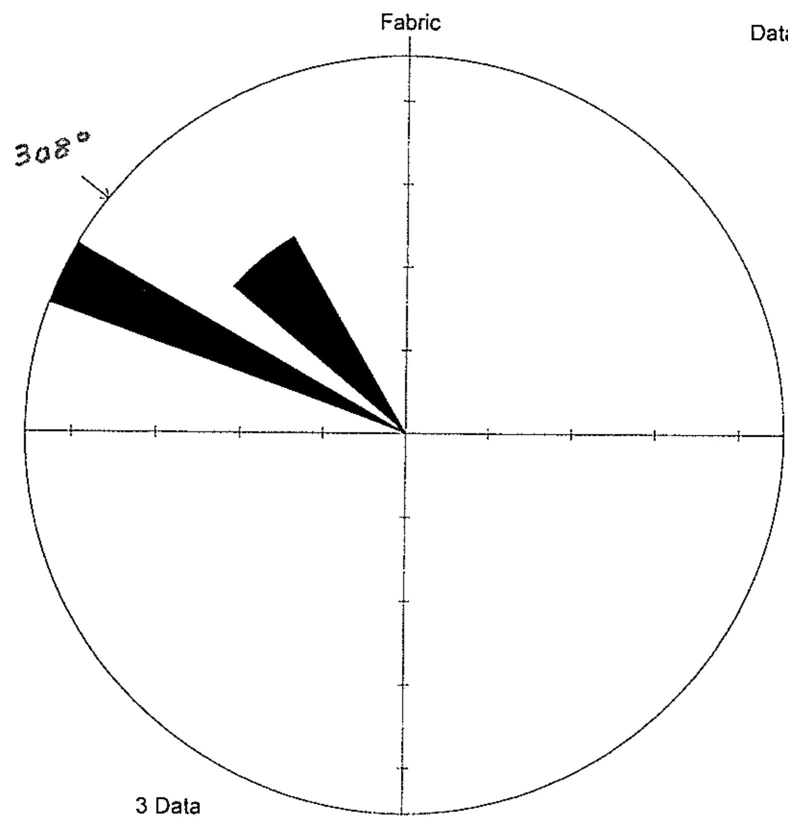
CV173B (rvsd)
5



EB189upper A
5



EB189 upper B
3

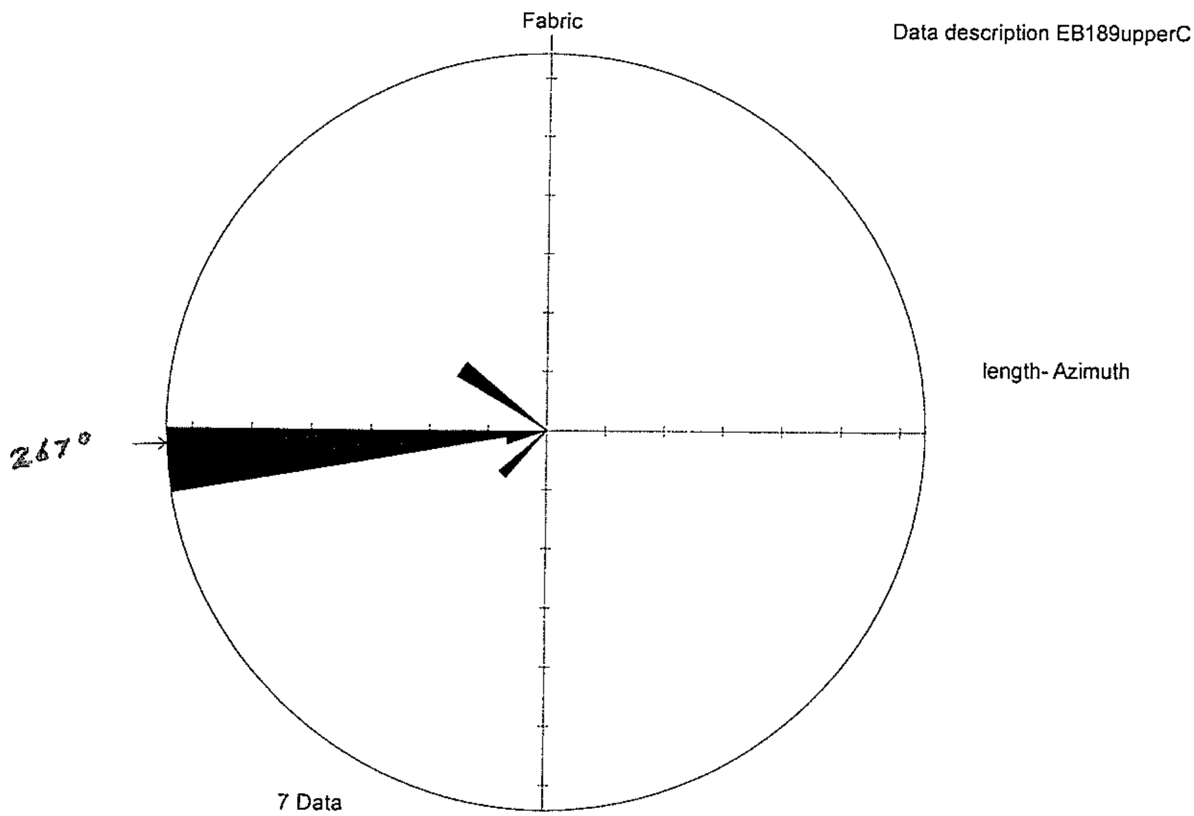


Data description EB189upperB

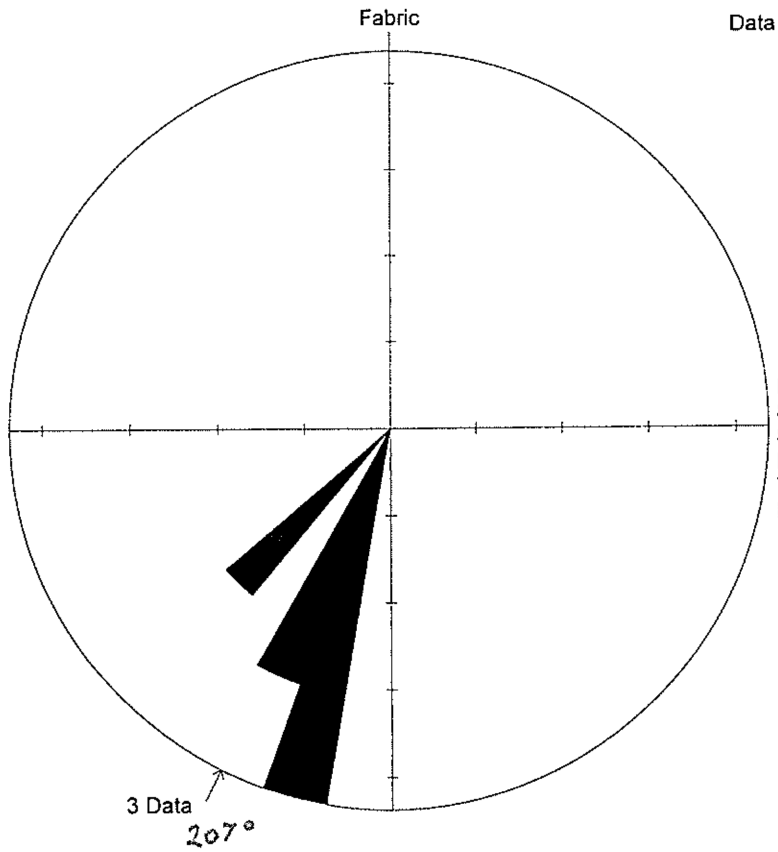
length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.10
Maximum = 45.5% [length: 5]
Total length = 11
Mean Resultant dir'n = 308

EB189upperC

7



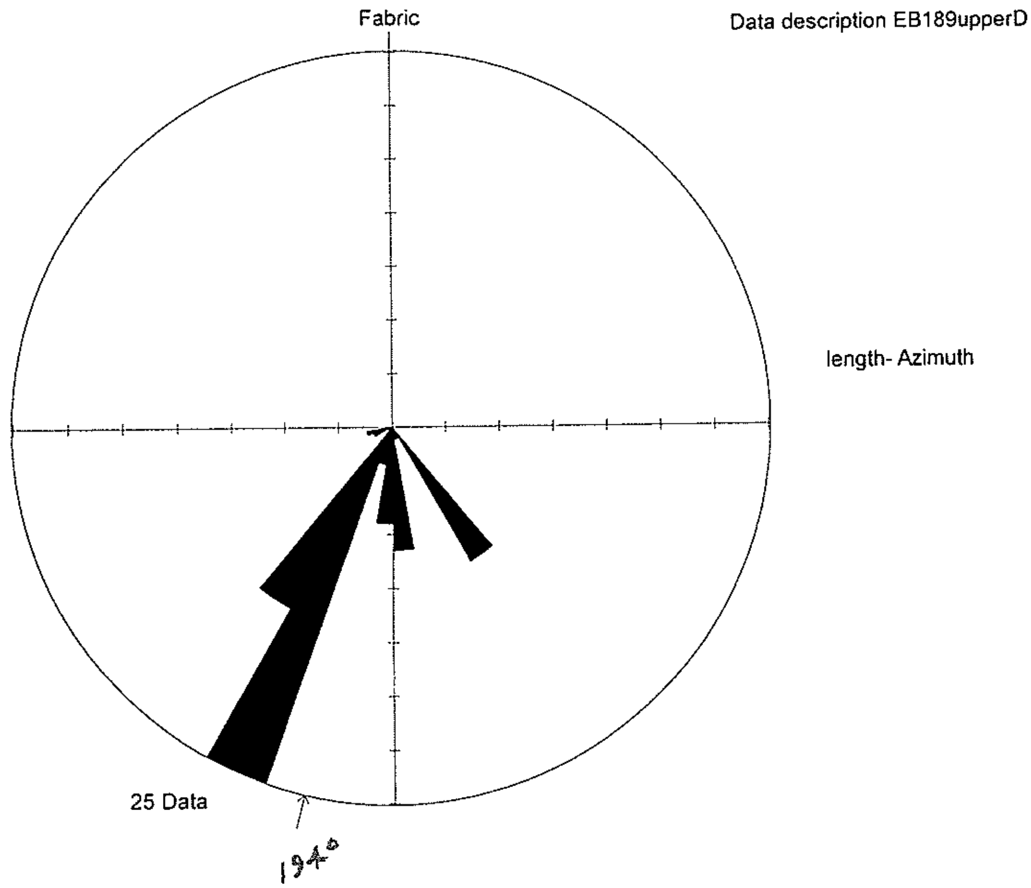
EB189 upper D
3



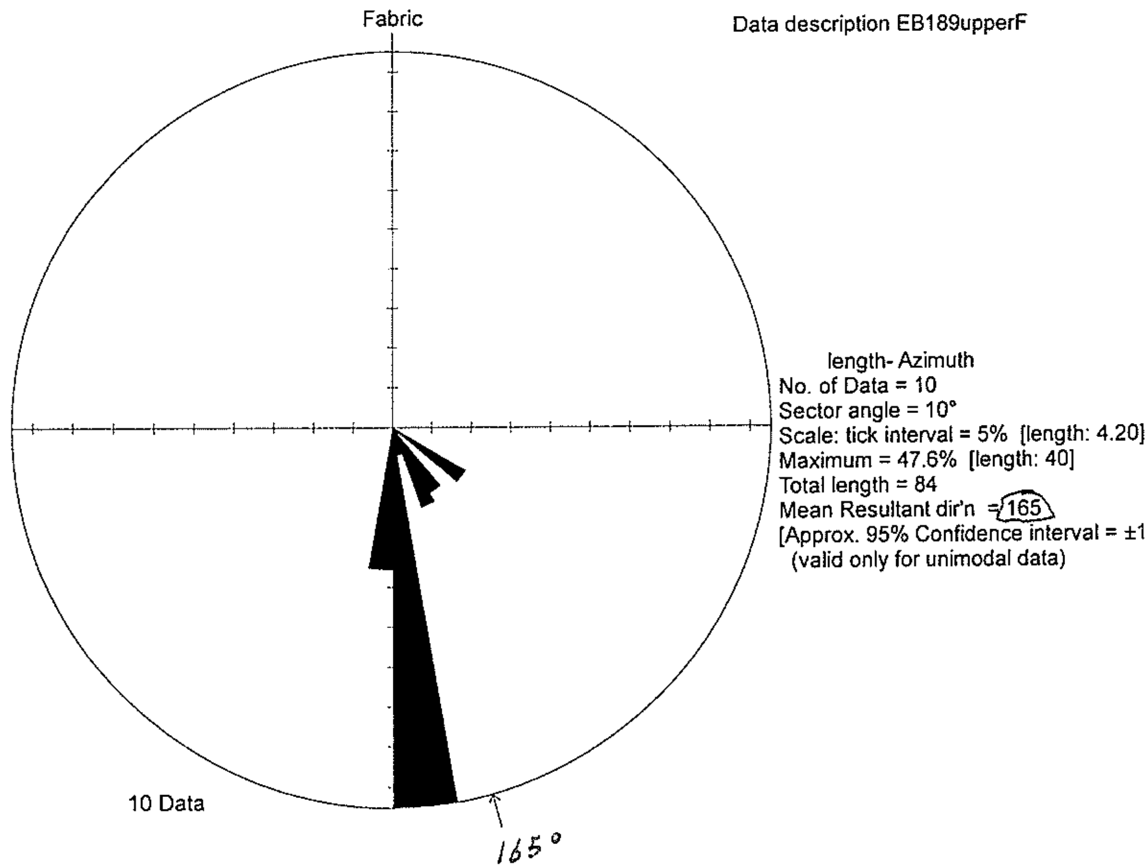
Data description EB189upperD

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.60
Maximum = 43.8% [length: 7]
Total length = 16
Mean Resultant dir'n = 207

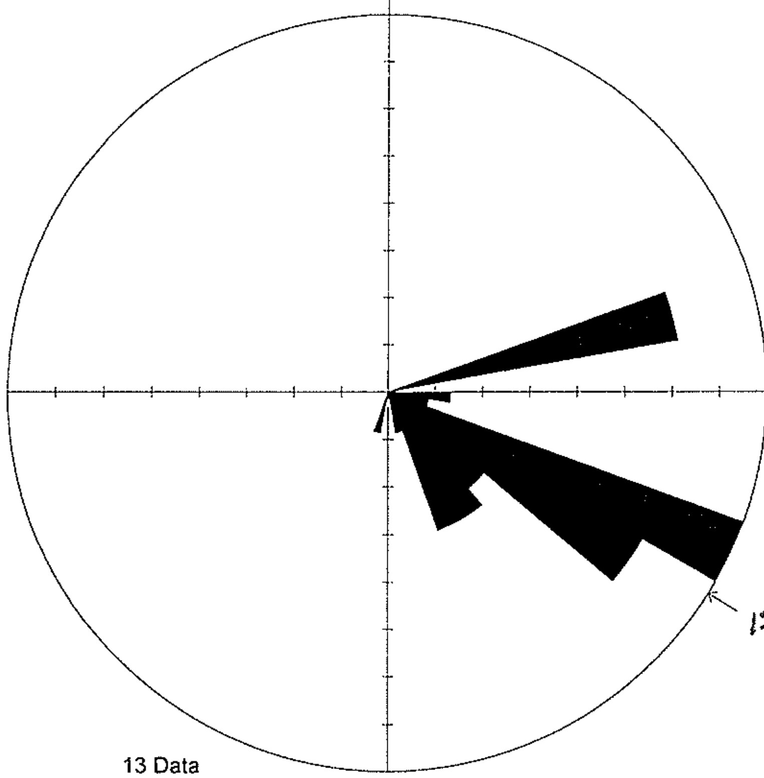
EB189upperE
25



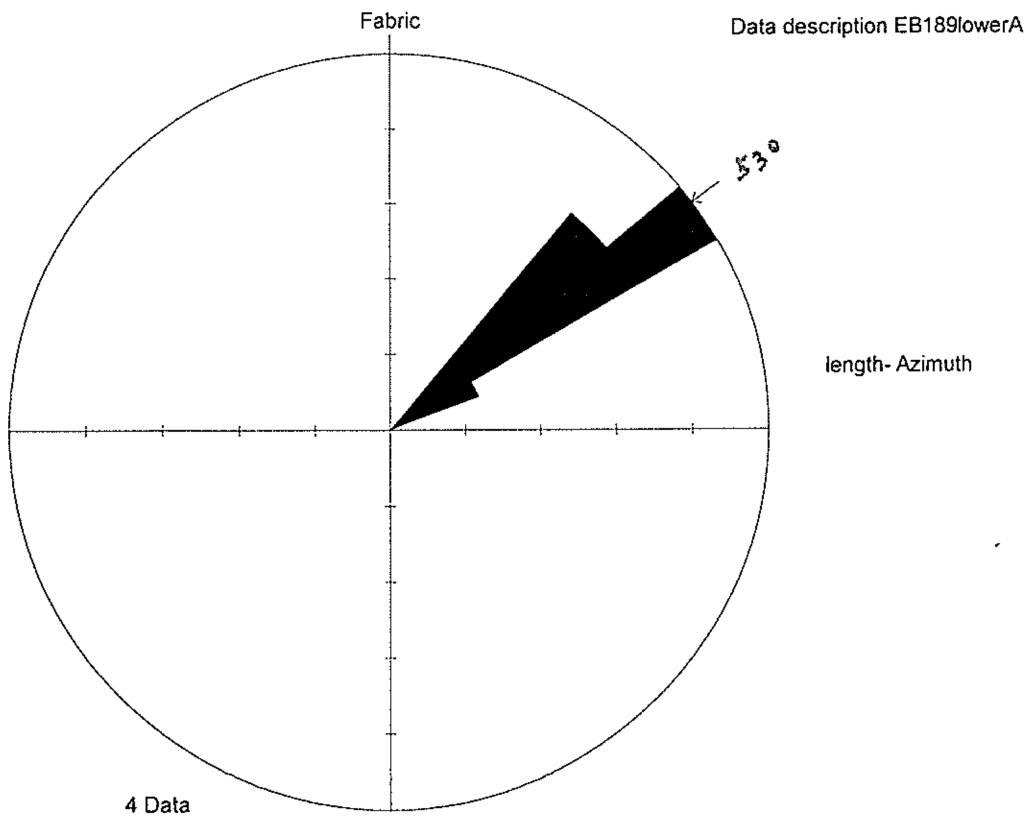
EB189upperF
10



EB189upperG
13

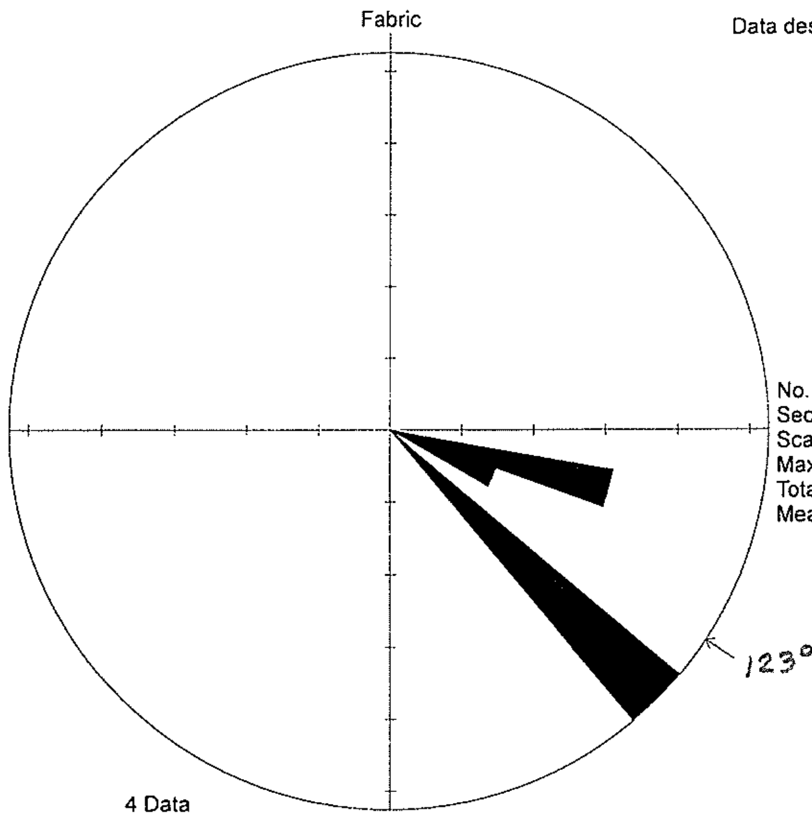


EB189lowerA
4



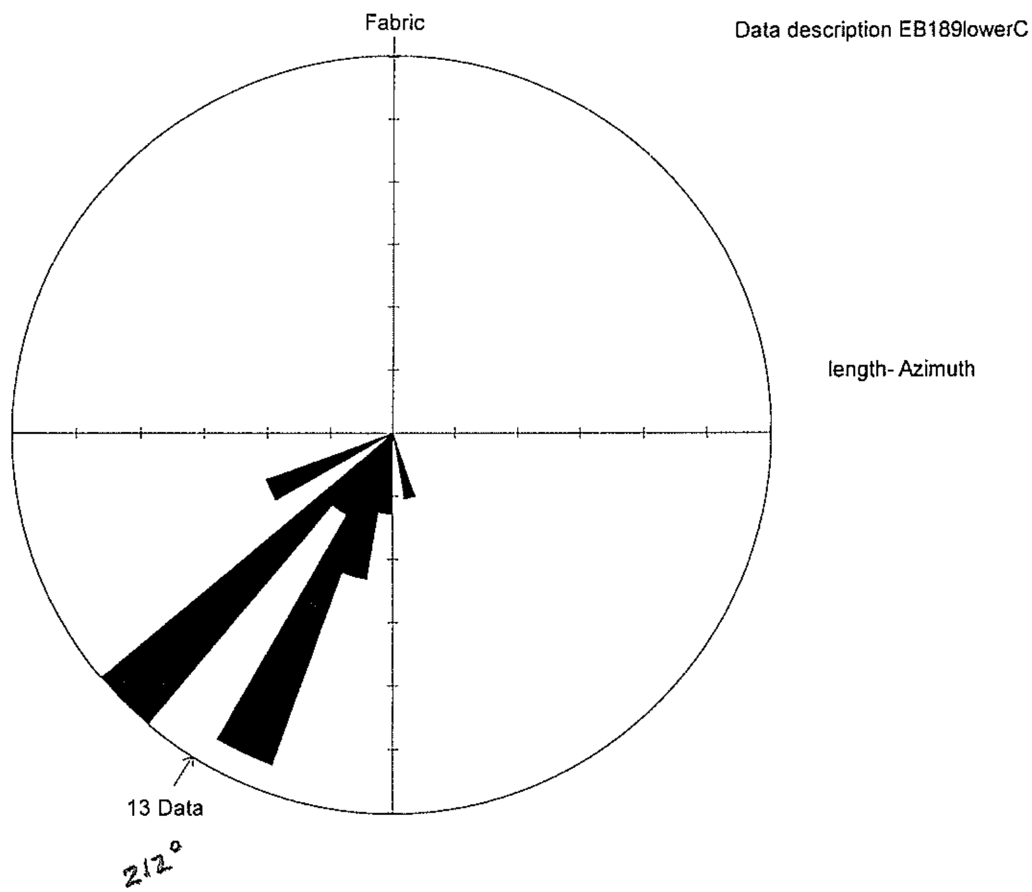
EB189lowerB
4

Data description EB189lowerB

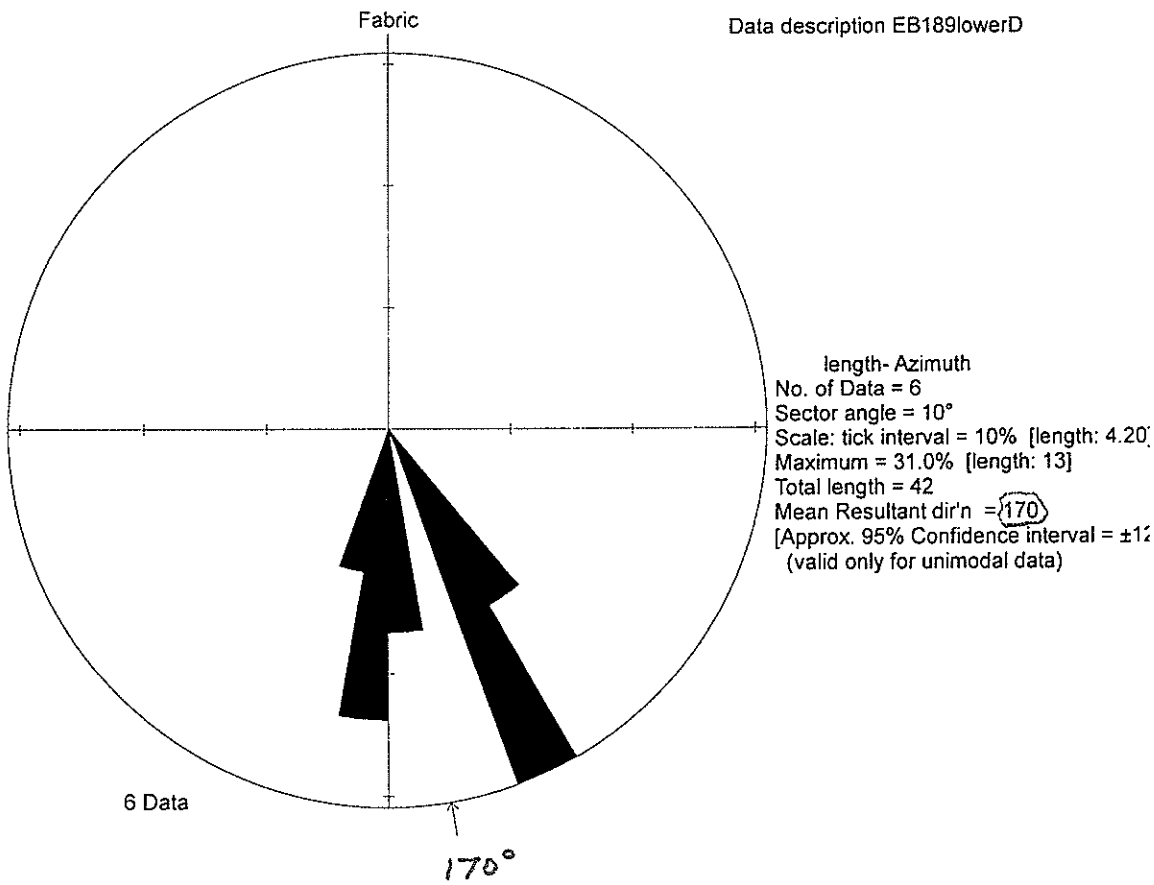


length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 1.90]
Maximum = 52.6% [length: 10]
Total length = 19
Mean Resultant dir'n = 123

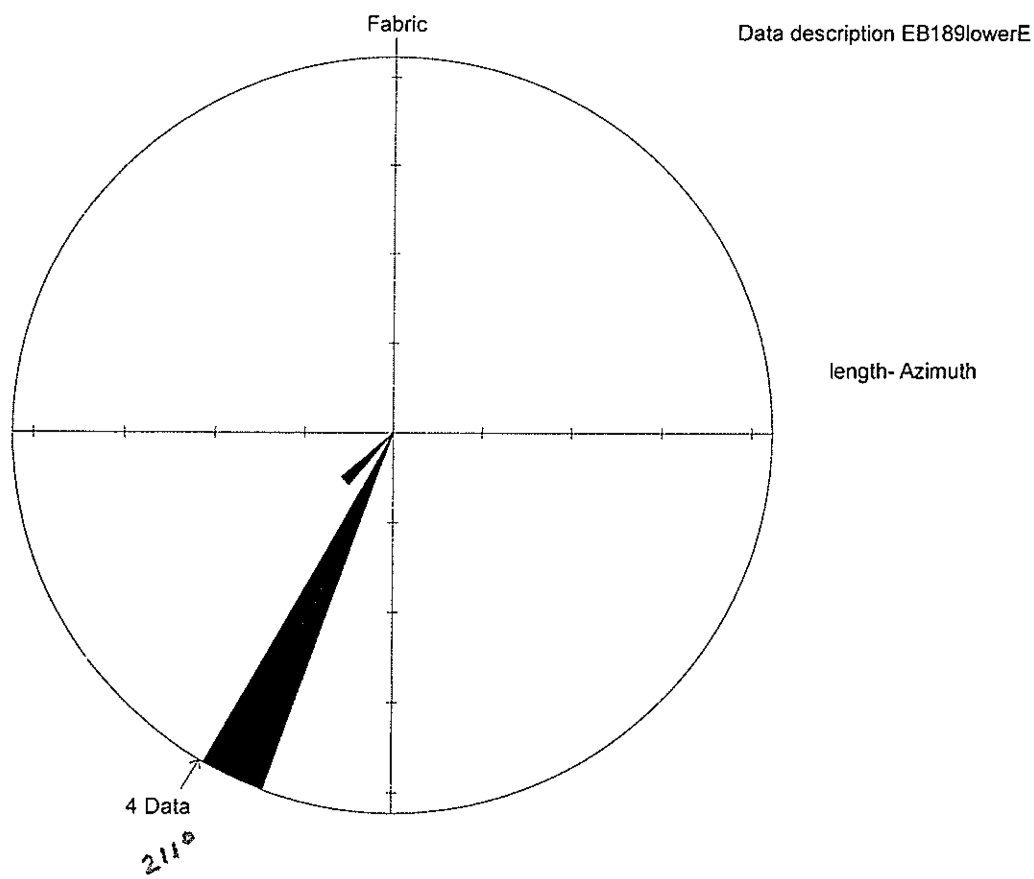
EB189lowerC
13



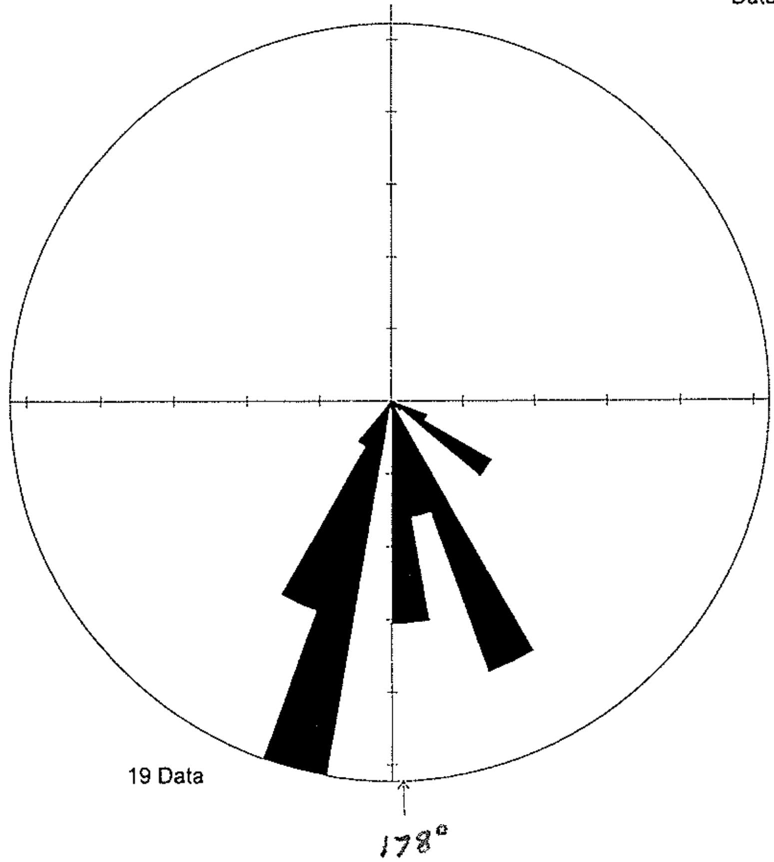
EB189lowerD
6



EB189lowerE
4



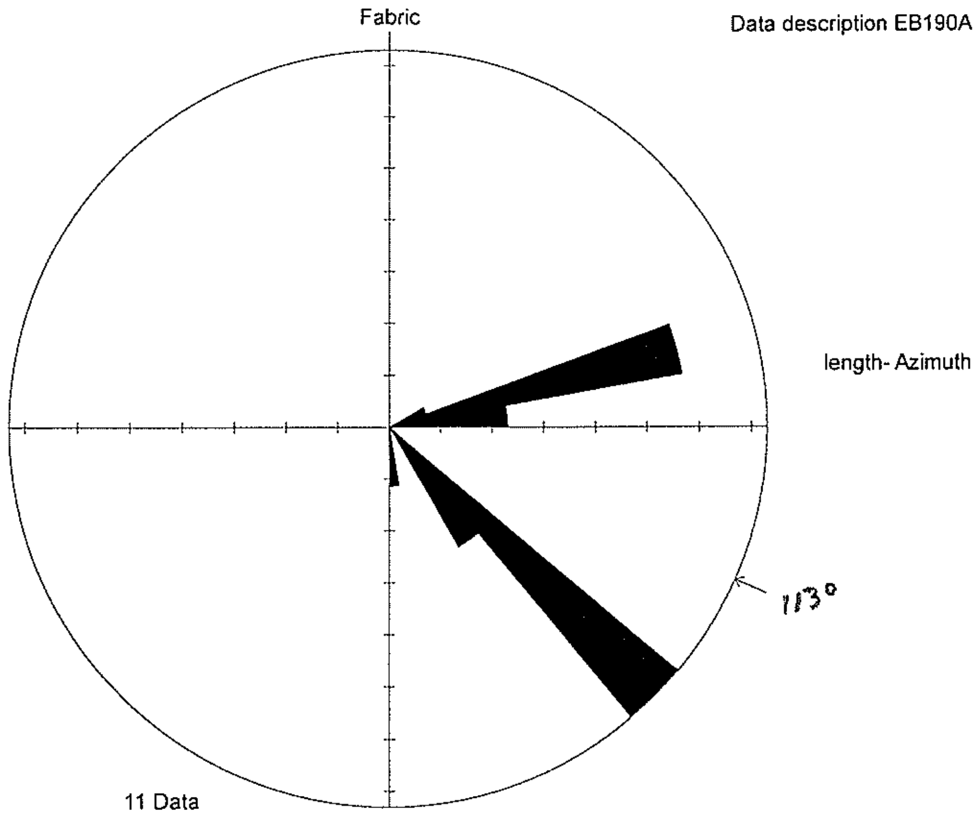
EB189lowerF



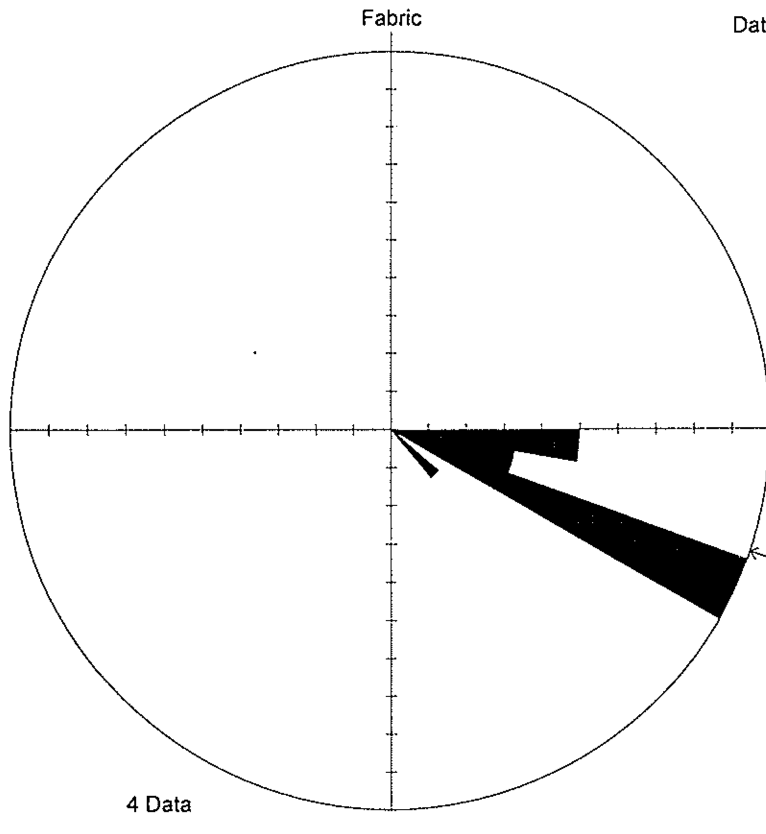
Data description EB189lowerF

length- Azimuth
No. of Data = 19
Sector angle = 10°
Scale: tick interval = 5% [length: 5.55]
Maximum = 26.1% [length: 29]
Total length = 111
Mean Resultant dir'n = 178
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

EB190A
11



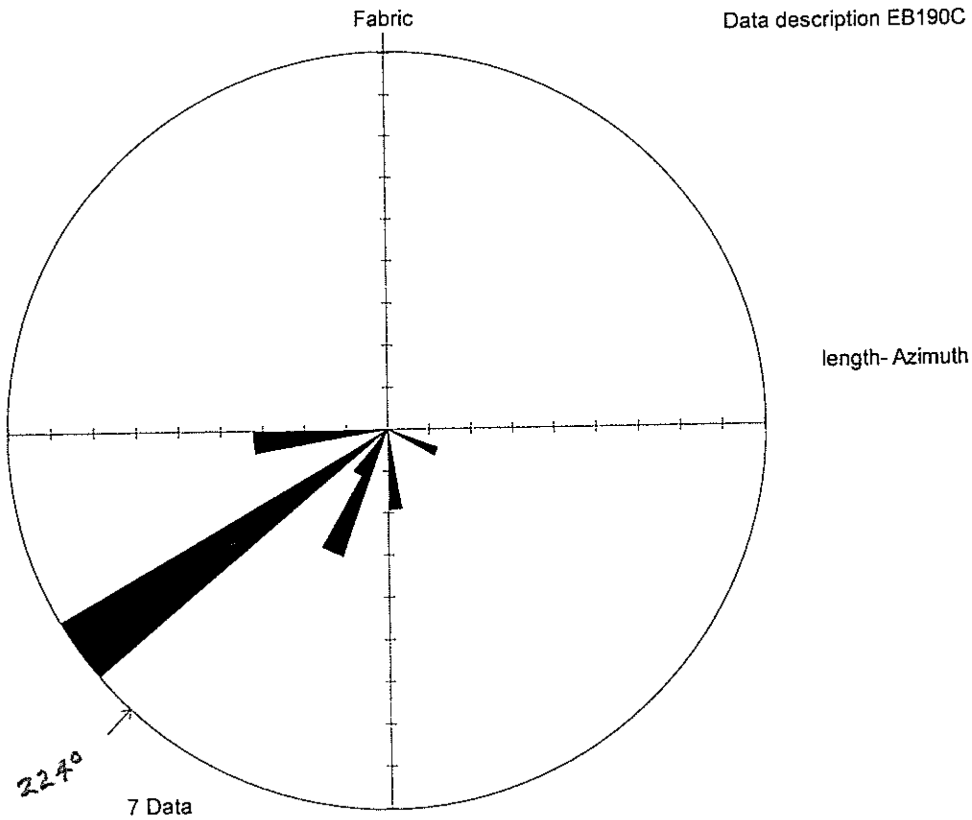
EB190B
4



Data description EB190B

length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 1.20]
Maximum = 50% [length: 12]
Total length = 24
Mean Resultant dir'n = 109

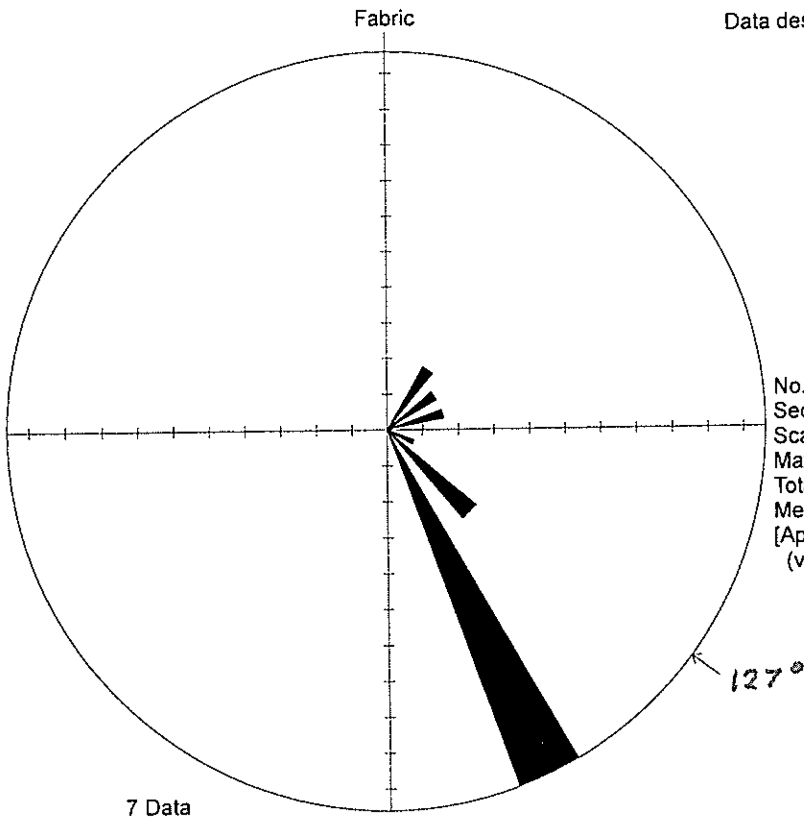
EB190C
7



EB190D

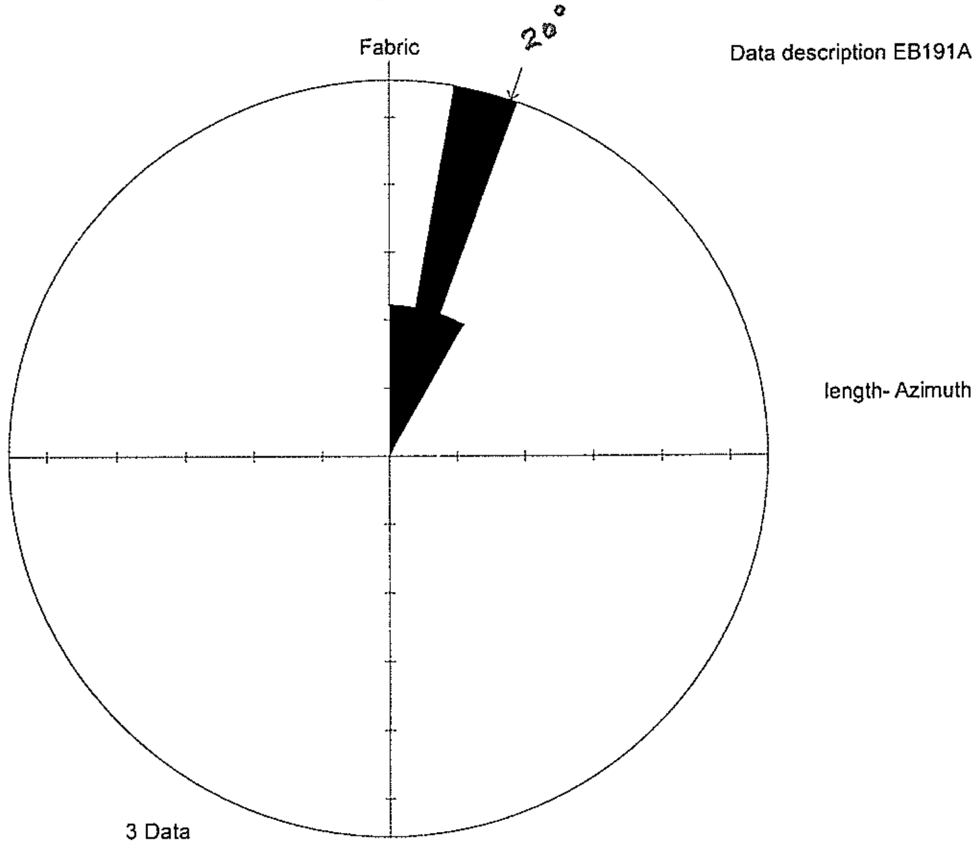
7

Data description EB190D

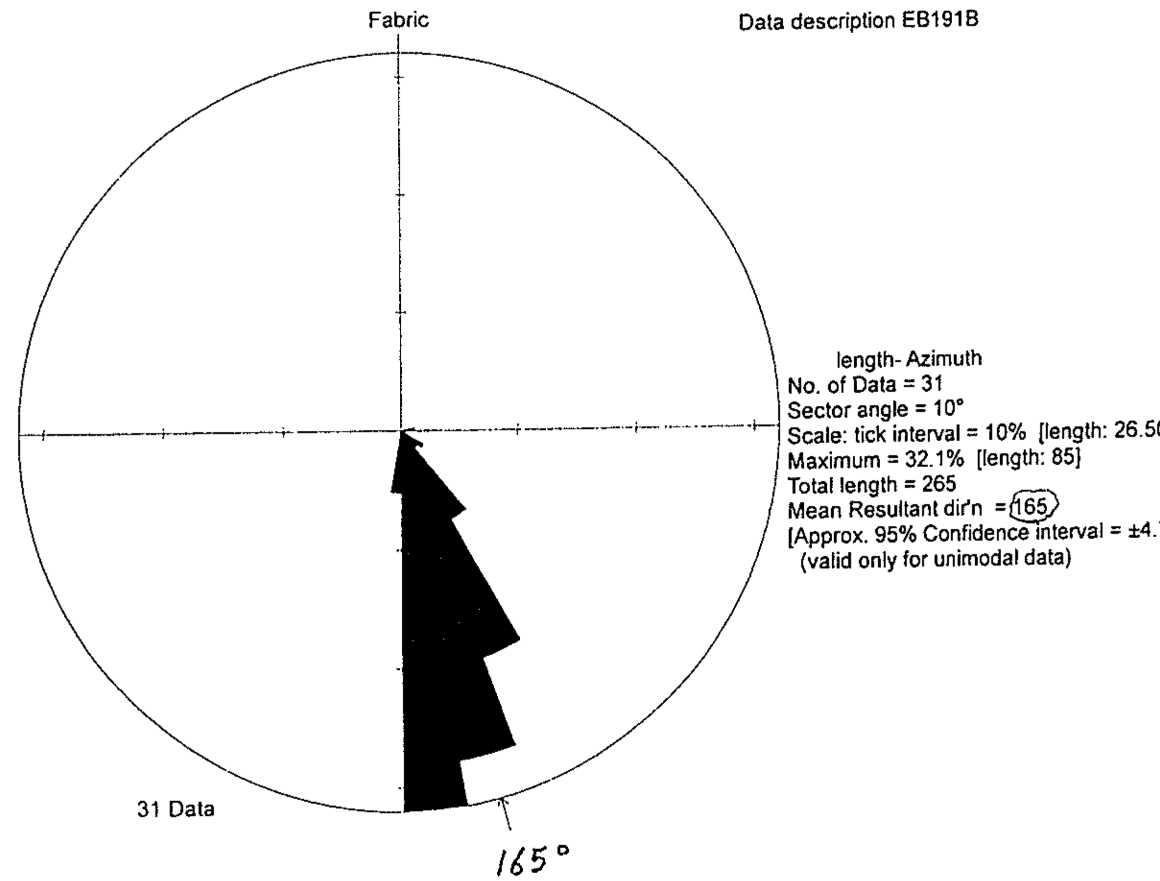


length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 5% [length: 2.45]
Maximum = 53.1% [length: 26]
Total length = 49
Mean Resultant dir'n = 127
[Approx. 95% Confidence interval = ±3
(valid only for unimodal data)

EB191A
3

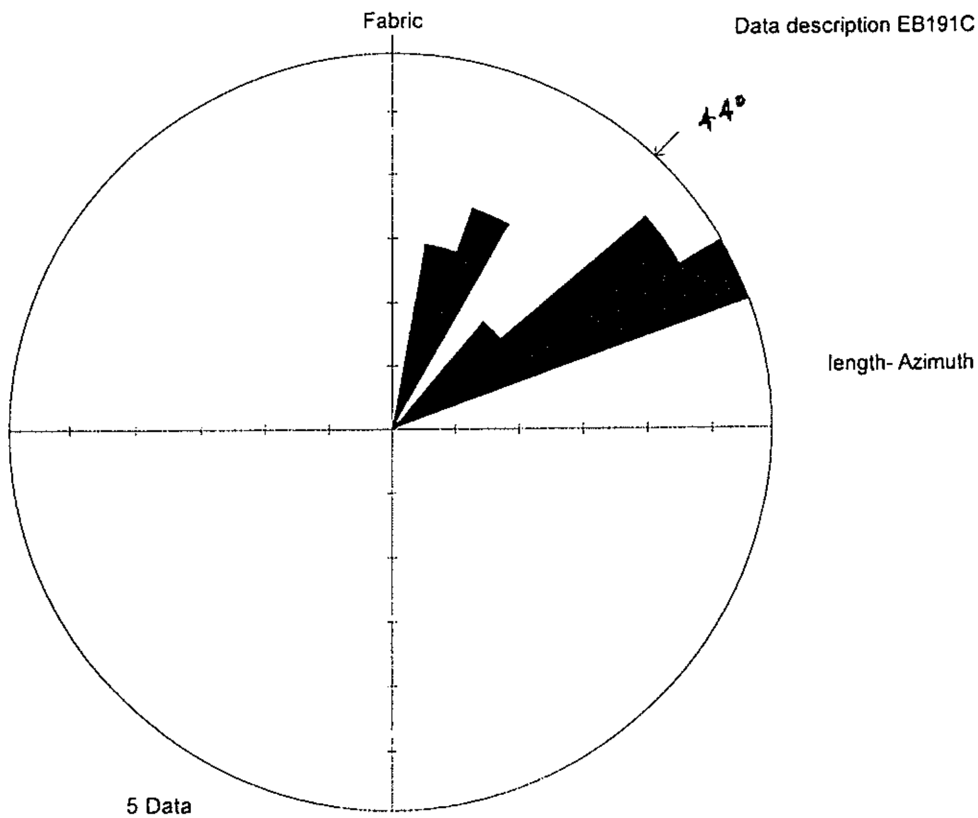


EB191B
31

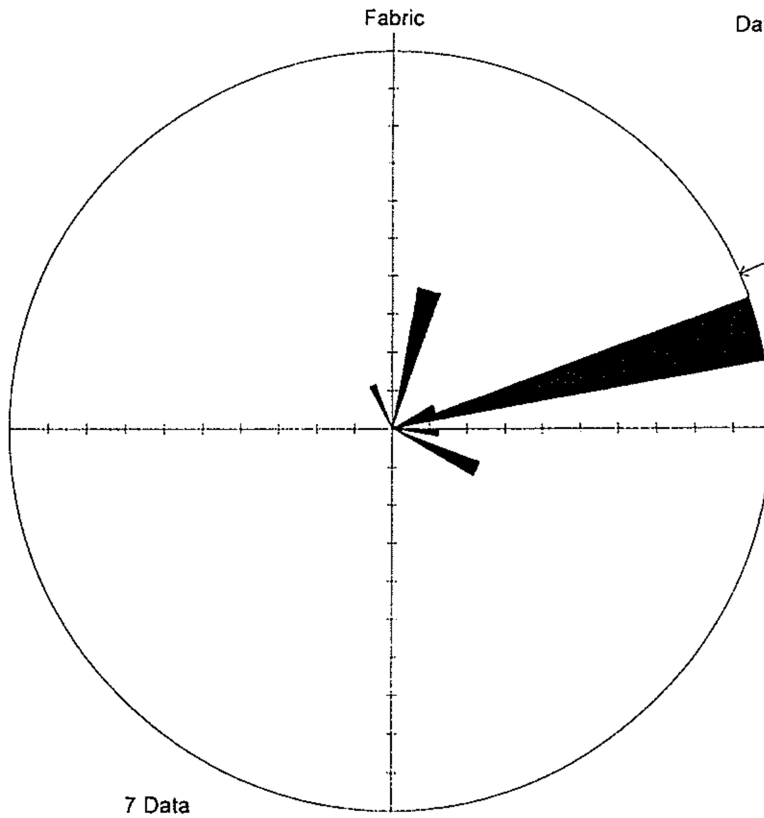

Fabric
Data description EB191B
length- Azimuth
No. of Data = 31
Sector angle = 10°
Scale: tick interval = 10% [length: 26.5
Maximum = 32.1% [length: 85]
Total length = 265
Mean Resultant dir'n = 165
[Approx. 95% Confidence interval = ±4.
(valid only for unimodal data)
31 Data
165°

EB191C

5



EB191D
7

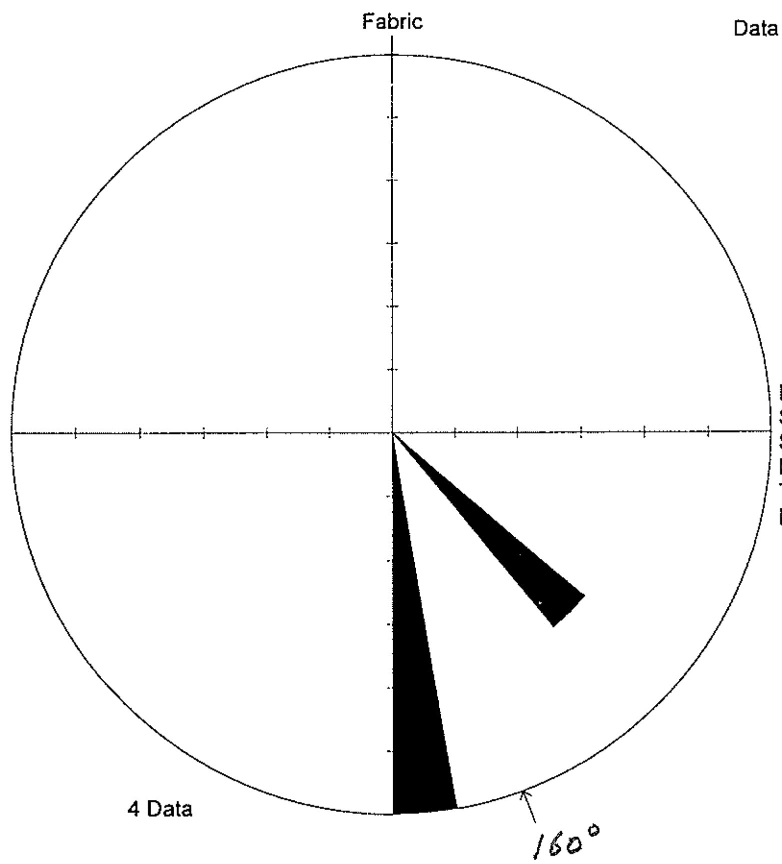


Data description EB191D

length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 5% [length: 1.60]
Maximum = 50% [length: 16]
Total length = 32
Mean Resultant dir'n = 066
[Approx. 95% Confidence interval = ±29
(valid only for unimodal data)

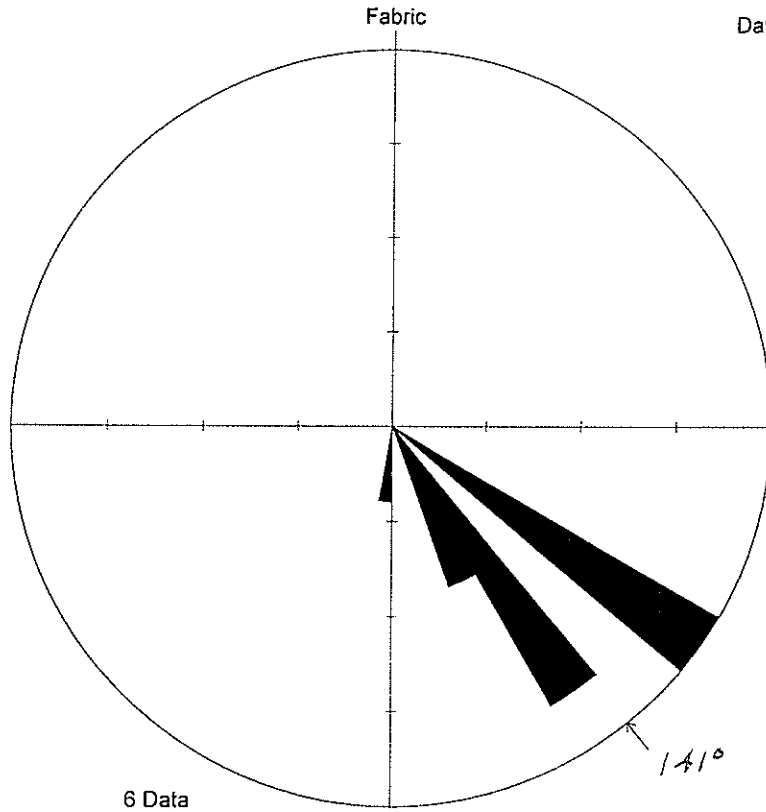
EB191E
4

Data description EB191E



length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 2.00]
Maximum = 60% [length: 12]
Total length = 20
Mean Resultant dir'n = 160

EB192A
6

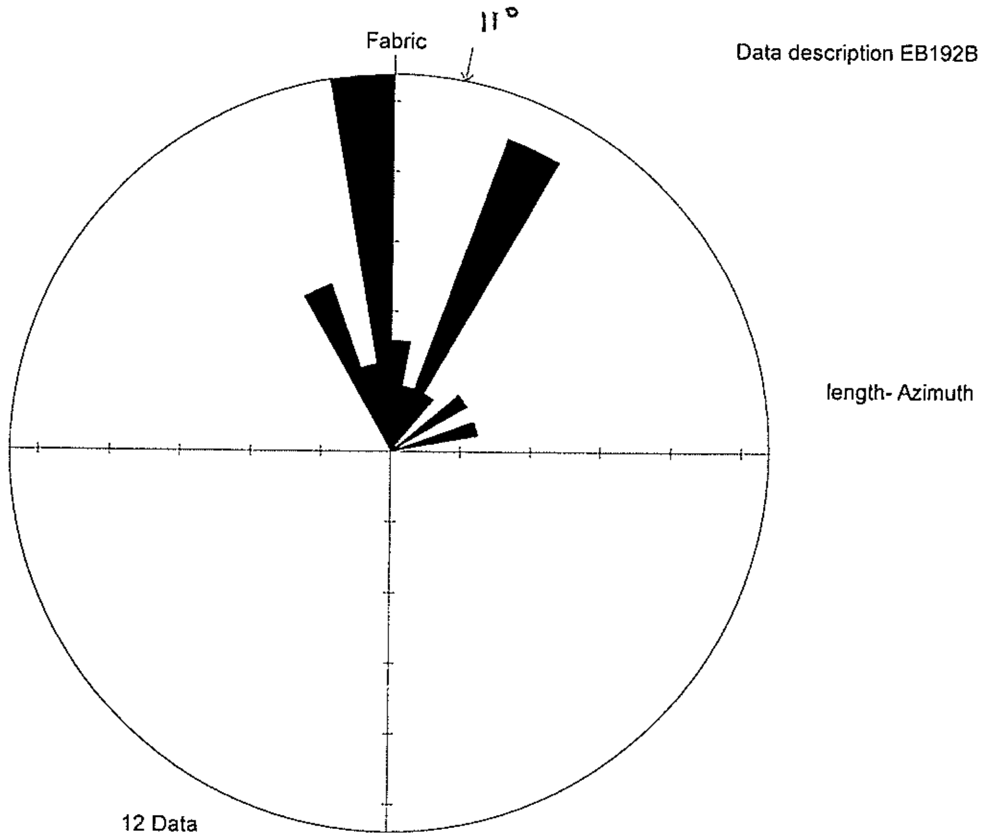


Data description EB192A

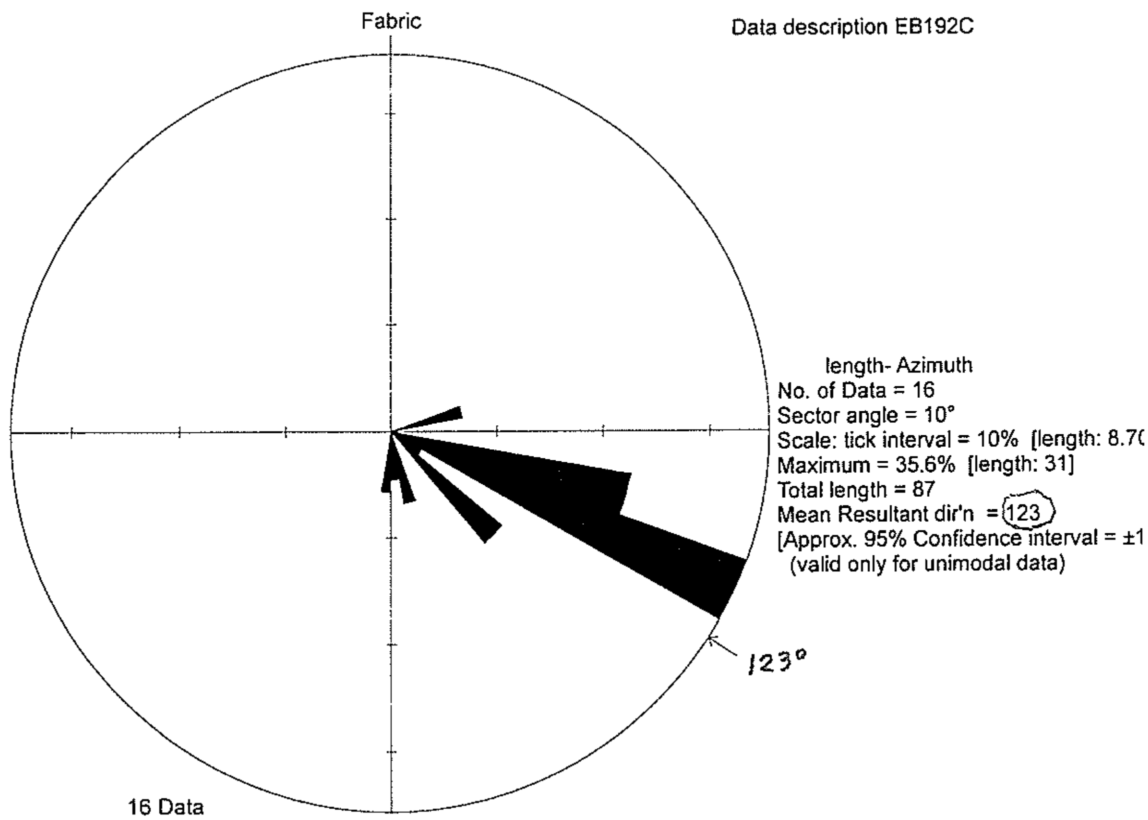
length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 10% [length: 5.00
Maximum = 40% [length: 20]
Total length = 50
Mean Resultant dir'n = 141
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

EB192B

12

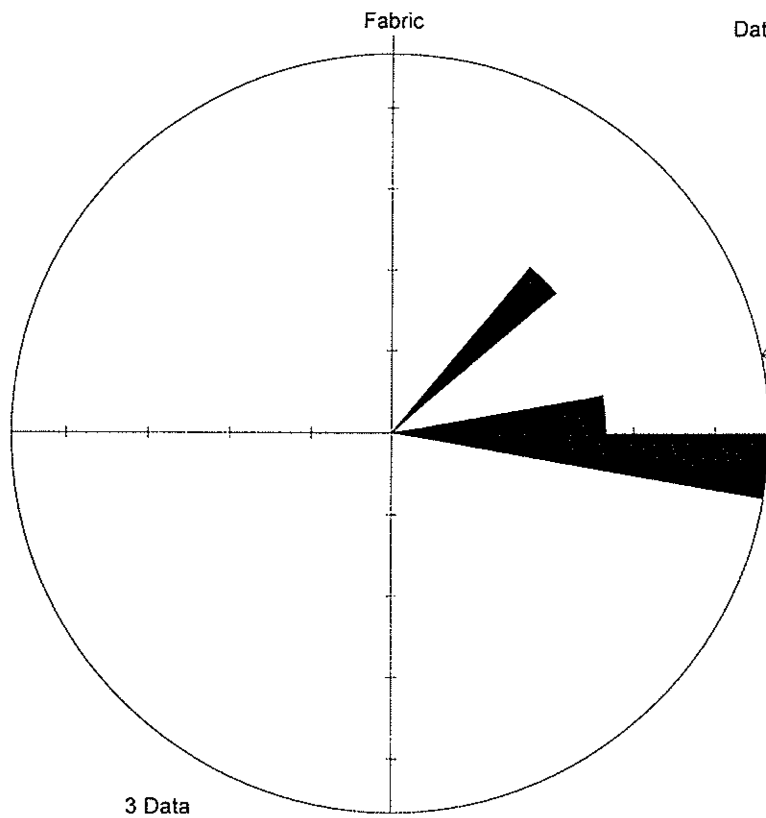


EB192C
16



Fabric
Data description EB192C
length- Azimuth
No. of Data = 16
Sector angle = 10°
Scale: tick interval = 10% [length: 8.7(
Maximum = 35.6% [length: 31]
Total length = 87
Mean Resultant dir'n = 123
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)
123°
16 Data

EB192D
3

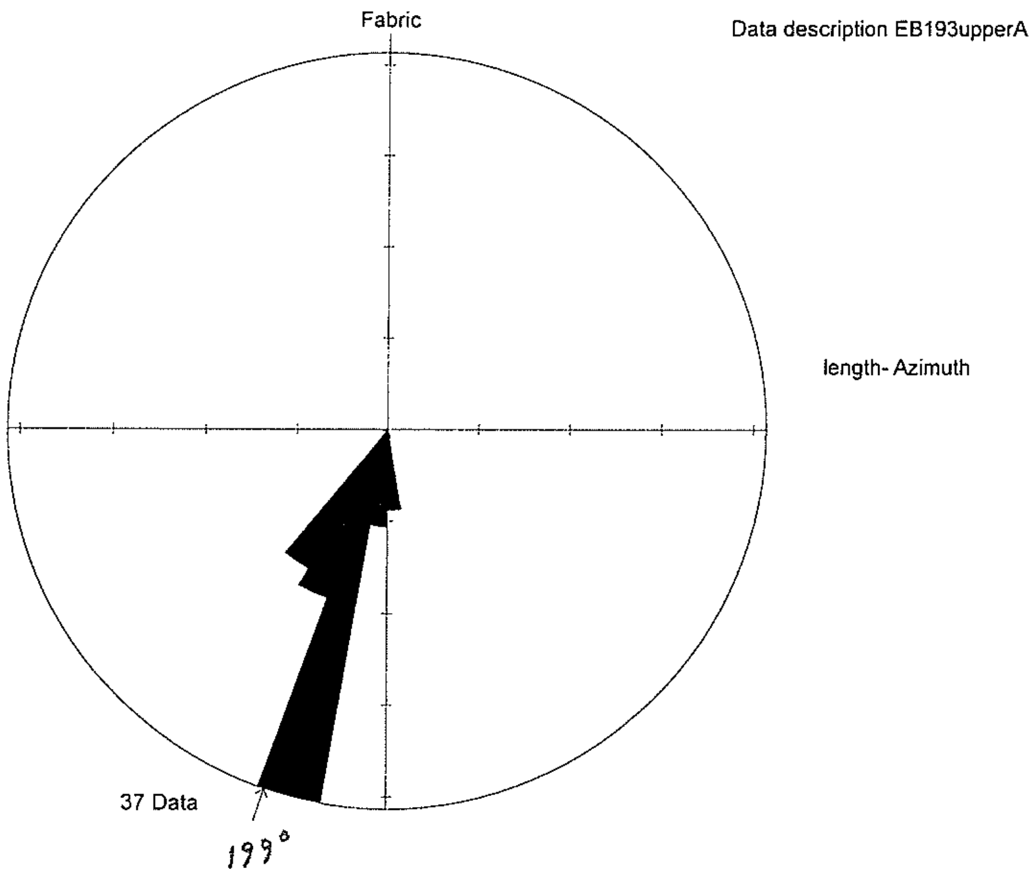


Data description EB192D

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.5(
Maximum = 46.7% [length: 7]
Total length = 15
Mean Resultant dir'n = 078

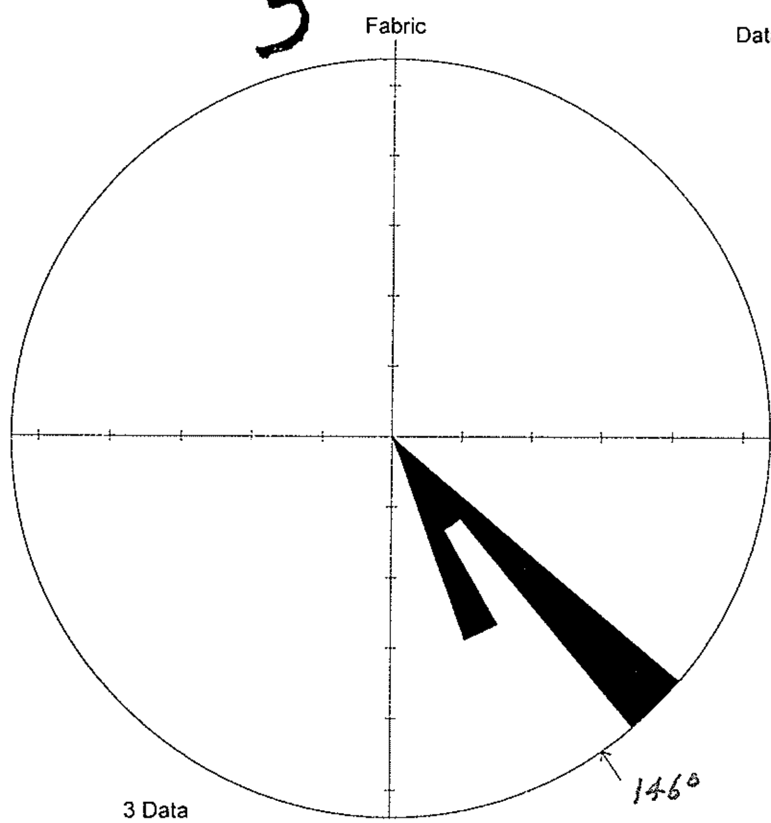
EB193 upper A

37



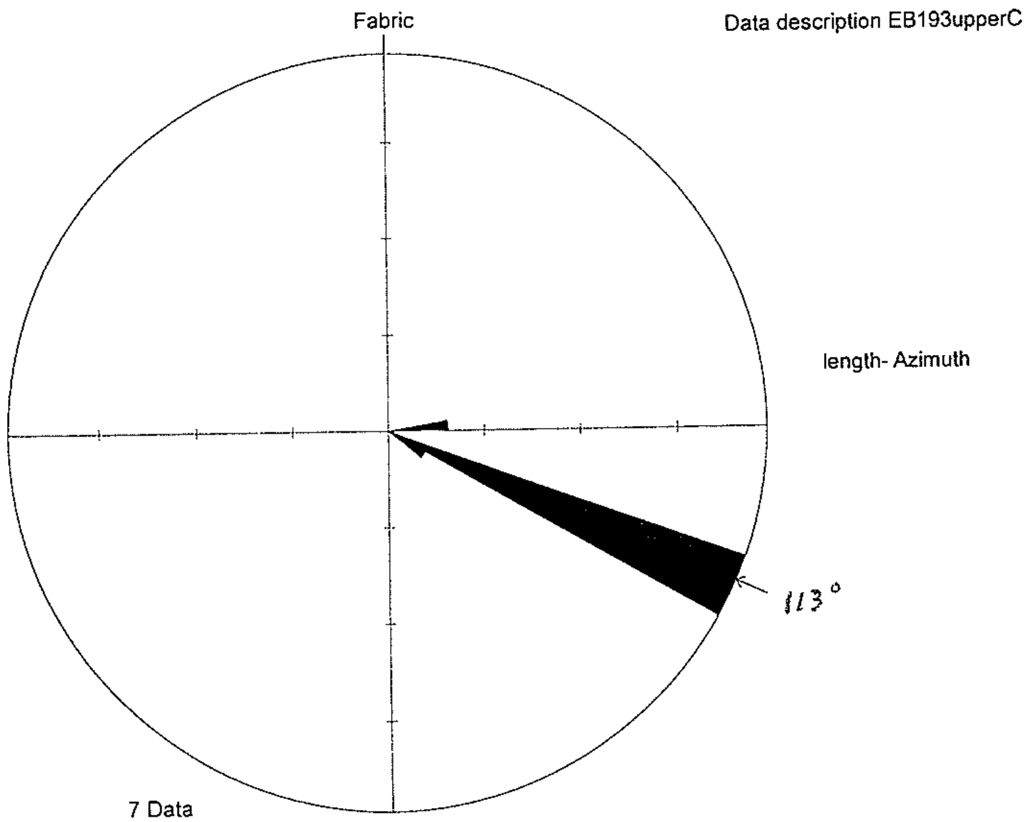
EB193 upper B
3

Data description EB193uperB

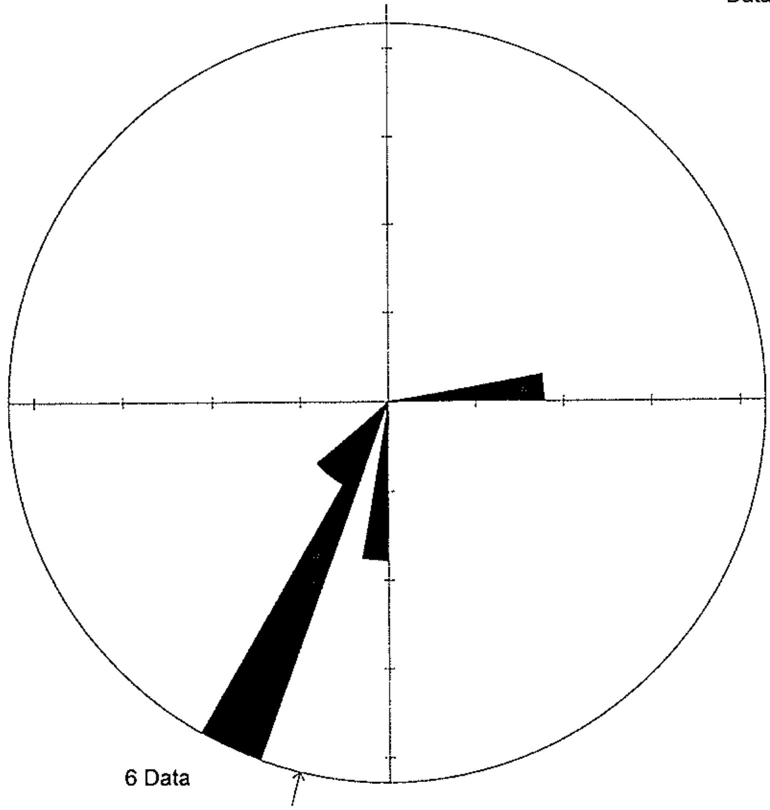


length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 3.9(
Maximum = 53.8% [length: 21]
Total length = 39
Mean Resultant dir'n = 146
[Approx. 95% Confidence interval = ±7
(valid only for unimodal data)

EB193upperC
7



EB193D
6

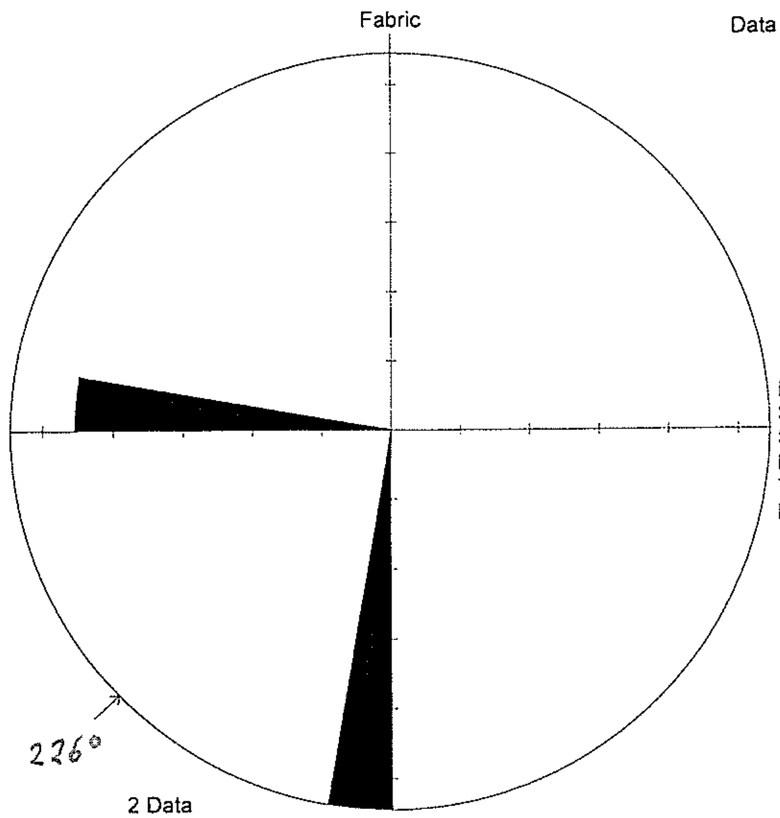


Data description EB193D

length- Azimuth
No. of Data = 6
Sector angle = 10°
Scale: tick interval = 10% [length: 2.80
Maximum = 42.9% [length: 12]
Total length = 28
Mean Resultant dir'n = 194
[Approx. 95% Confidence interval = ±2
(valid only for unimodal data)

EB194A

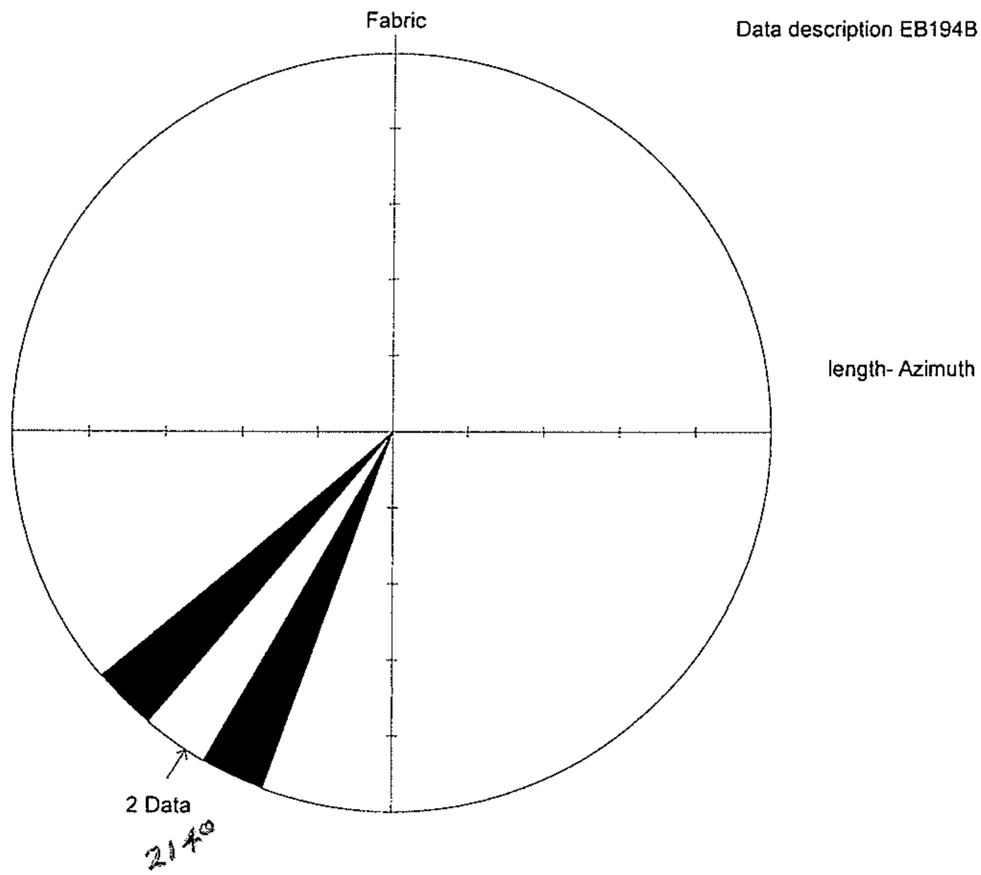
2



Data description EB194A

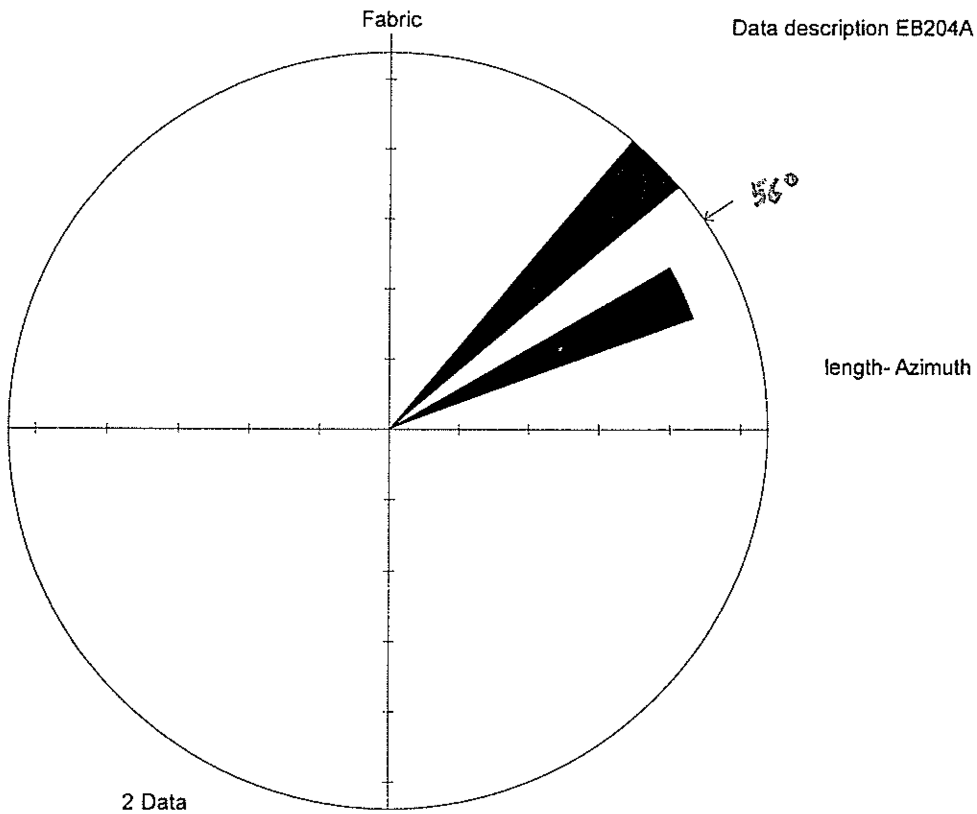
length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.10]
Maximum = 54.5% [length: 6]
Total length = 11
Mean Resultant dir'n = 226

EB194B
2



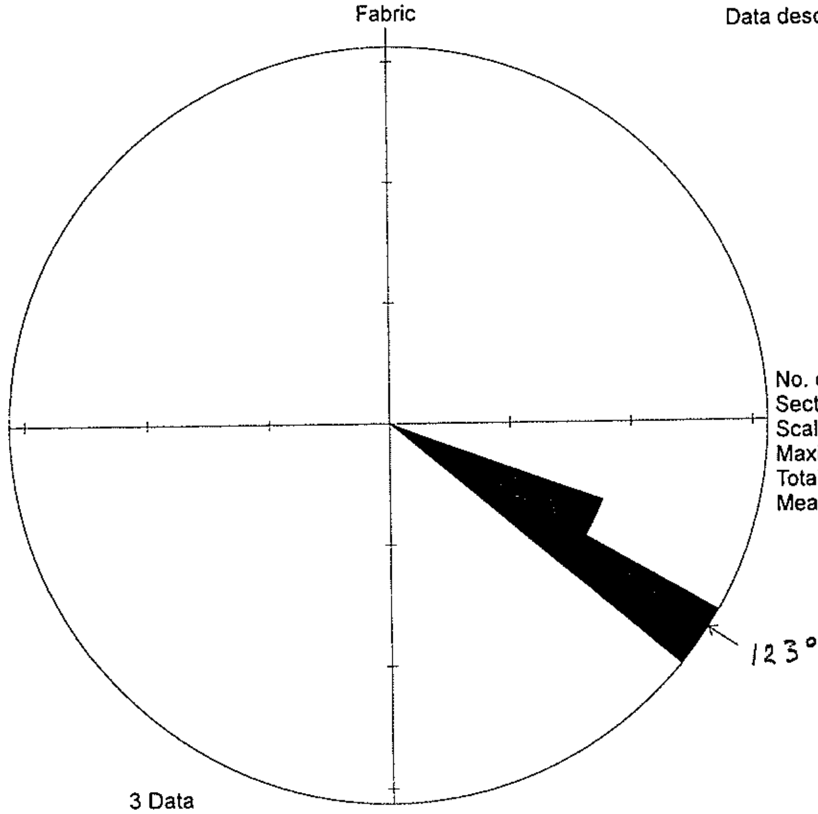
EB 204A (rvsd)

2



EB204B (rvsd)

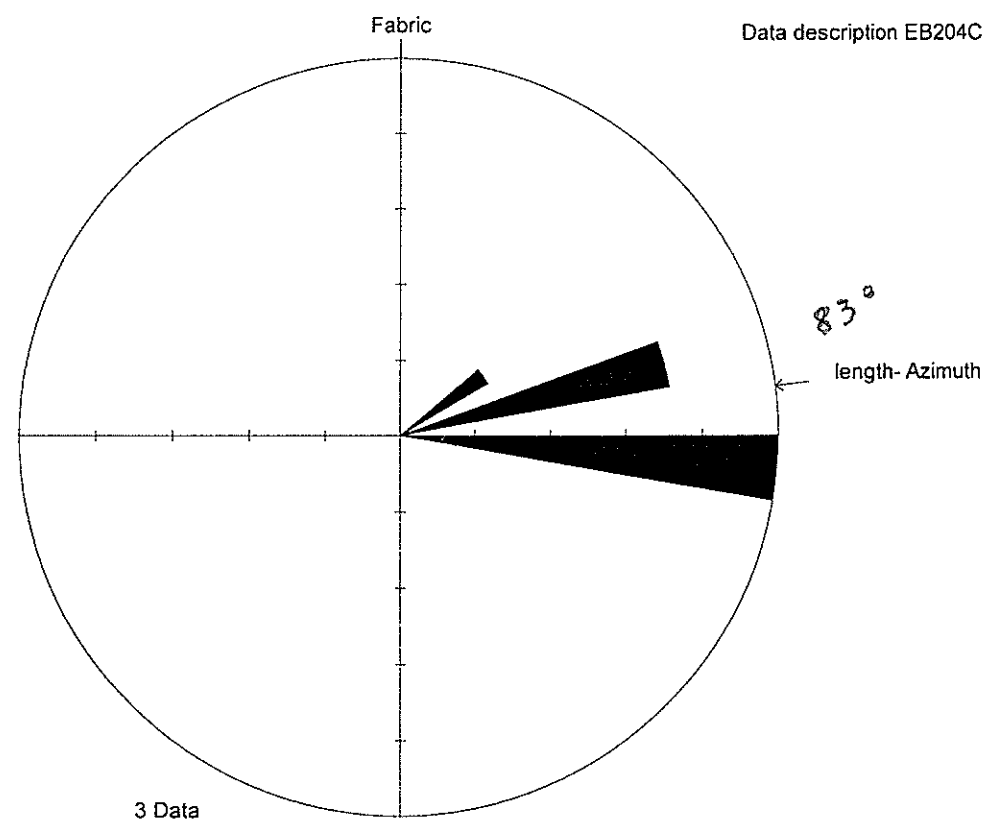
3



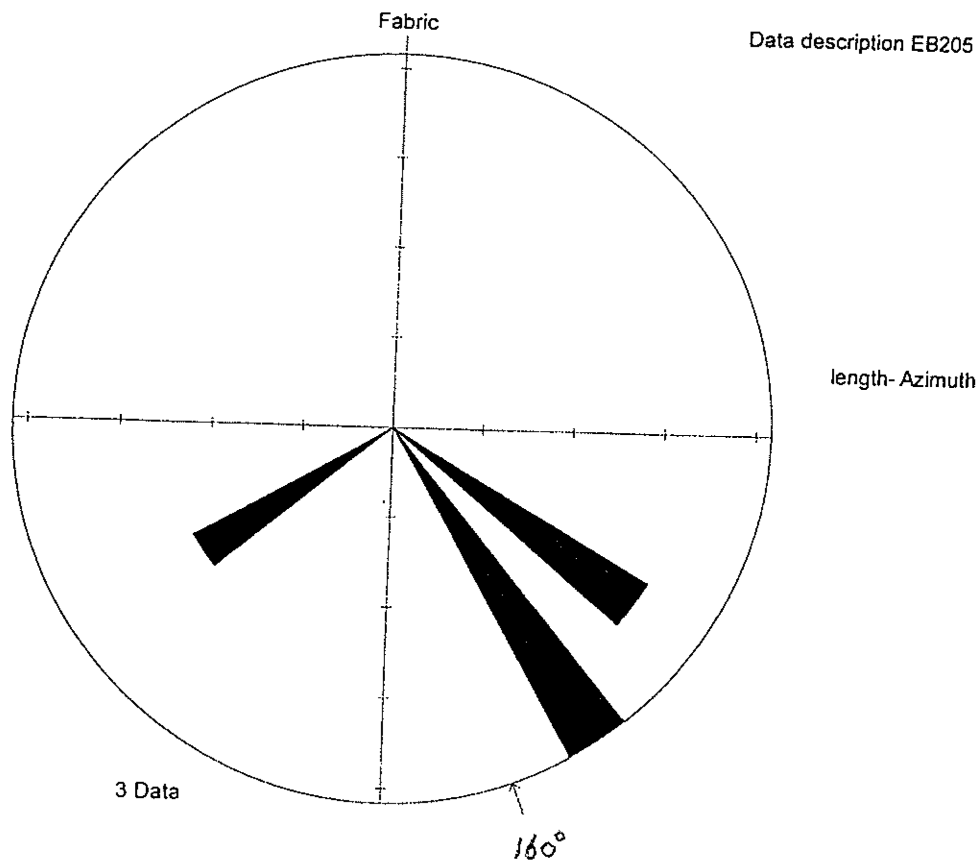
Data description EB204B

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 20% [length: 4.80
Maximum = 62.5% [length: 15]
Total length = 24
Mean Resultant dir'n = 123

EB204C (new)
3

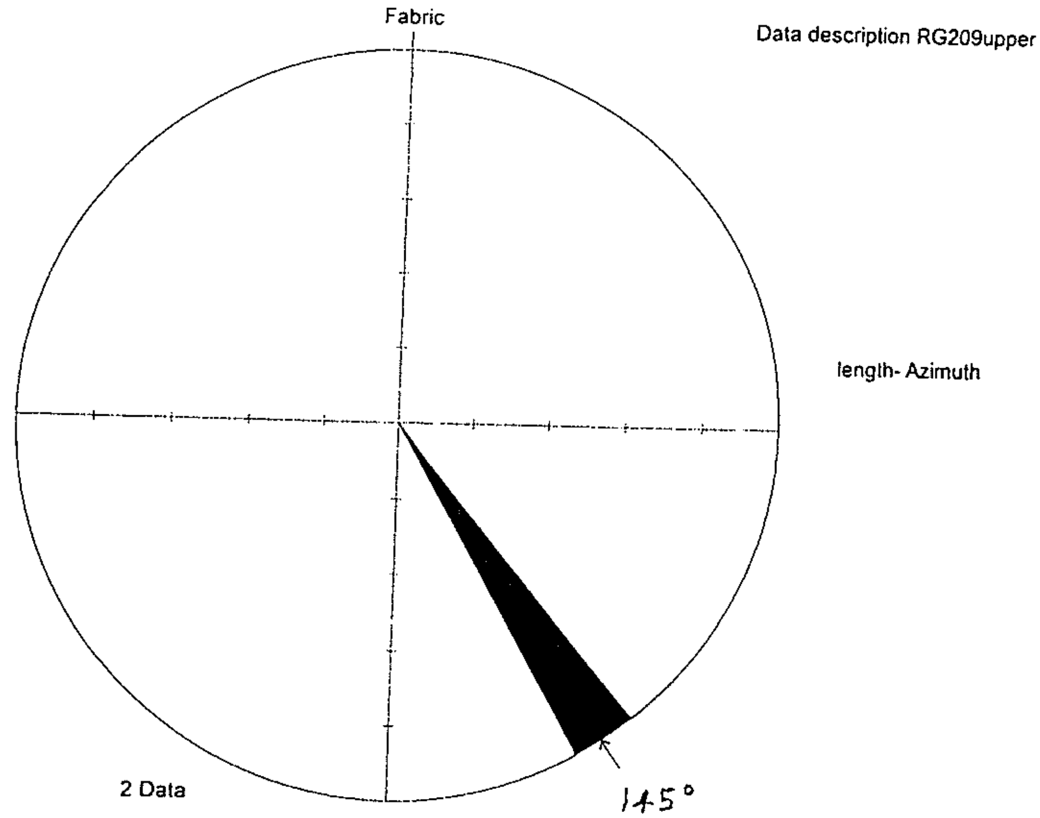


EB205
3



RG209A

2

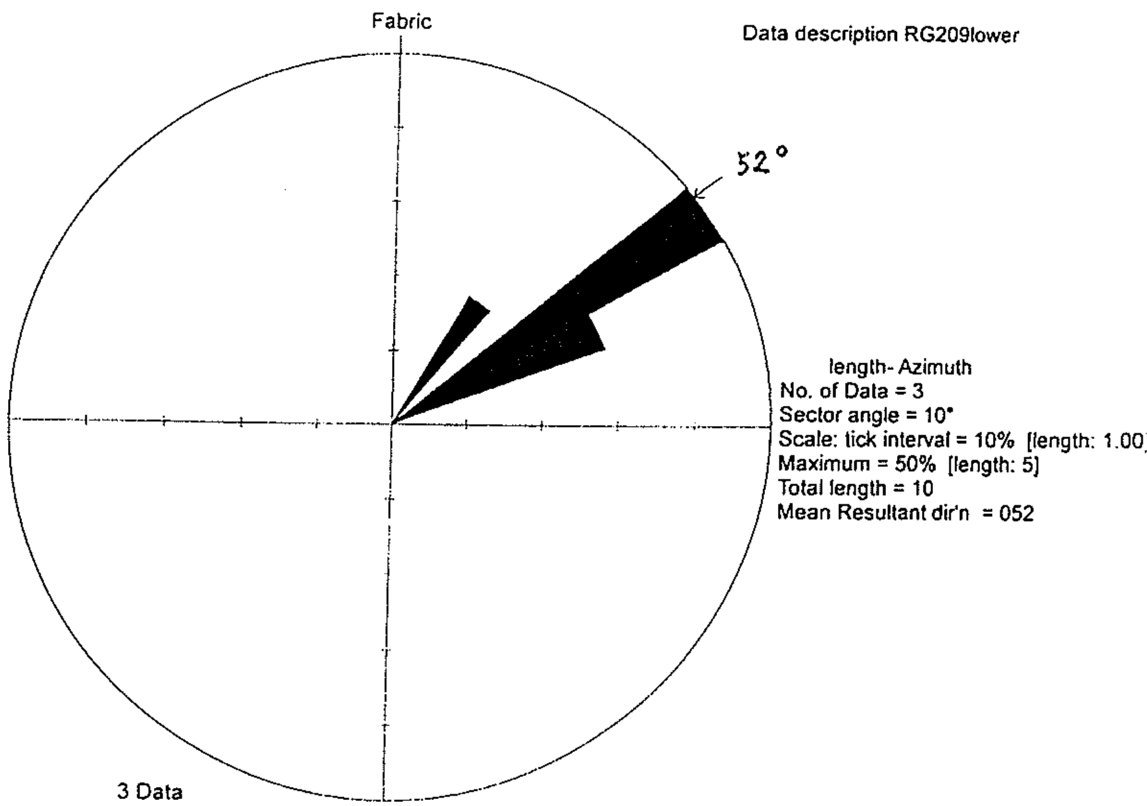


Fabric
Data description RG209upper
length- Azimuth
2 Data
145°

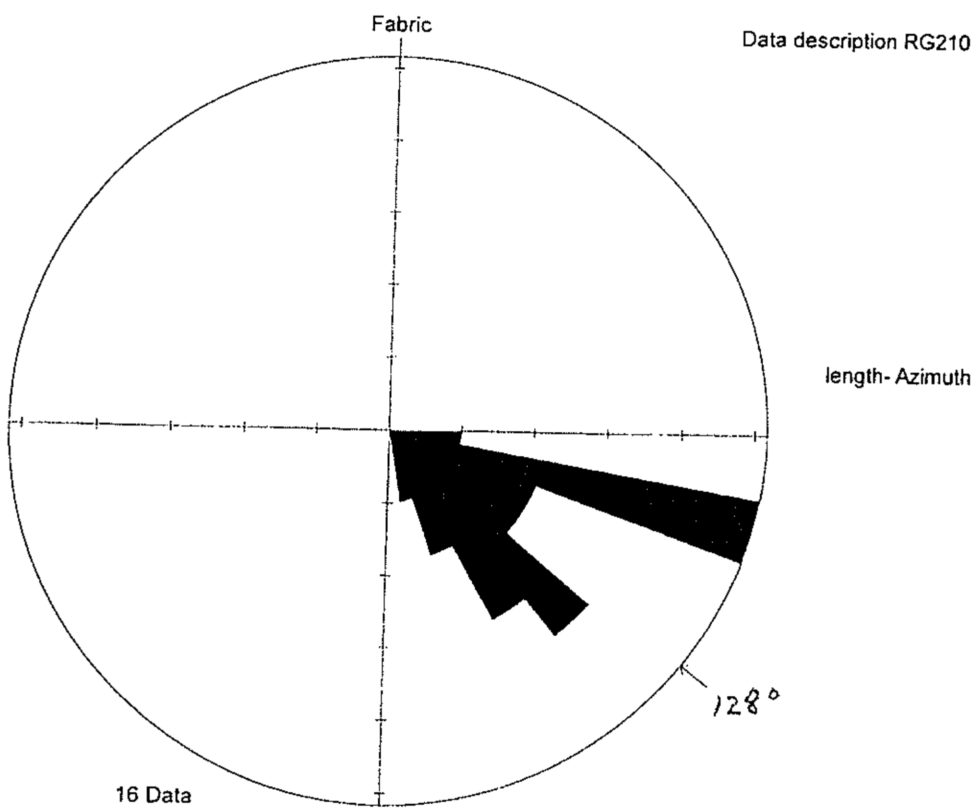
B

RG209

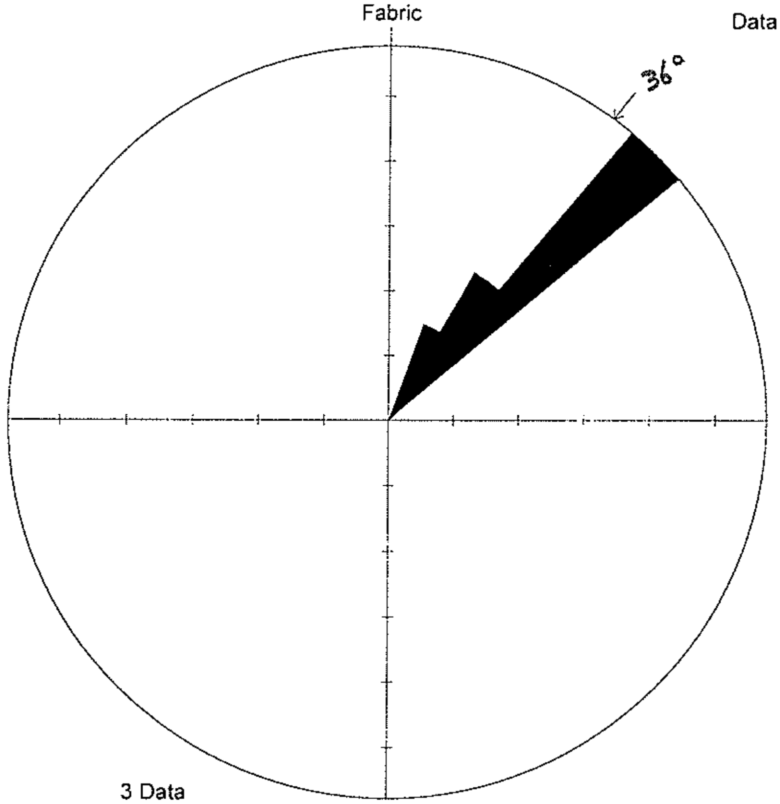
3


Fabric
Data description RG209lower
52°
length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 10% [length: 1.00]
Maximum = 50% [length: 5]
Total length = 10
Mean Resultant dir'n = 052
3 Data

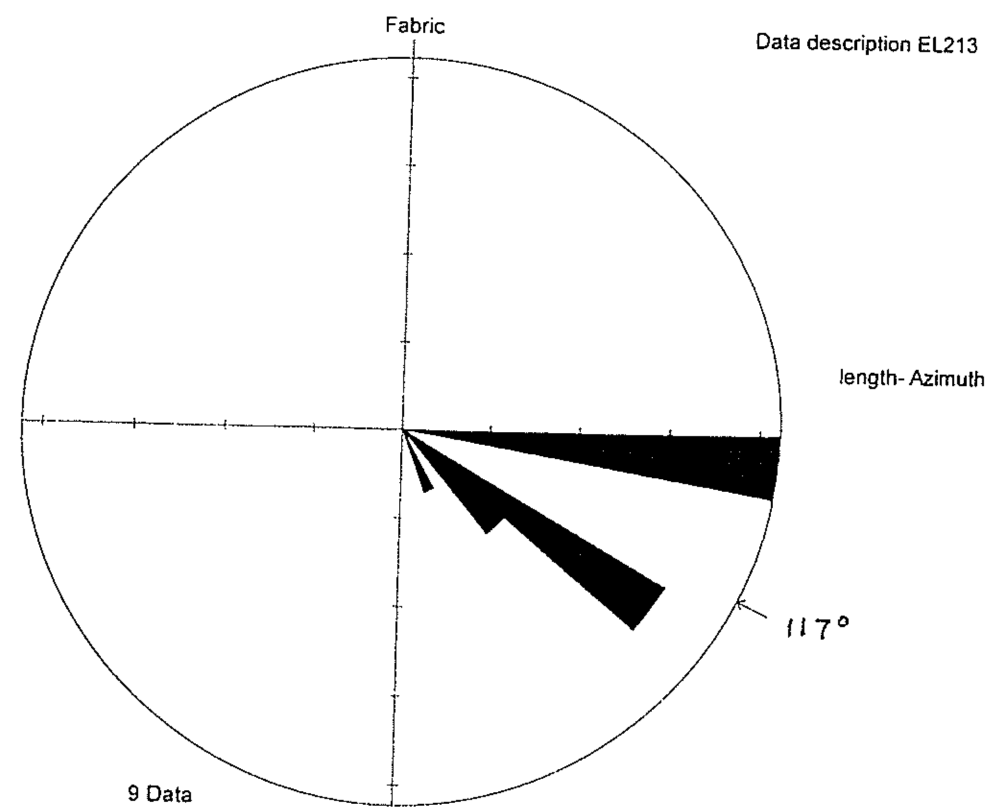
RG210
16



EL212A
3

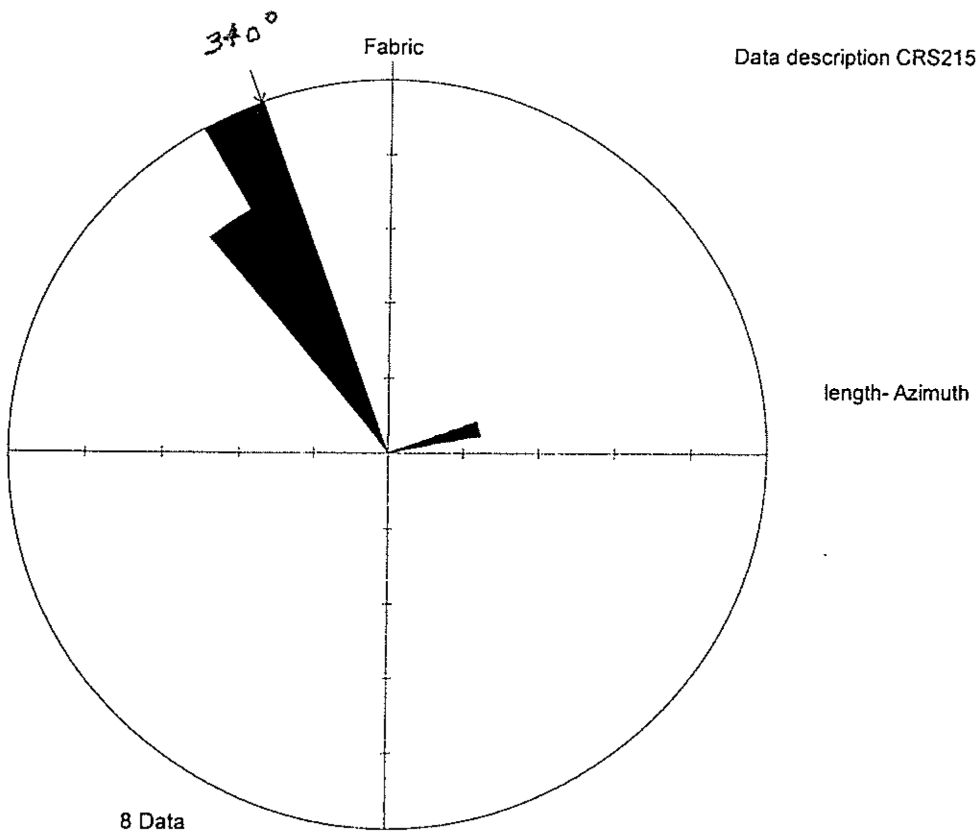


EL213
9

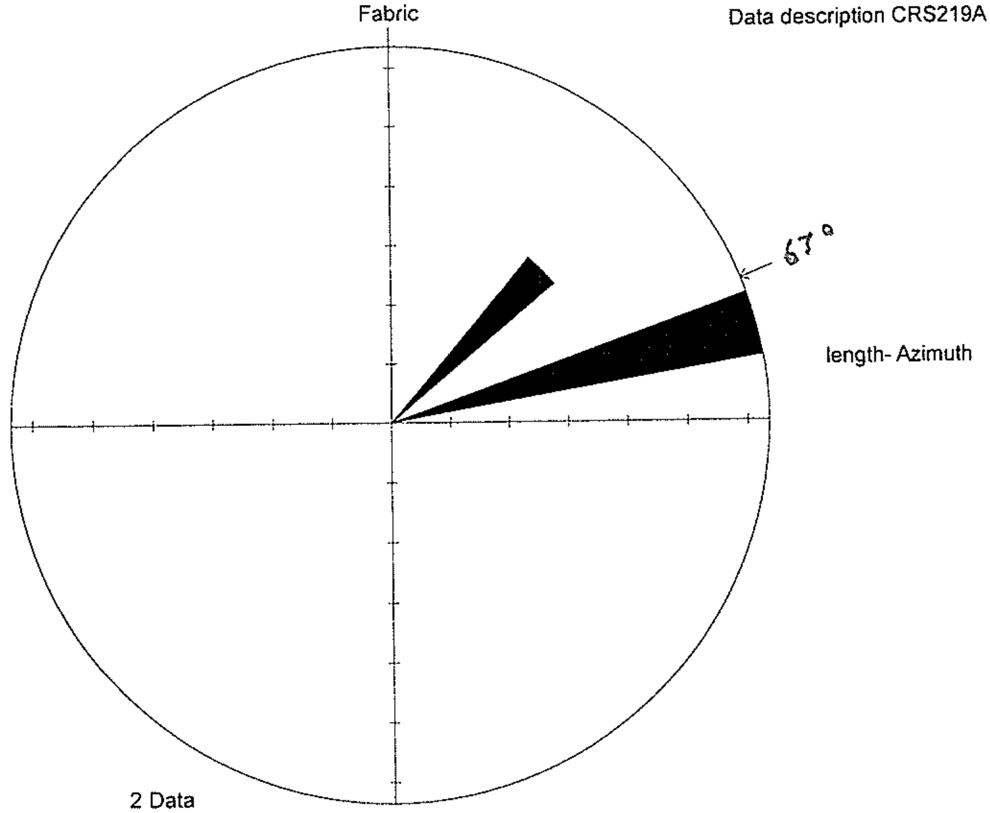


CRS215

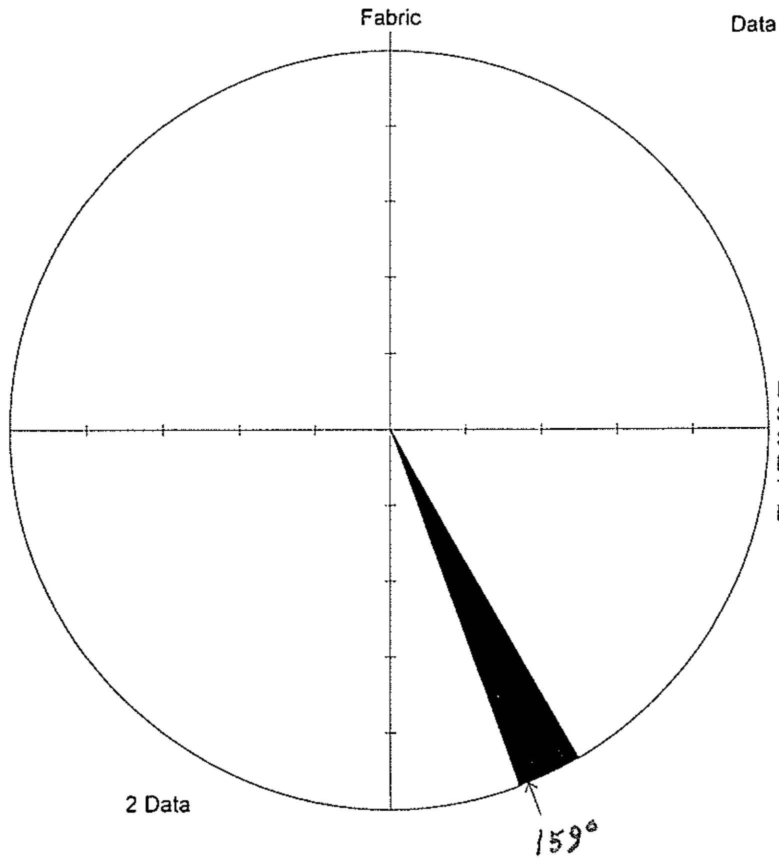
8



CRS219A
2



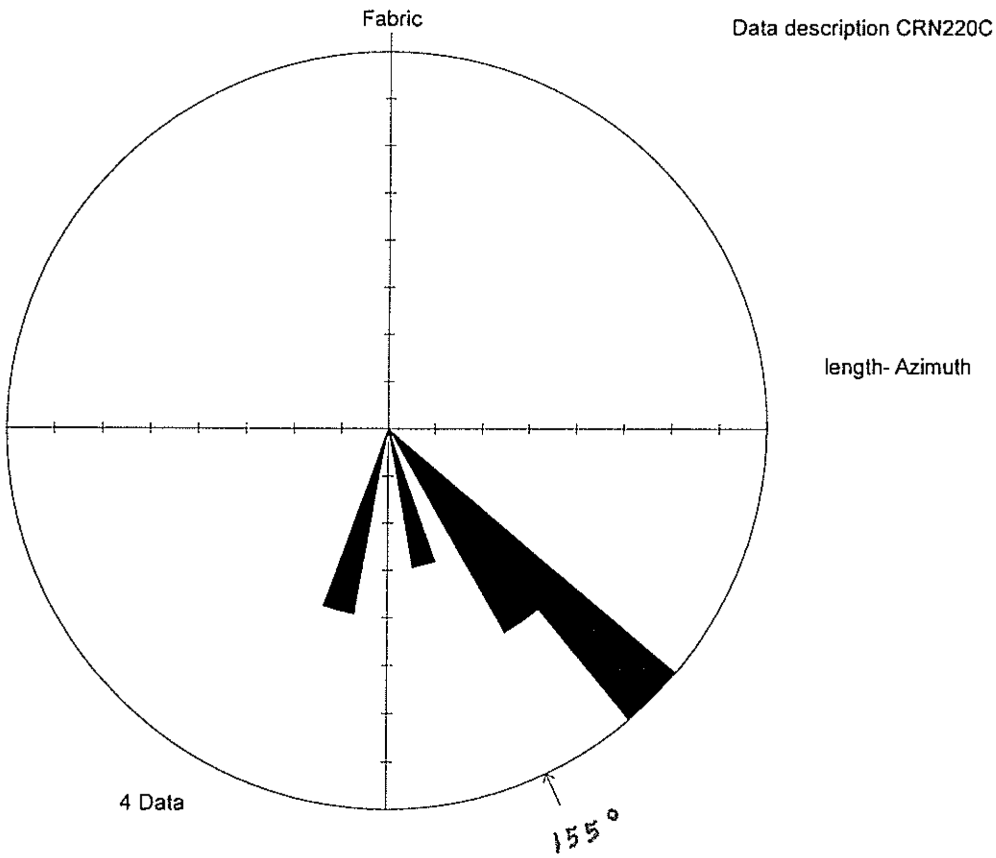
CRS219B
2



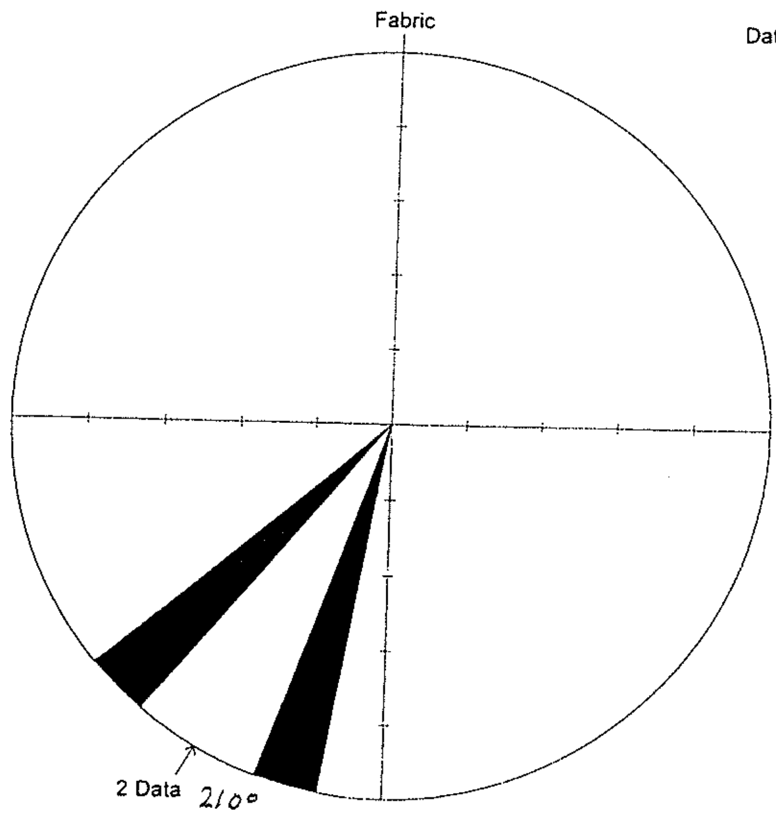
Data description CRS219B

length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 20% [length: 3.4(
Maximum = 100% [length: 17]
Total length = 17
Mean Resultant dir'n = 159

CRN220C
4



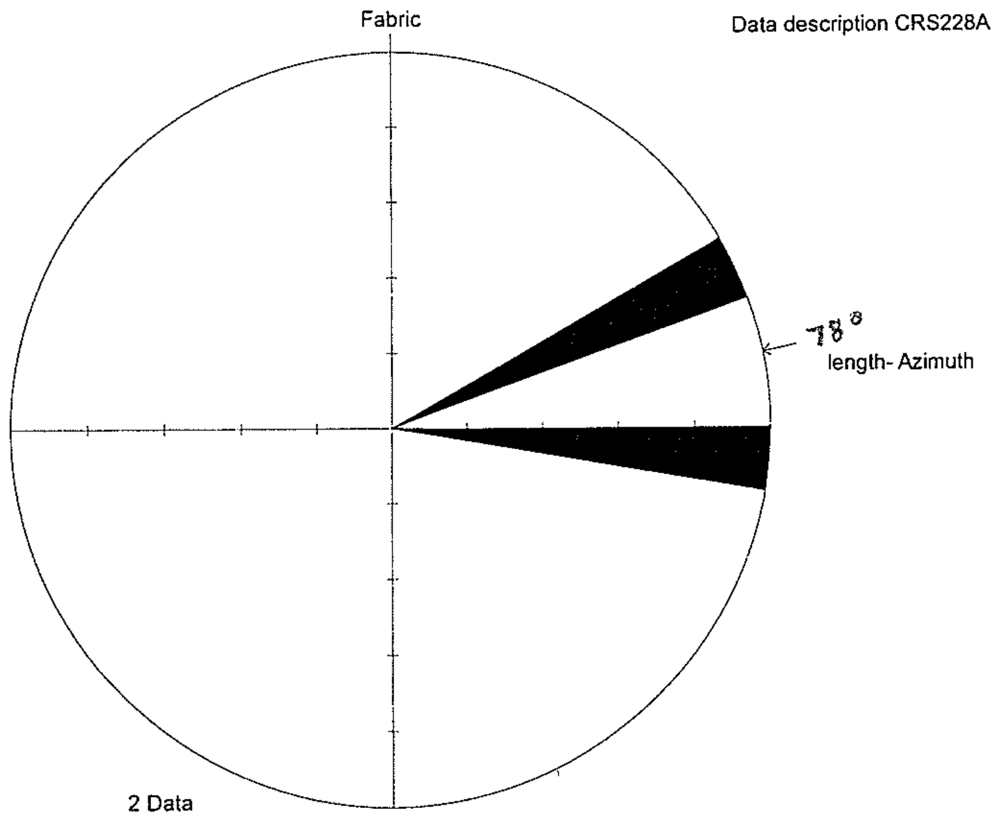
CRS227
2



Data description CRS227

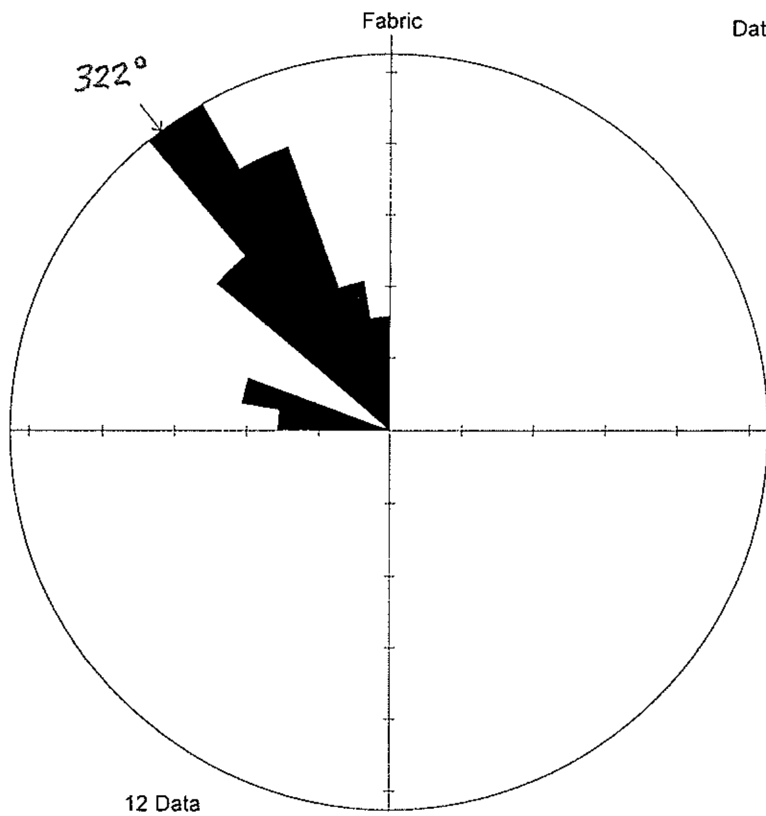
length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.40]
Maximum = 50% [length: 7]
Total length = 14
Mean Resultant dir'n = 210

CRS228A
2



CRS228B
12

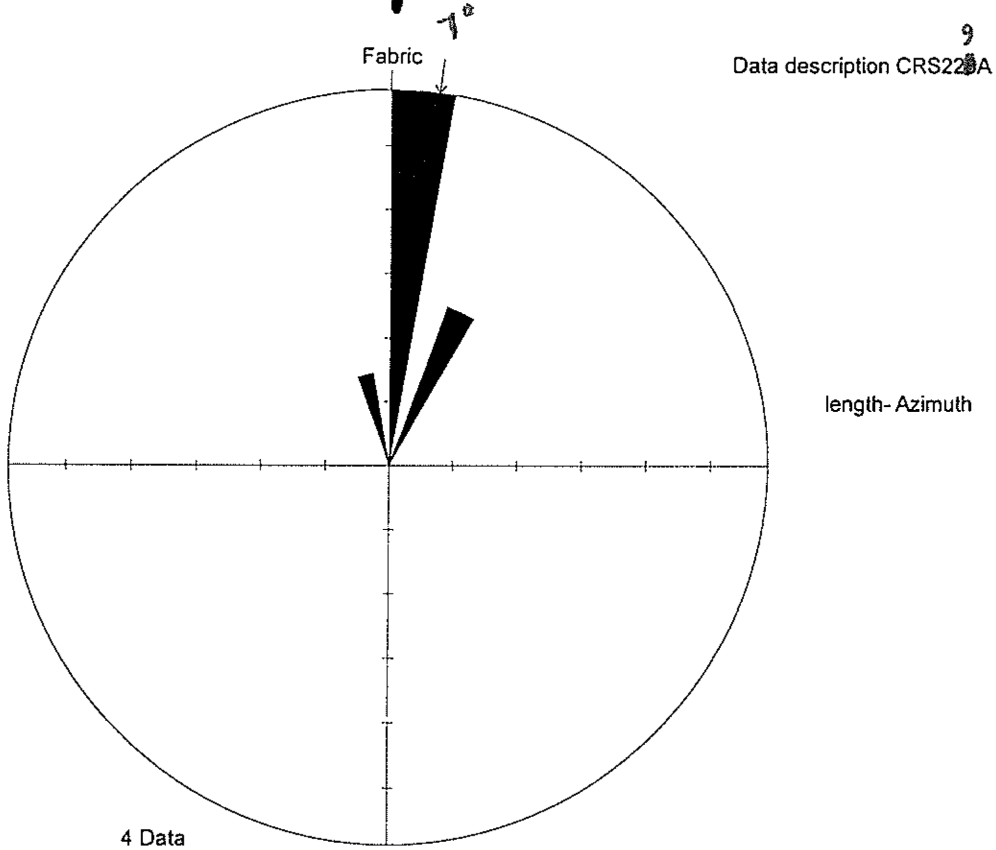
Data description CRS228B



length- Azimuth
No. of Data = 12
Sector angle = 10°
Scale: tick interval = 5% [length: 1.90]
Maximum = 26.3% [length: 10]
Total length = 38
Mean Resultant dir'n = 322
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

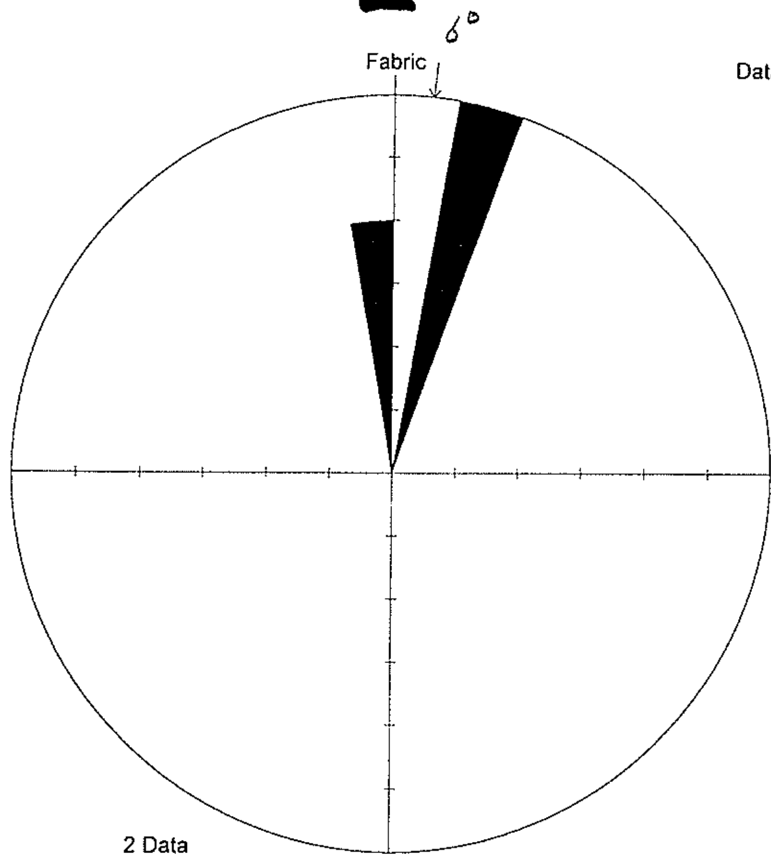
CRS229A

4



CRS229B

2

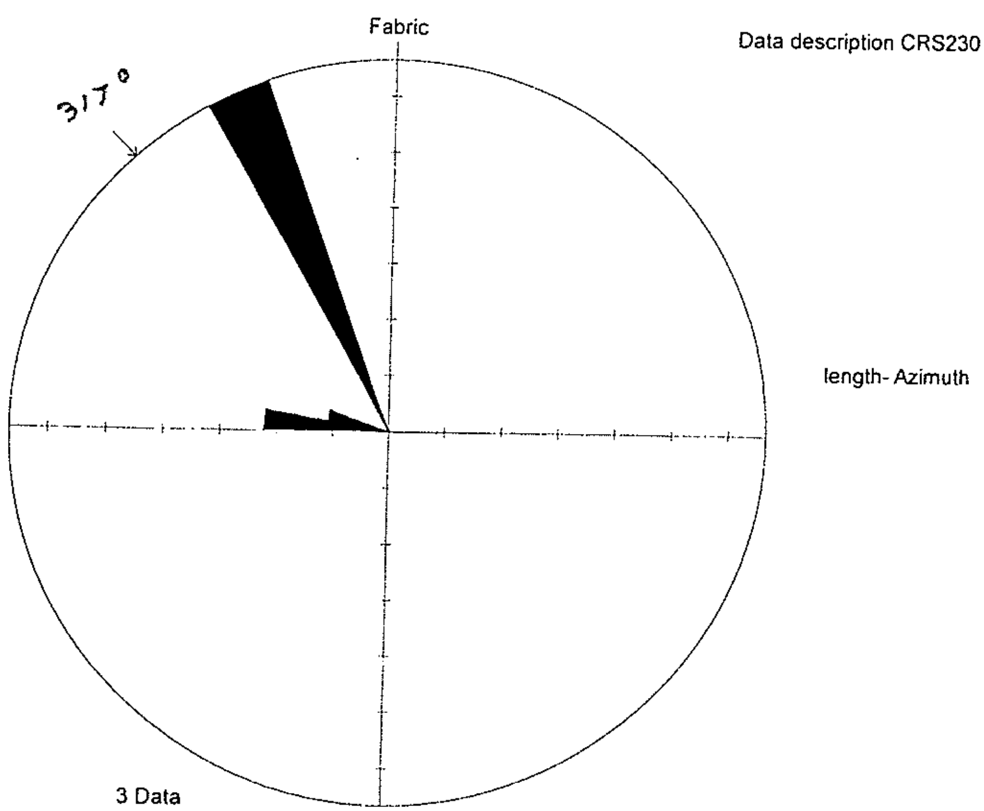


Data description CRS229B

length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 0.50]
Maximum = 60% [length: 3]
Total length = 5
Mean Resultant dir'n = 006

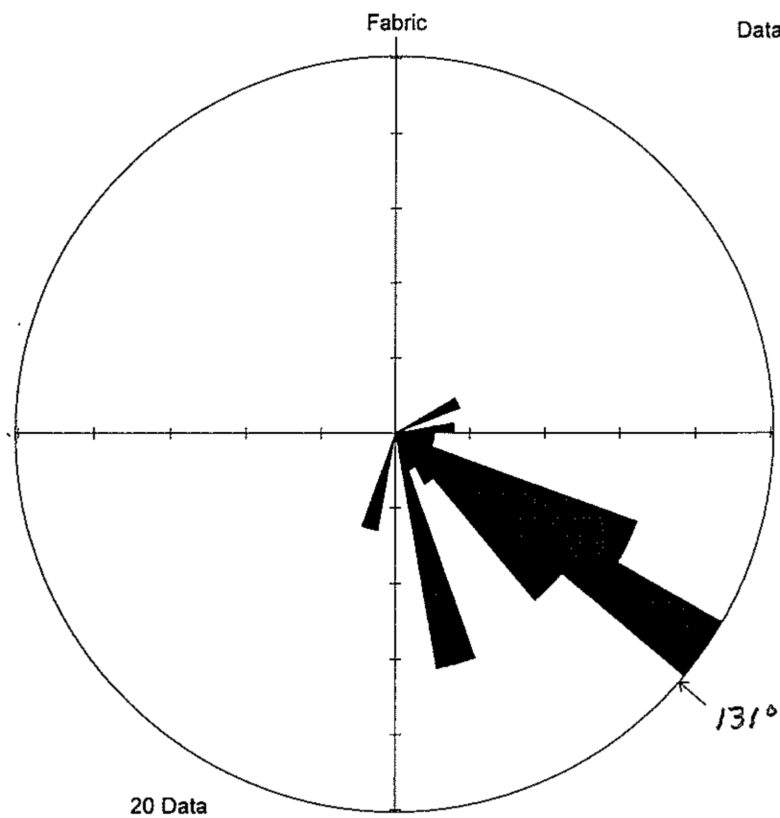
CRS230

3



RG231A (rvsd)
20

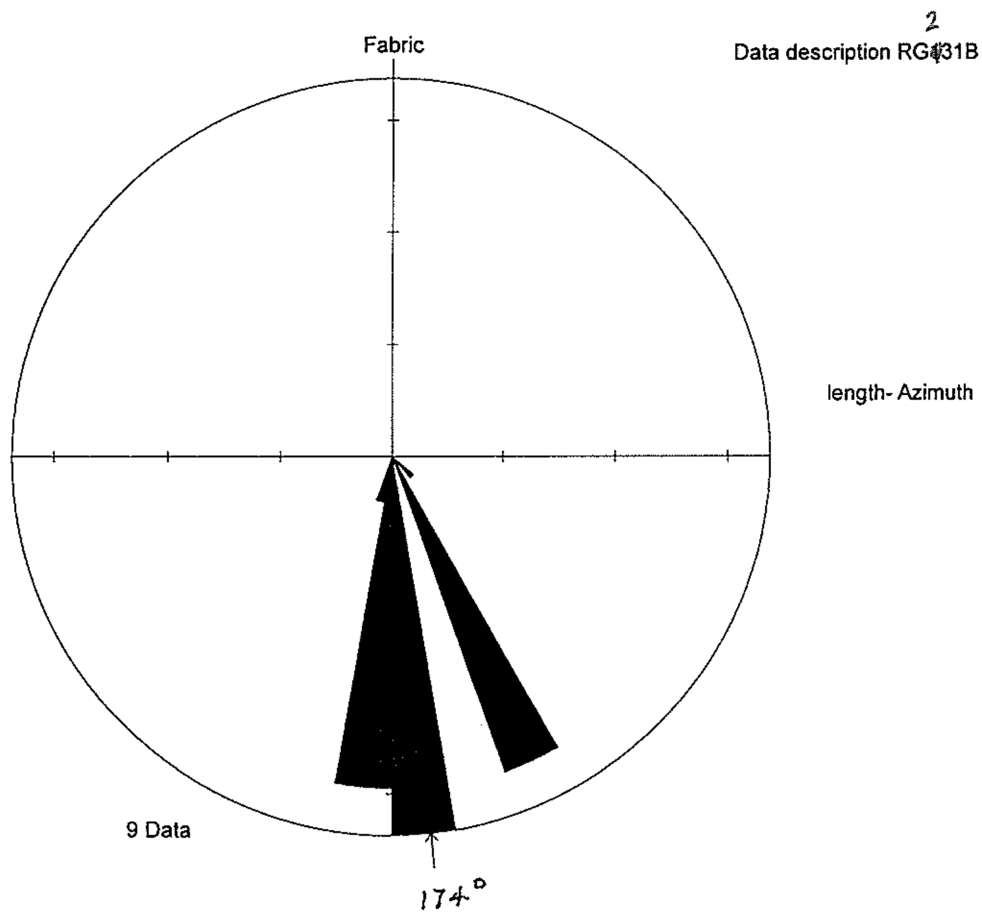
Data description RG231A



length- Azimuth
No. of Data = 20
Sector angle = 10°
Scale: tick interval = 5% [length: 7.55]
Maximum = 25.2% [length: 38]
Total length = 151
Mean Resultant dir'n = 131
[Approx. 95% Confidence interval = ±12.
(valid only for unimodal data)

RG231B

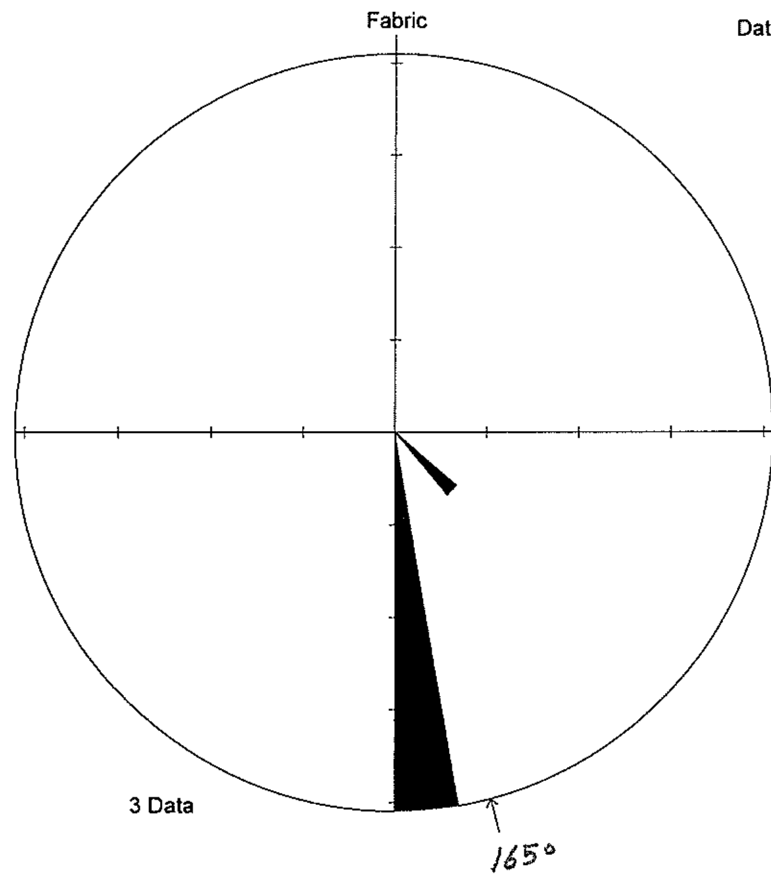
9



RG231C

3

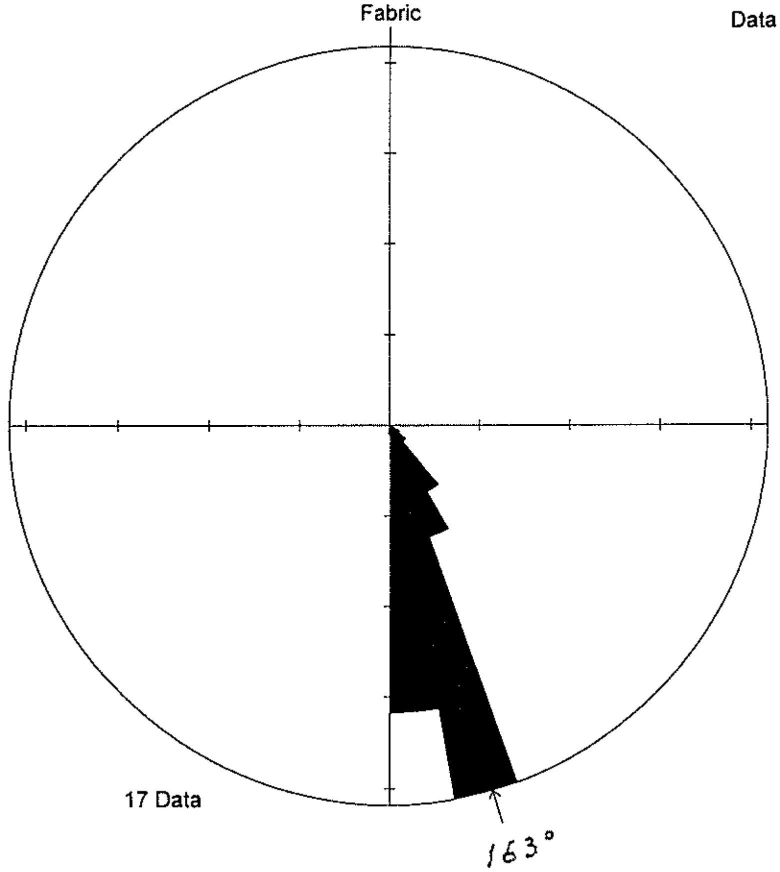
Data description RG231C



length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 20% [length: 7.80]
Maximum = 82.1% [length: 32]
Total length = 39
Mean Resultant dir'n = 165
[Approx. 95% Confidence interval = ±17.
(valid only for unimodal data)

RG231D

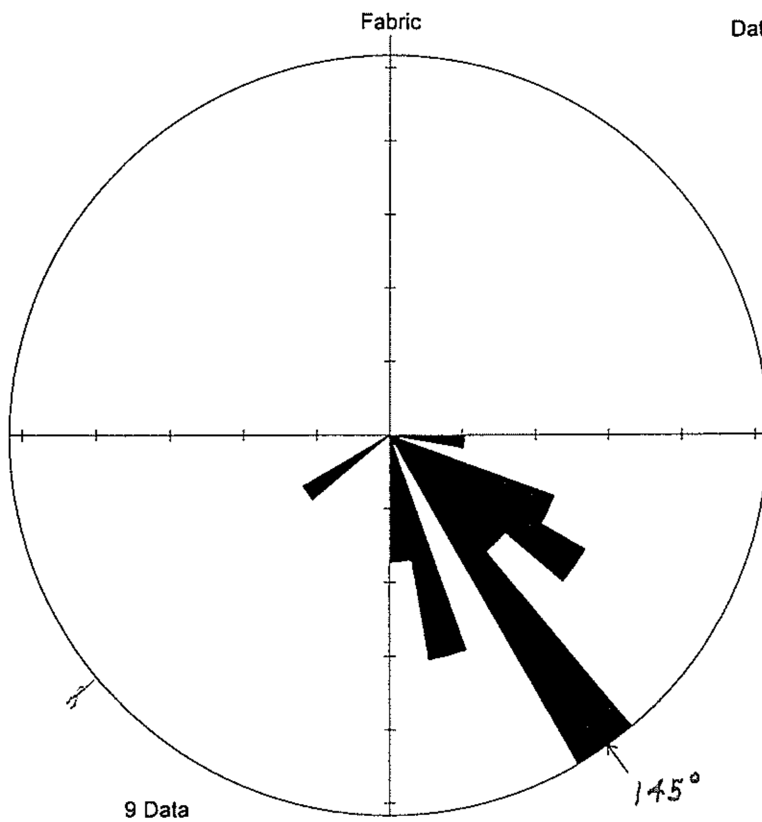
17



RG231E

9

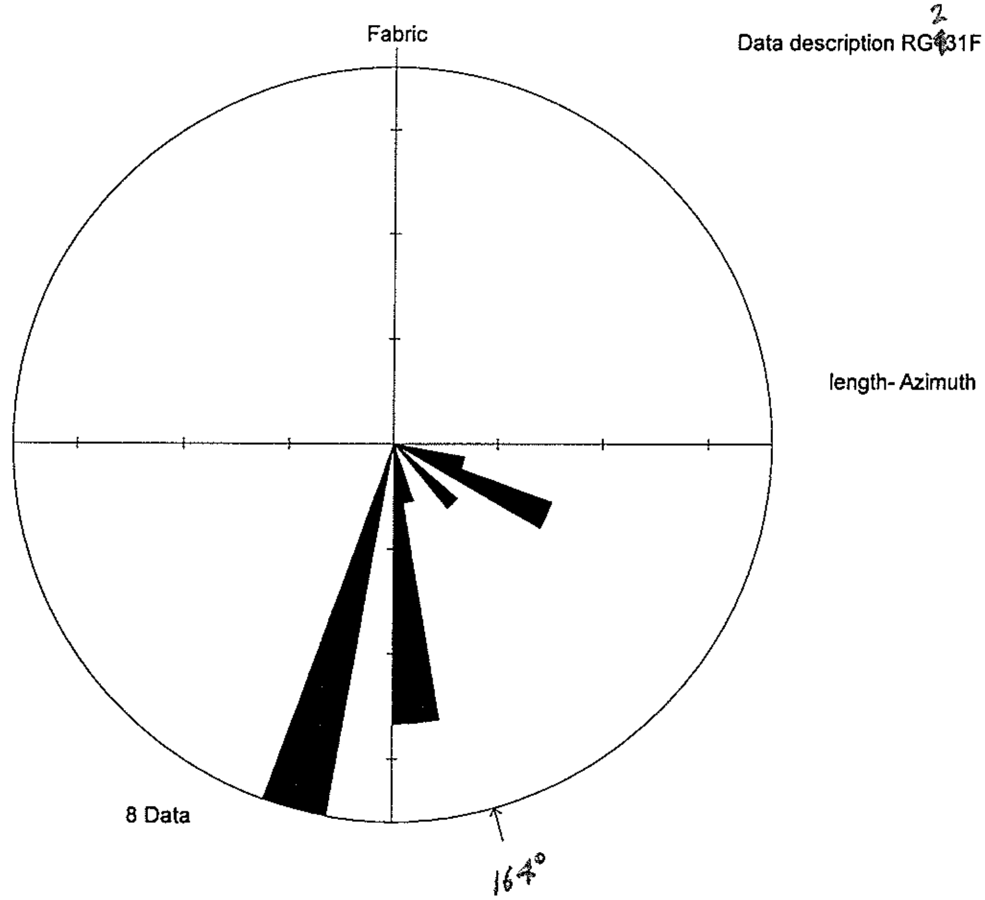
Data description RG231E



length- Azimuth
No. of Data = 9
Sector angle = 10°
Scale: tick interval = 5% [length: 2.90]
Maximum = 25.9% [length: 15]
Total length = 58
Mean Resultant dir'n = 145
[Approx. 95% Confidence interval = ±19
(valid only for unimodal data)

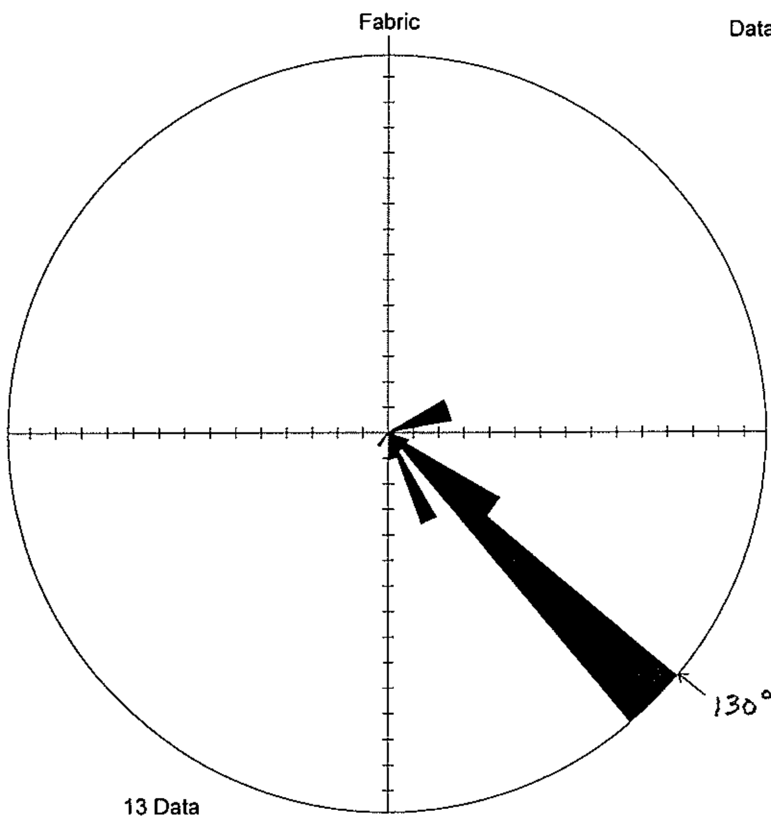
RG231F

8



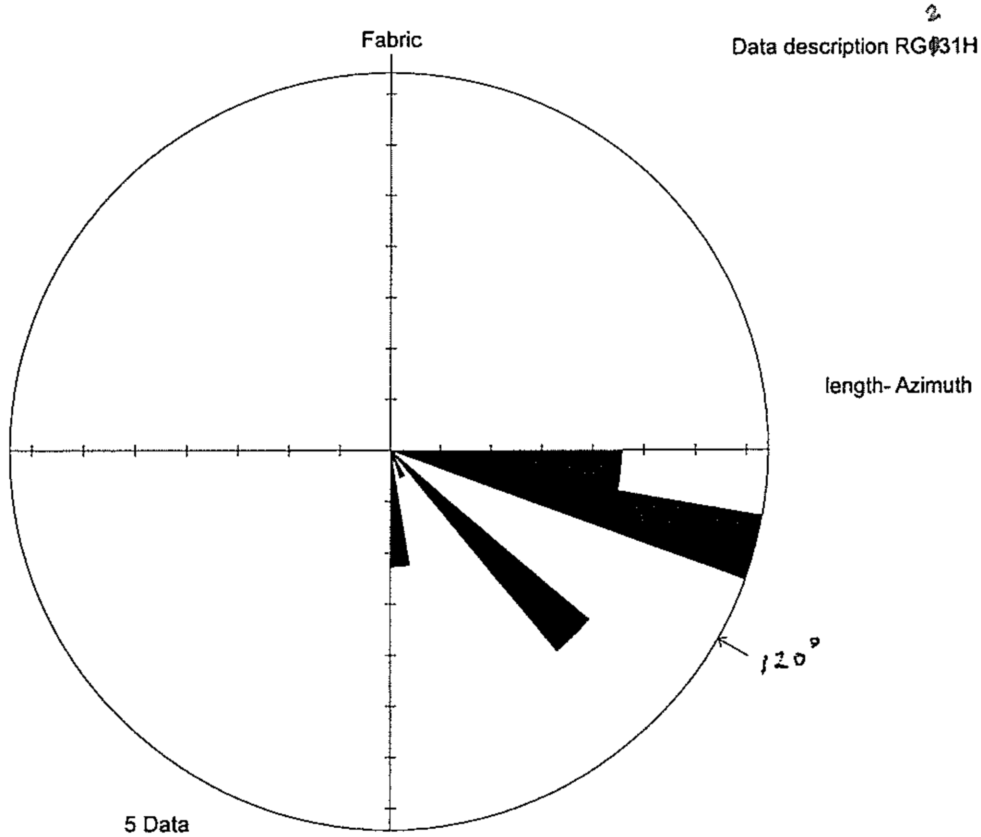
RG231G
13

Data description RG231G



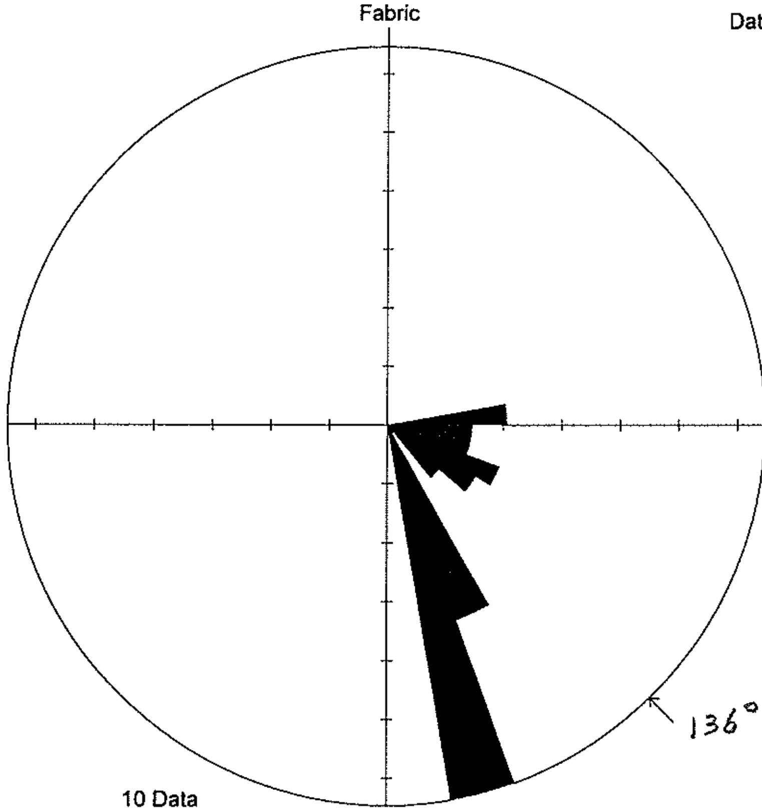
length- Azimuth
No. of Data = 13
Sector angle = 10°
Scale: tick interval = 3% [length: 4.71]
Maximum = 44.6% [length: 70]
Total length = 157
Mean Resultant dir'n = 130
[Approx. 95% Confidence interval = ±14.
(valid only for unimodal data)

RG231H
5



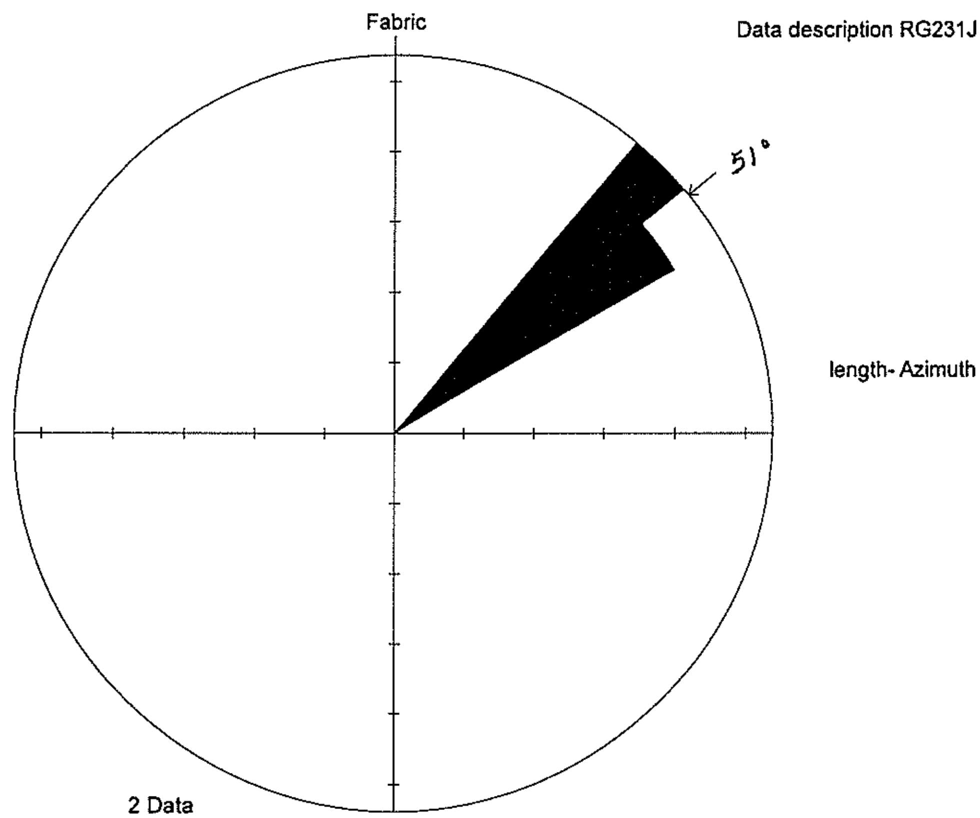
I
RG231I
10

Data description RG231I



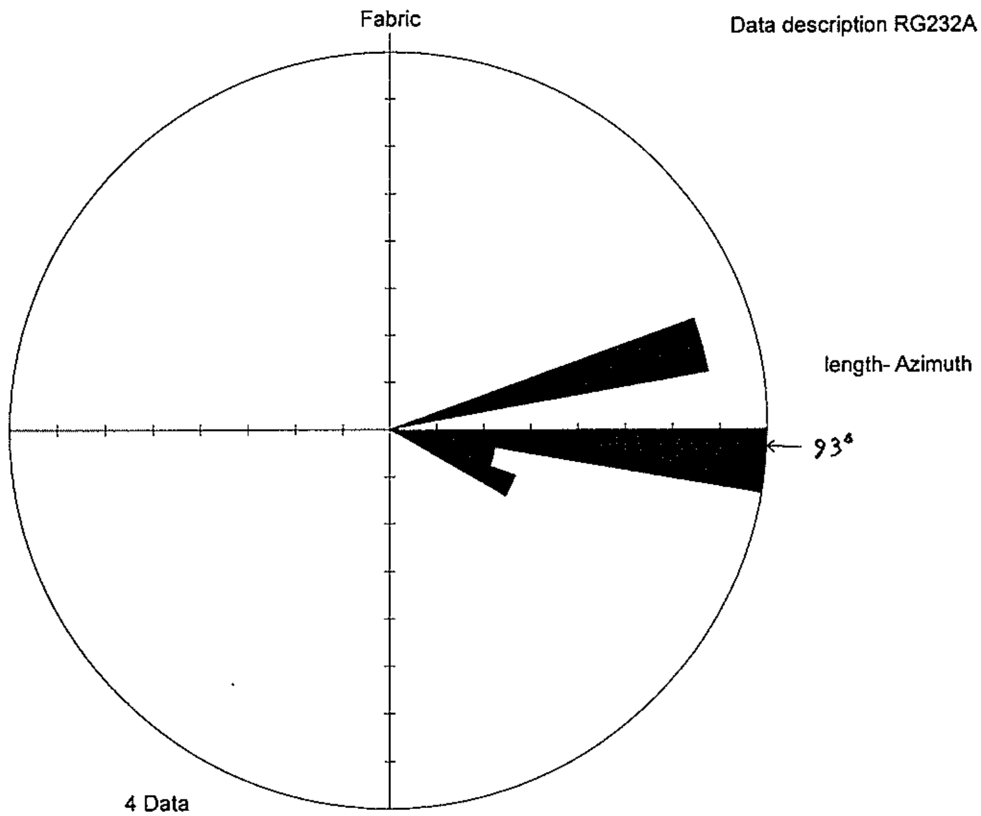
length- Azimuth
No. of Data = 10
Sector angle = 10°
Scale: tick interval = 5% [length: 3.40]
Maximum = 32.4% [length: 22]
Total length = 68
Mean Resultant dir'n = 136
[Approx. 95% Confidence Interval = ±18.
(valid only for unimodal data)

RG231J (new)
2



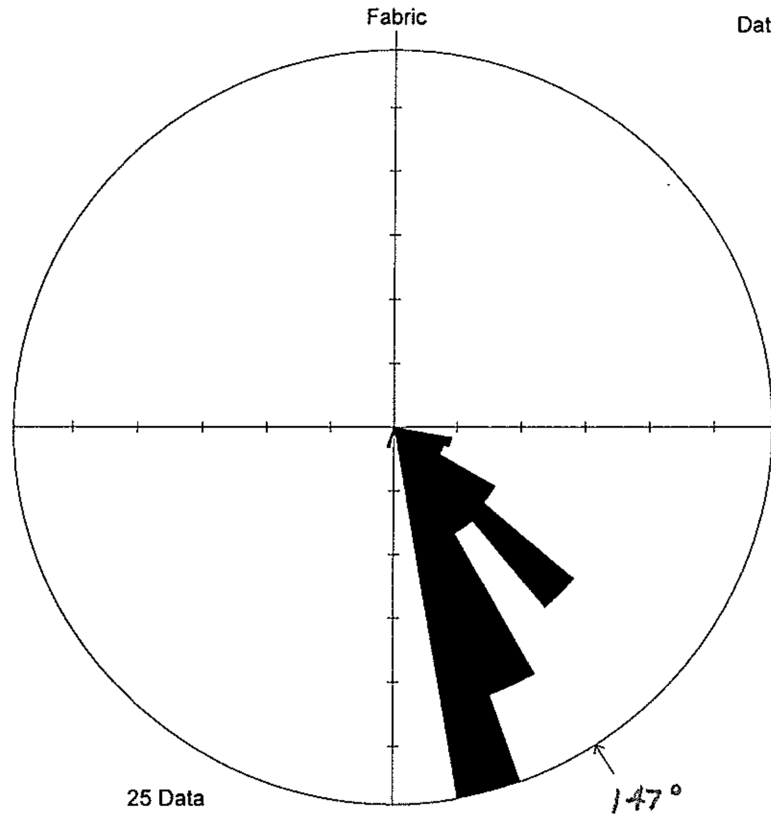
RG232A

4



RG232B
25

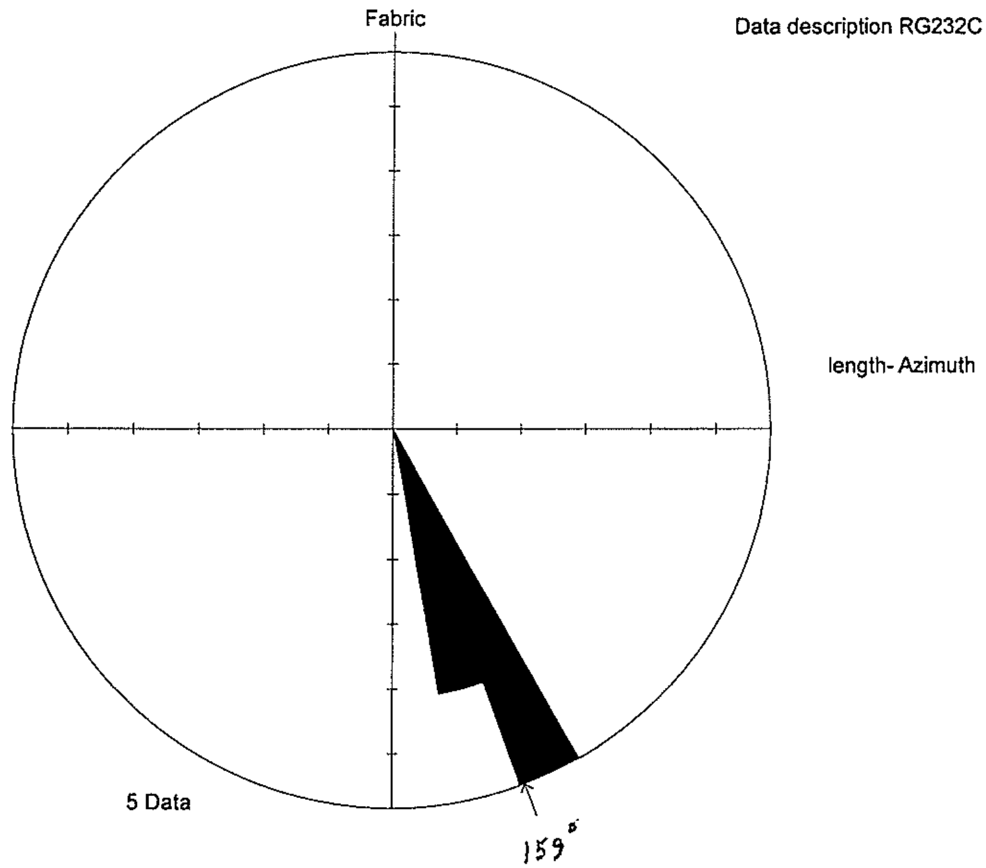
Data description RG232B



length- Azimuth
No. of Data = 25
Sector angle = 10°
Scale: tick interval = 5% [length: 11.85]
Maximum = 29.5% [length: 70]
Total length = 237
Mean Resultant dir'n = 147
[Approx. 95% Confidence interval = ±6.8
(valid only for unimodal data)

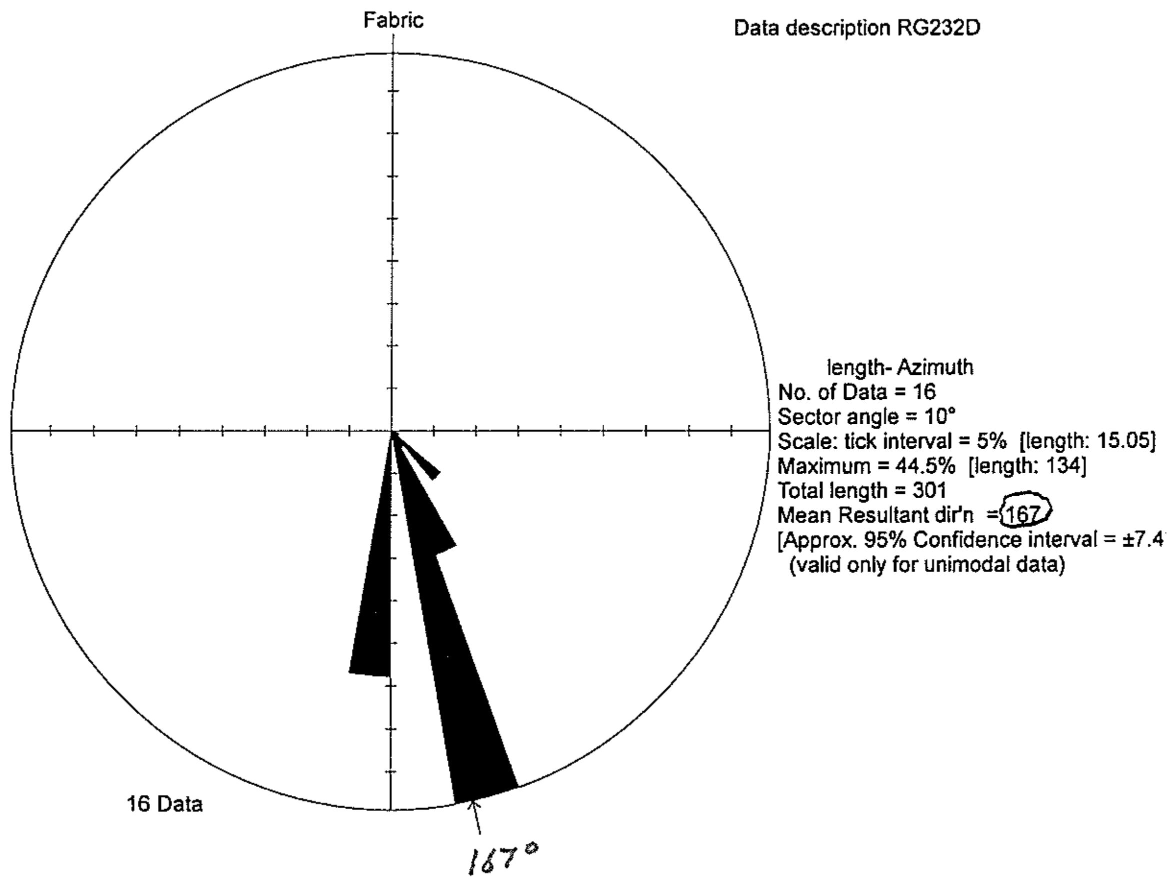
RG232C

5



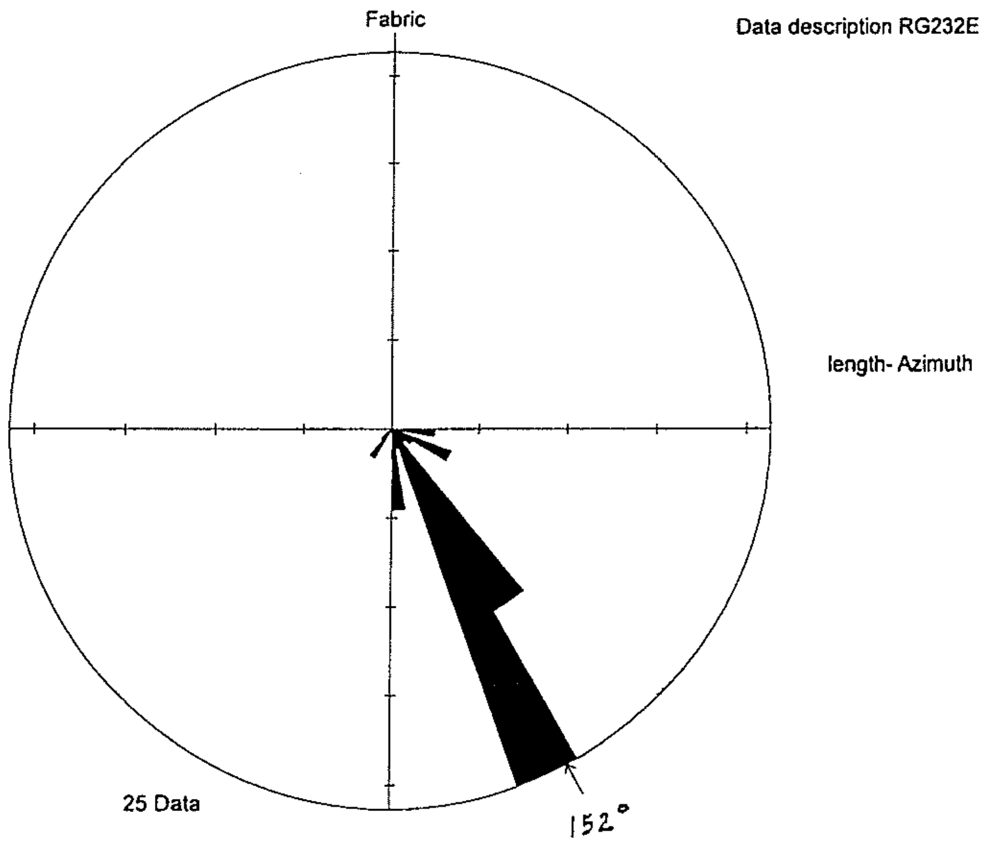
RG232D

16



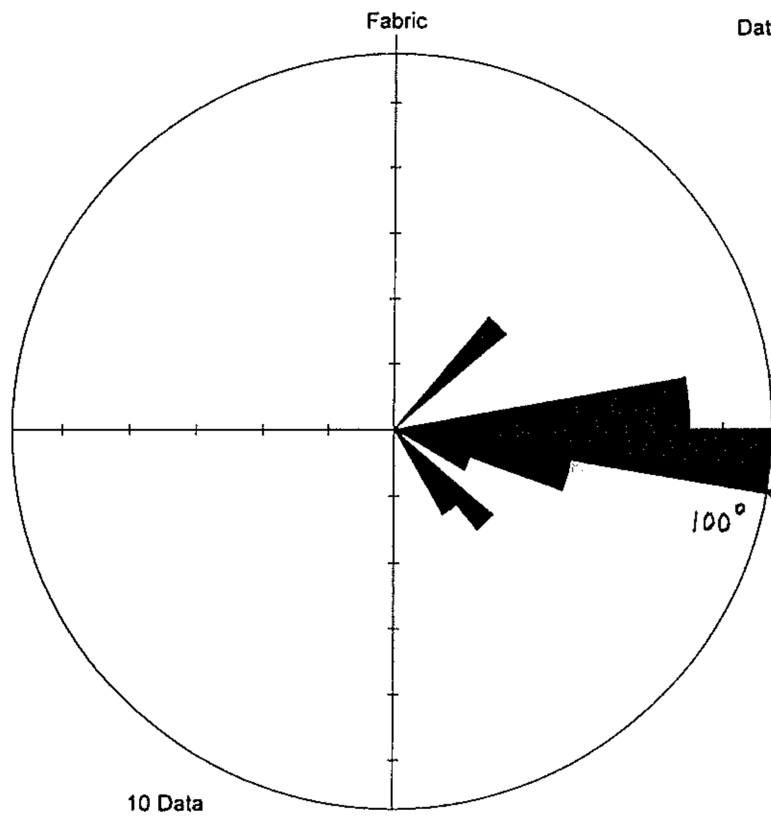
Fabric
Data description RG232D
length- Azimuth
No. of Data = 16
Sector angle = 10°
Scale: tick interval = 5% [length: 15.05]
Maximum = 44.5% [length: 134]
Total length = 301
Mean Resultant dir'n = 167
[Approx. 95% Confidence interval = ±7.4
(valid only for unimodal data)
16 Data
167°

RG232E
25



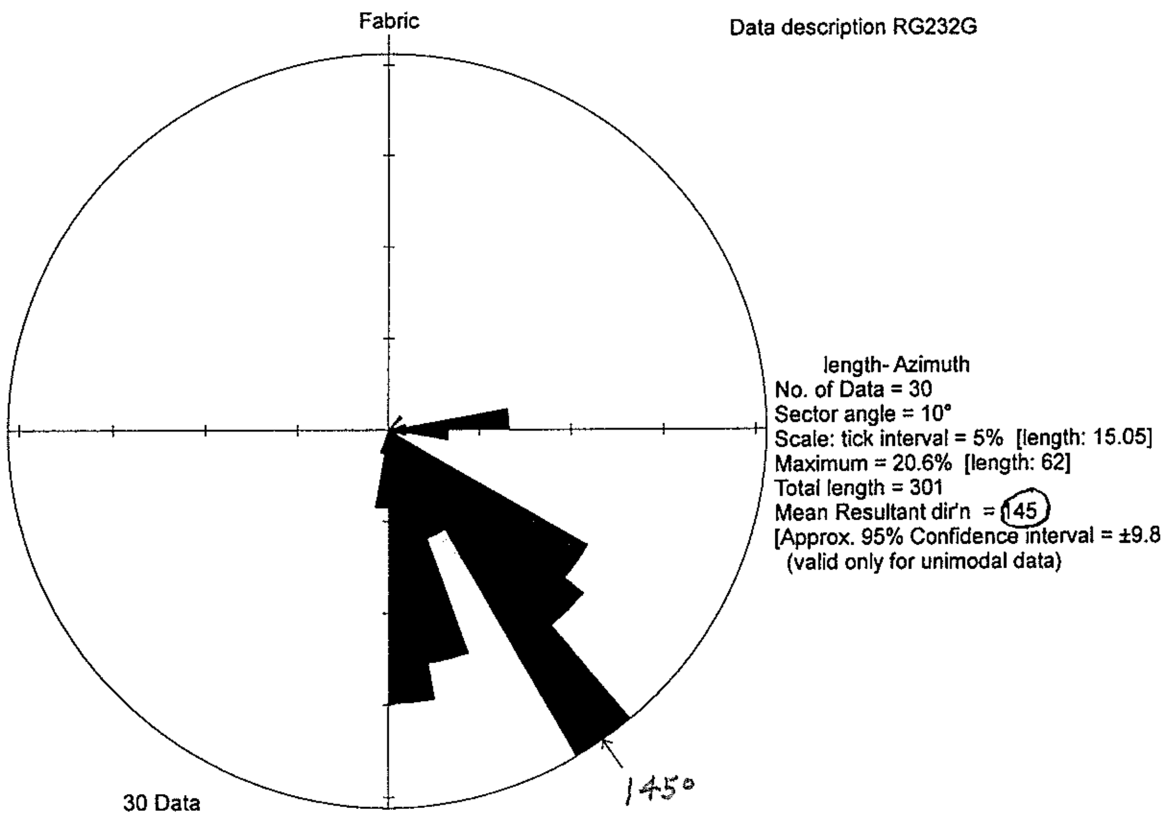
RG232F
10

Data description RG232F

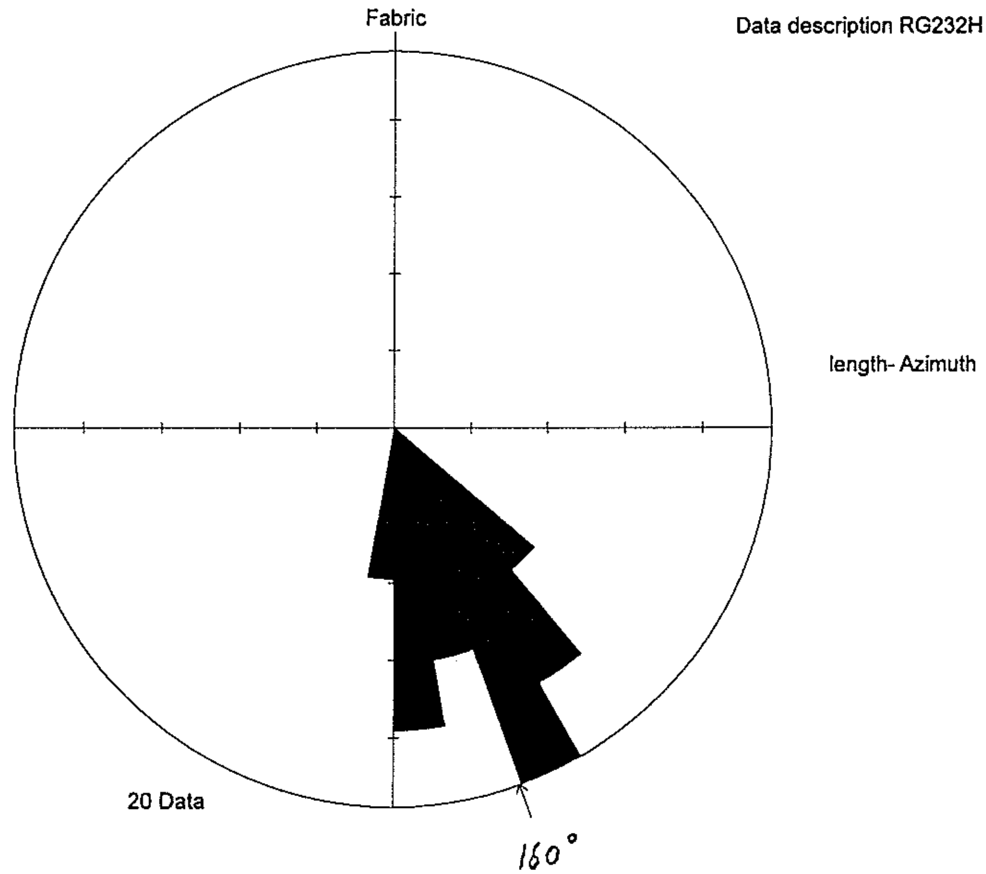


length- Azimuth
No. of Data = 10
Sector angle = 10°
Scale: tick interval = 5% [length: 4.00]
Maximum = 28.8% [length: 23]
Total length = 80
Mean Resultant dir'n = 100
[Approx. 95% Confidence interval = ±15.
(valid only for unimodal data)

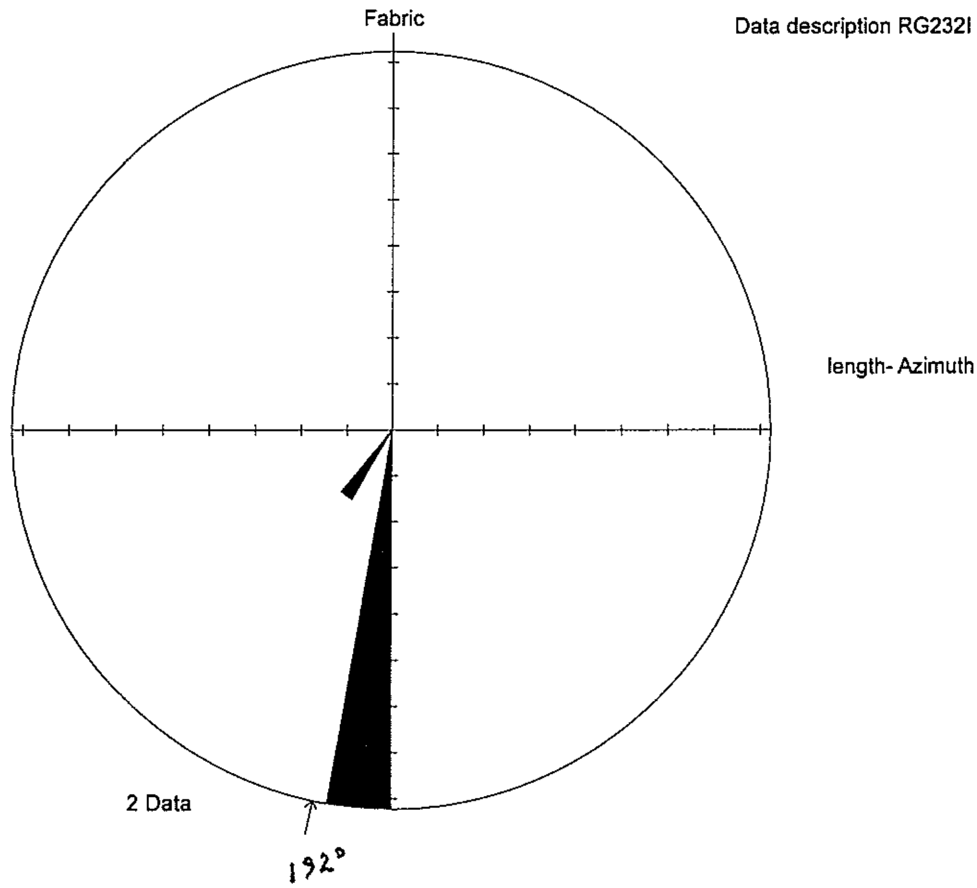
RG232G (rvsd)
30



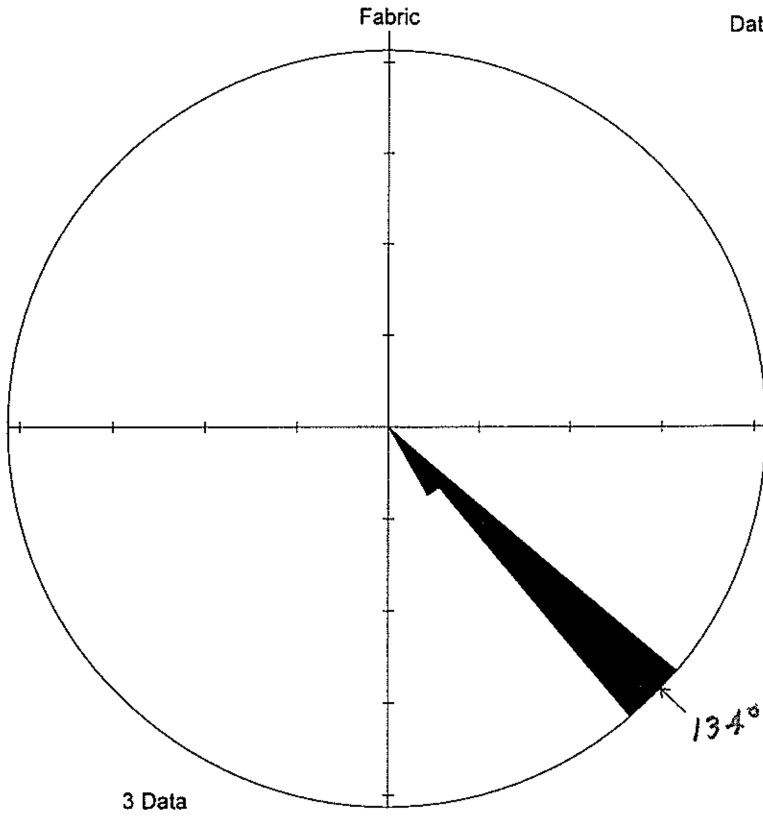
RG232H (rvsd)
20



RG232I
2



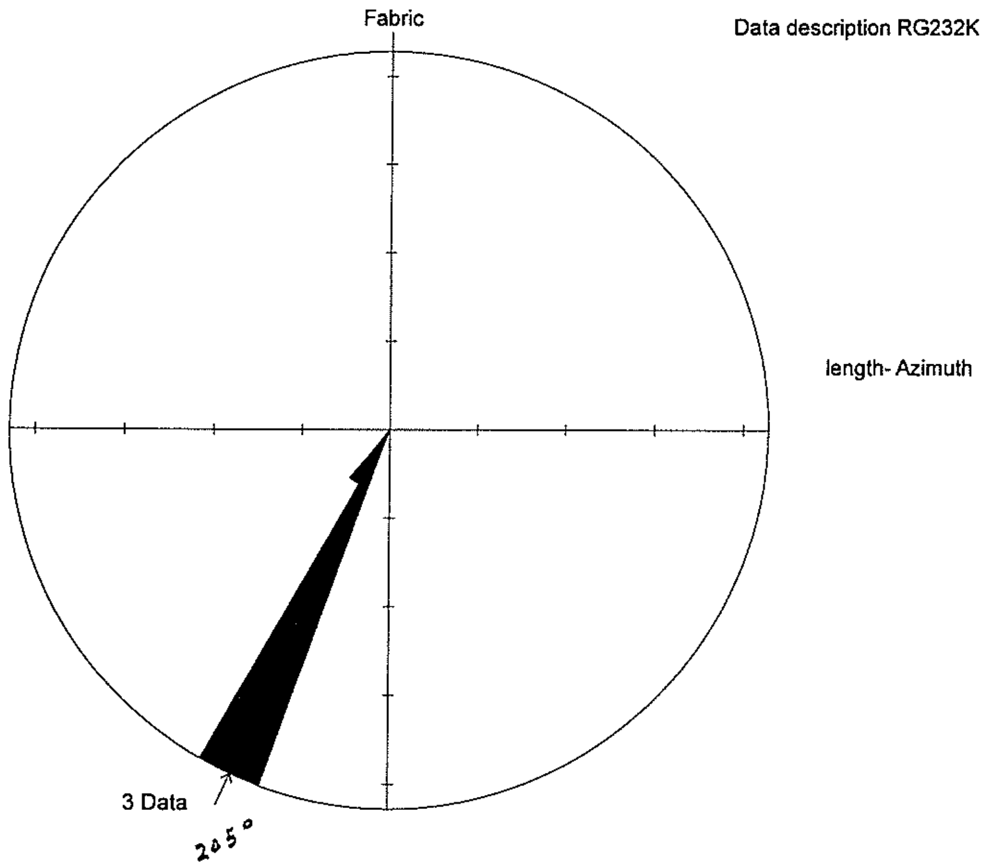
RG232J
3



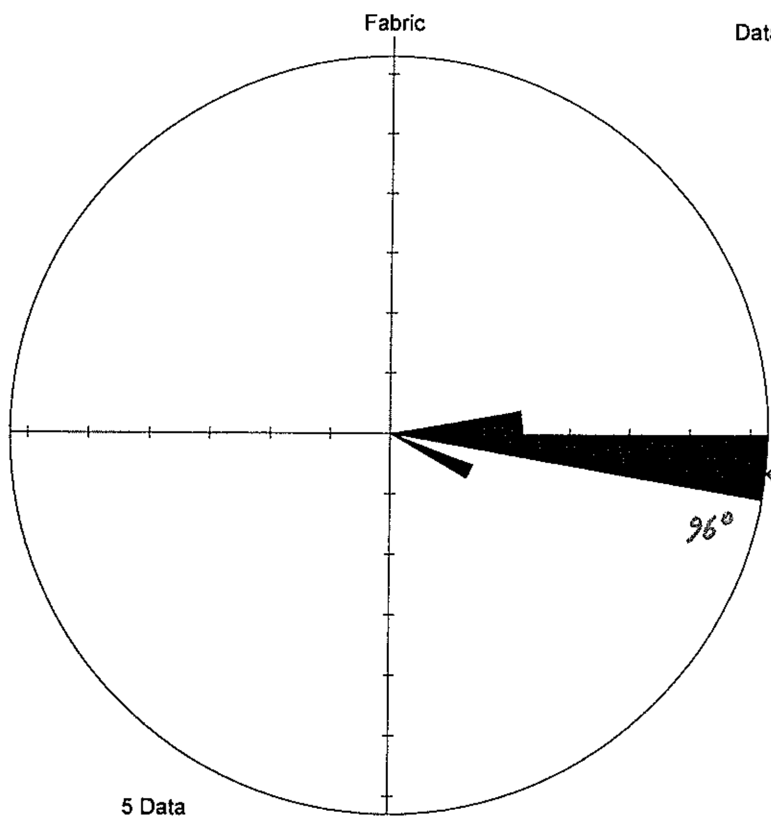
Data description RG232J

length- Azimuth
No. of Data = 3
Sector angle = 10°
Scale: tick interval = 20% [length: 4.60]
Maximum = 82.6% [length: 19]
Total length = 23
Mean Resultant dir'n = 134

RG232K
3



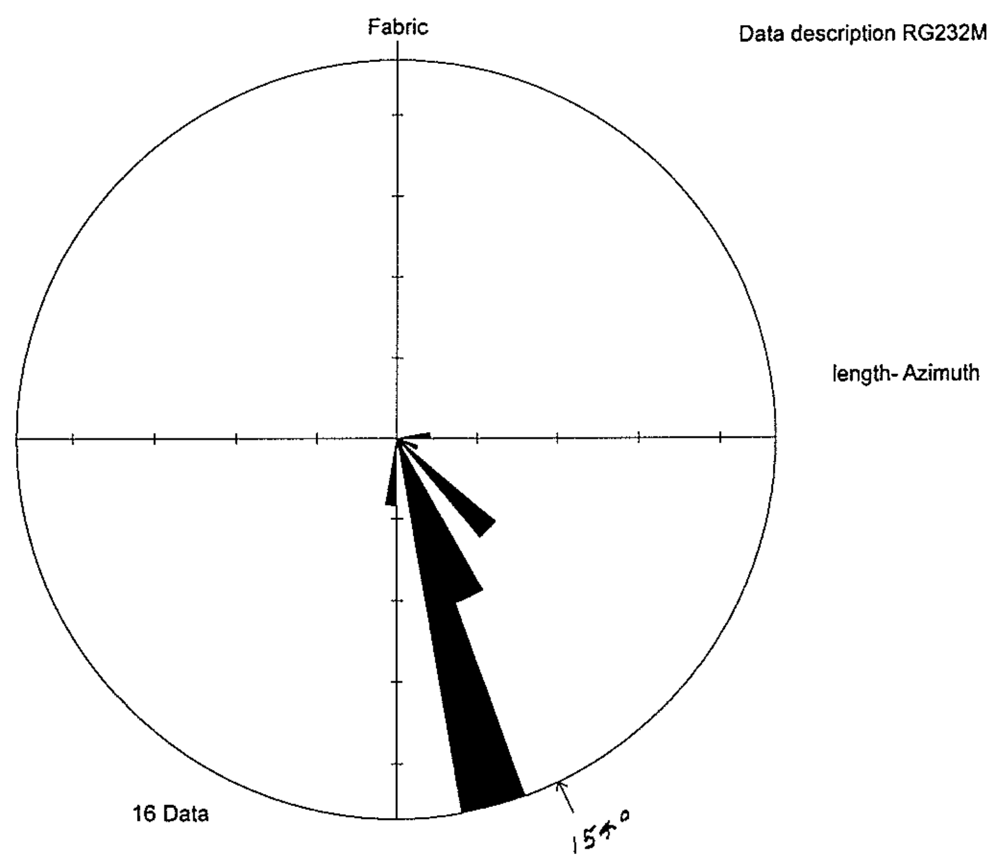
RG 232L (rvsd)
5



Data description RG232L

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 2.70]
Maximum = 63.0% [length: 17]
Total length = 27
Mean Resultant dir'n = 096
[Approx. 95% Confidence interval = ±8.5'
(valid only for unimodal data)

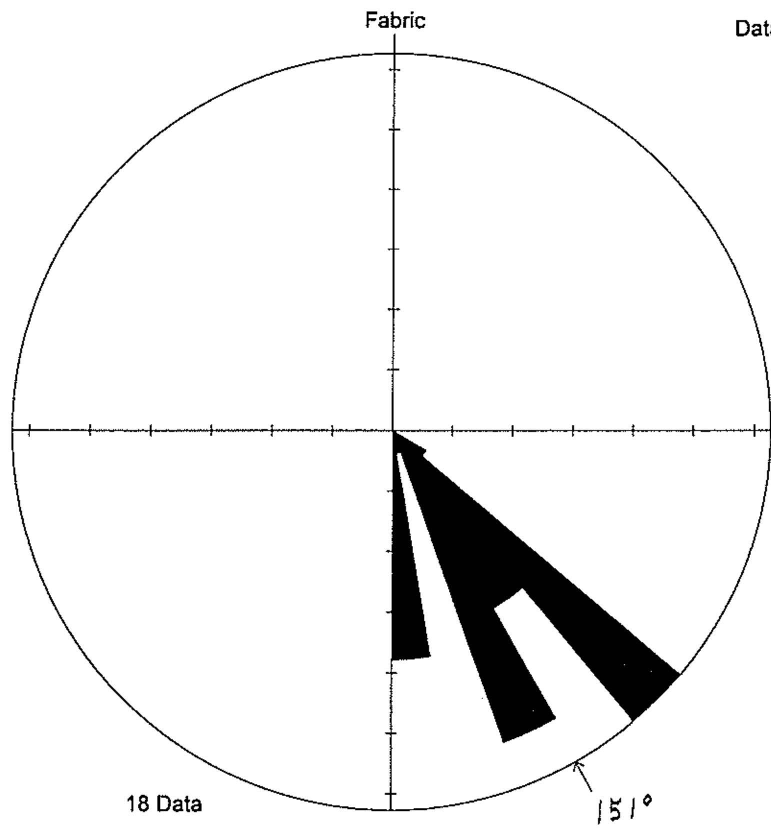
RG232M
16



RG232N

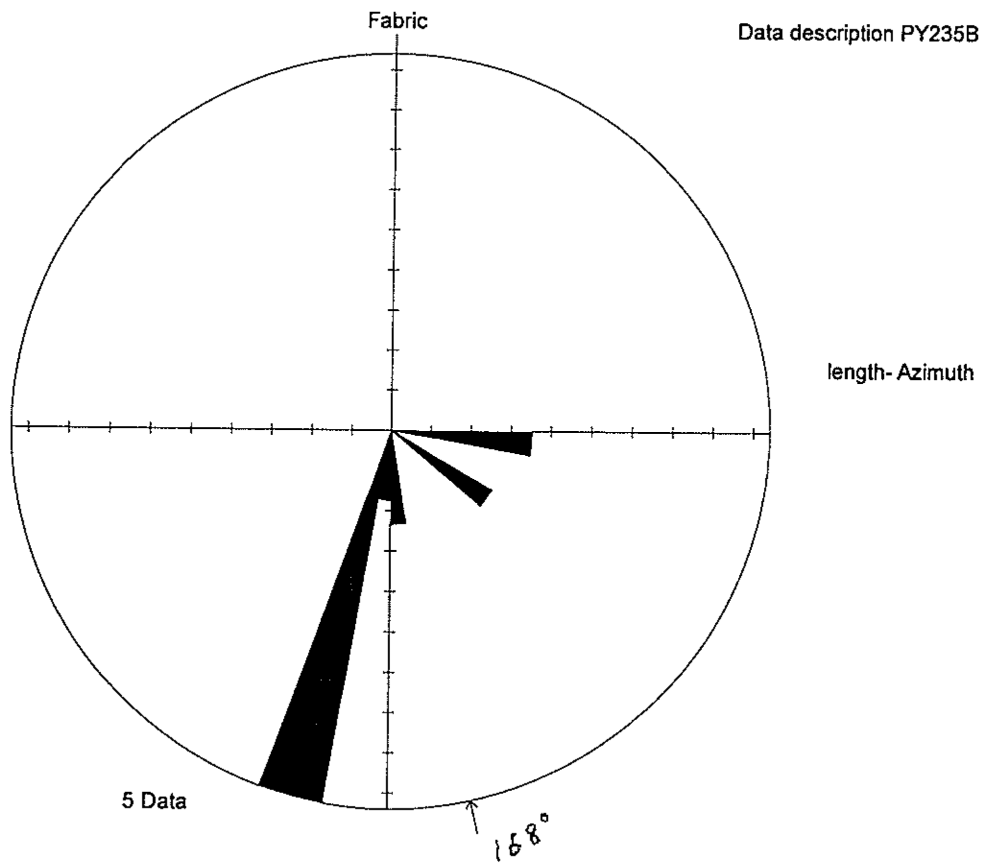
18

Data description RG232N



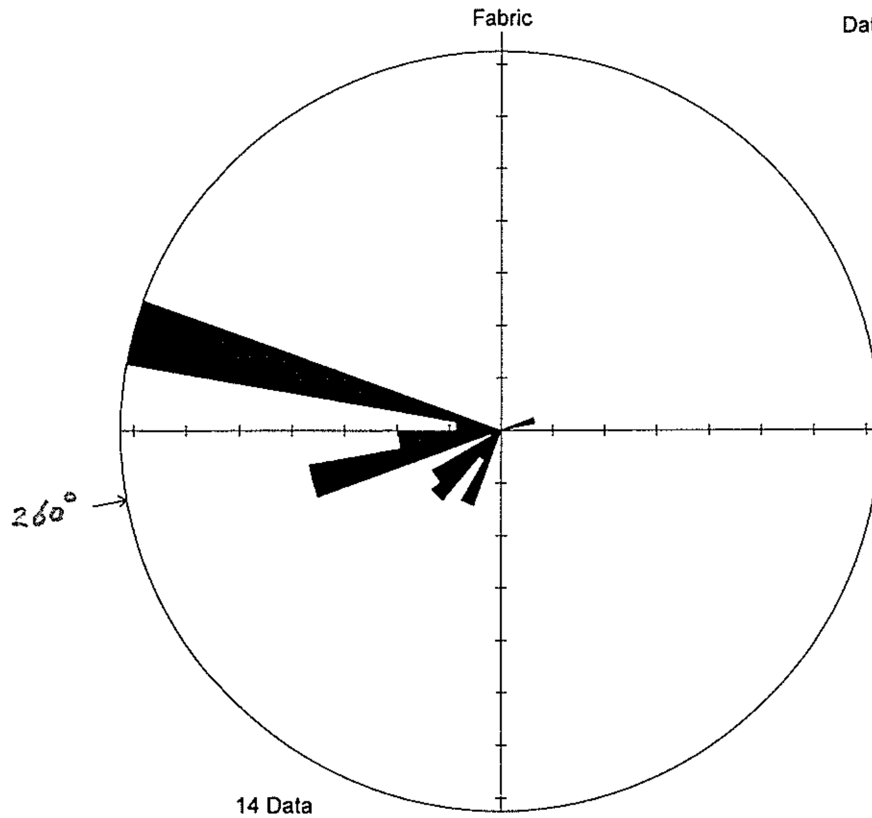
length- Azimuth
No. of Data = 18
Sector angle = 10°
Scale: tick interval = 5% [length: 7.65]
Maximum = 31.4% [length: 48]
Total length = 153
Mean Resultant dir'n = 151
[Approx. 95% Confidence interval = ±7.3
(valid only for unimodal data)

PY235B
-5



BB236A

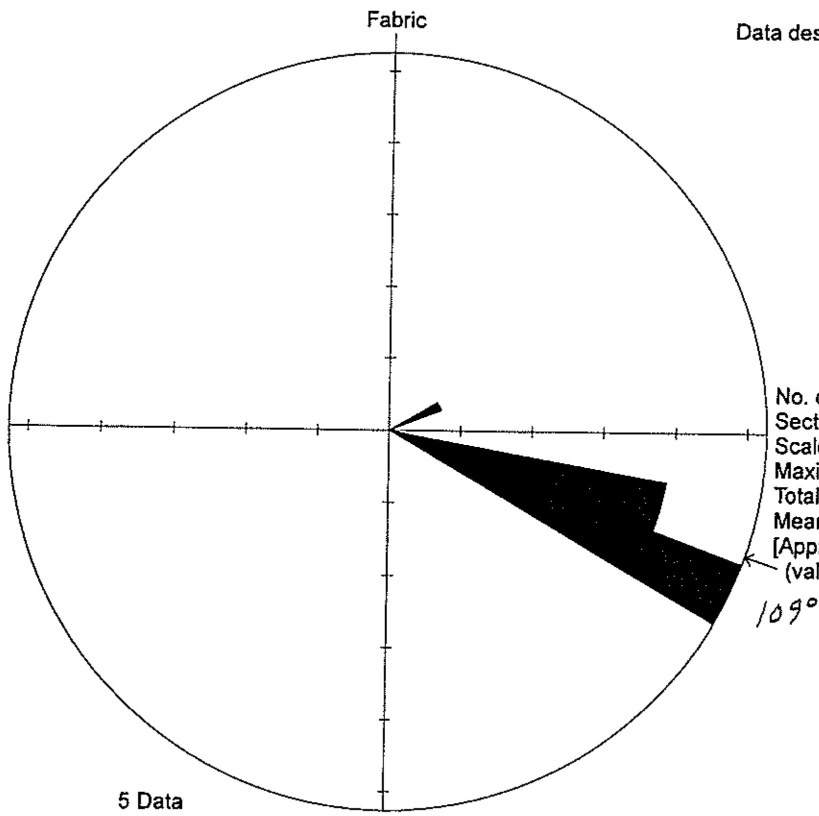
14



Data description BB236A

length- Azimuth
No. of Data = 14
Sector angle = 10°
Scale: tick interval = 5% [length: 4.55]
Maximum = 36.3% [length: 33]
Total length = 91
Mean Resultant dir'n = 260
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

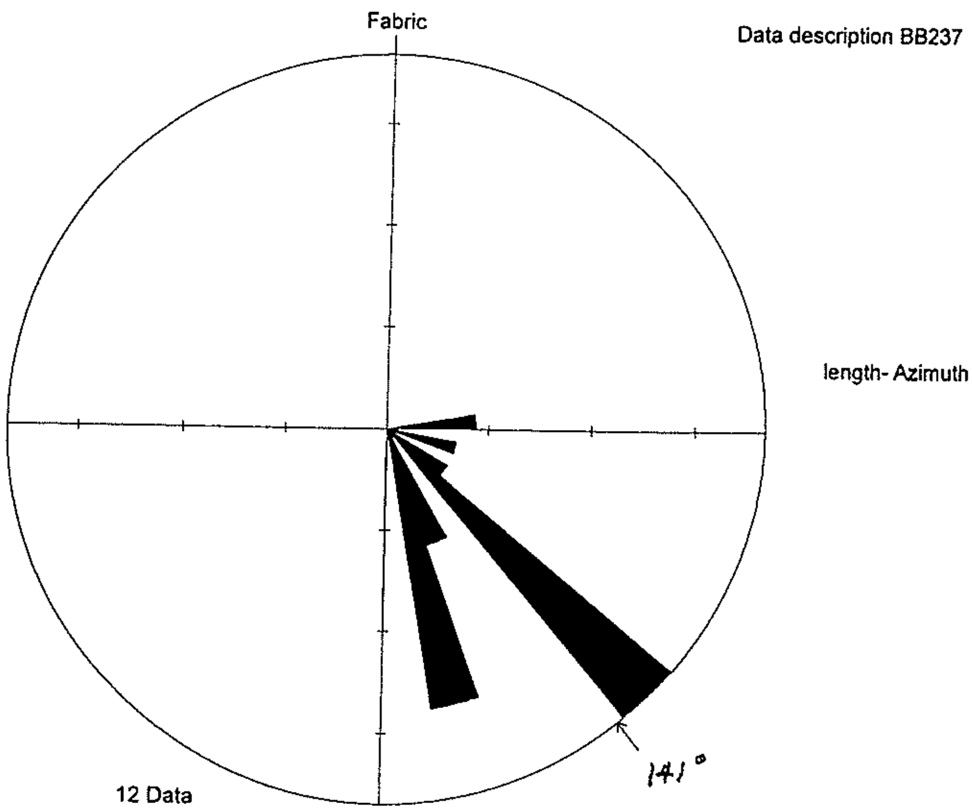
BB236B
5



Data description BB236B

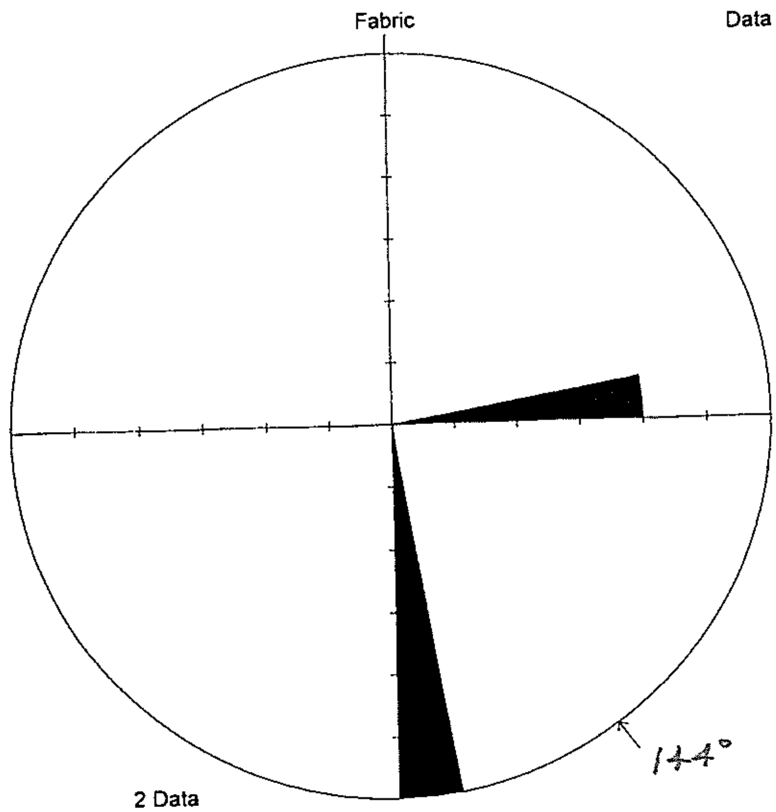
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 3.80]
Maximum = 52.6% [length: 20]
Total length = 38
Mean Resultant dir'n = 109
[Approx. 95% Confidence interval = ±11.
(valid only for unimodal data)

BB237
12



BB238
2

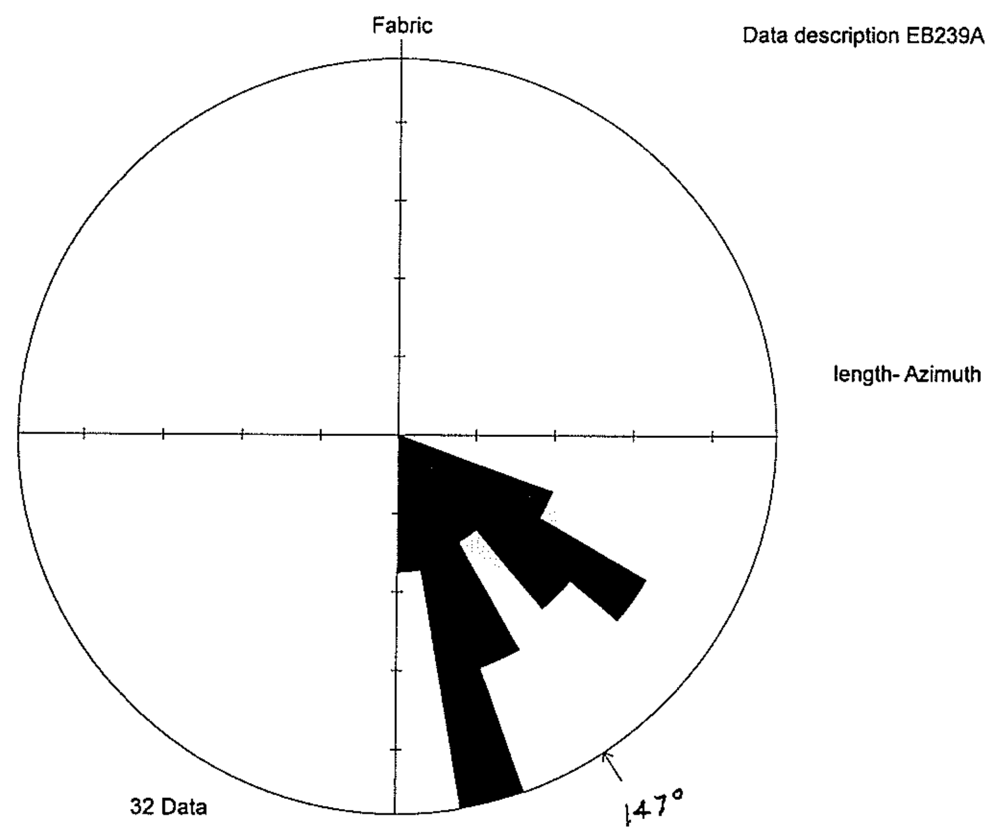
Data description BB238



length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 1.5(
Maximum = 60% [length: 9]
Total length = 15
Mean Resultant dir'n = 144

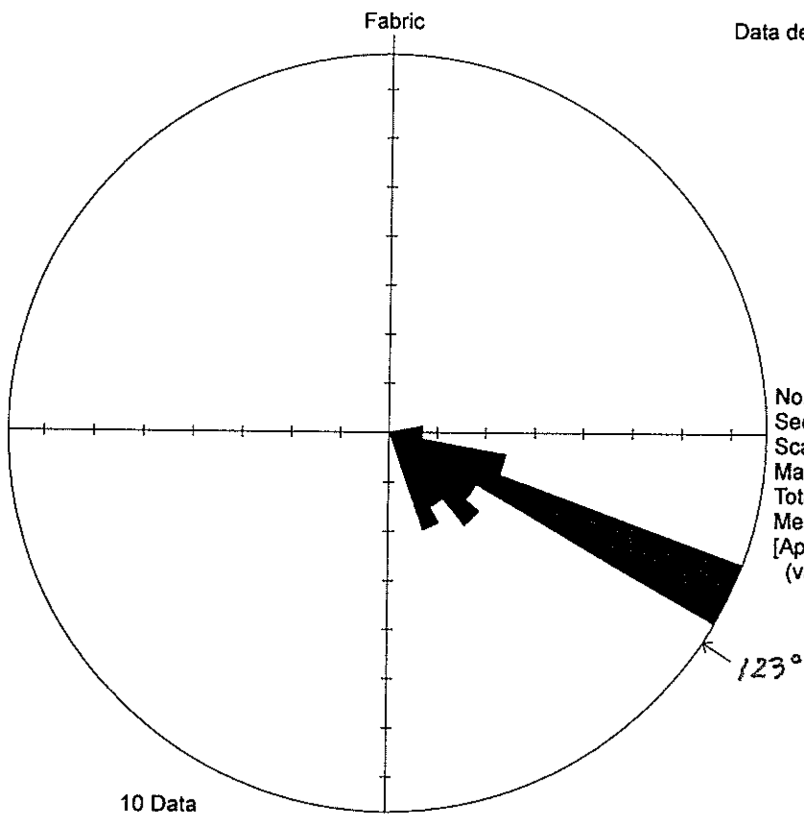
EB239A (rvsd)

32



EB239B (rvsd)

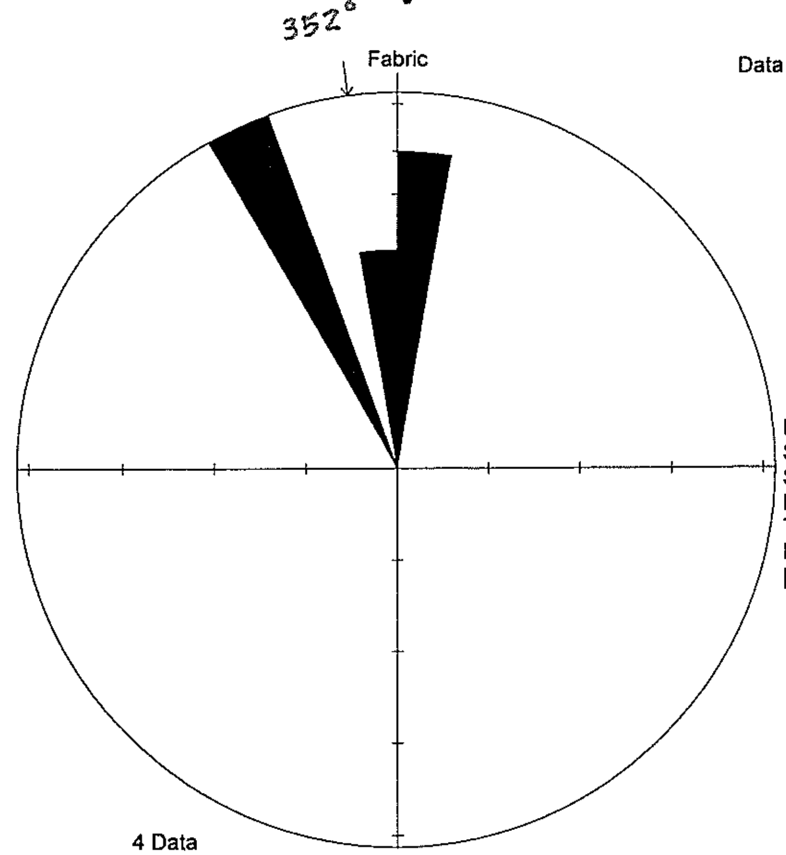
10



Data description EB239B

length- Azimuth
No. of Data = 10
Sector angle = 10°
Scale: tick interval = 5% [length: 2.85]
Maximum = 38.6% [length: 22]
Total length = 57
Mean Resultant dir'n = 123
[Approx. 95% Confidence interval = ±11.
(valid only for unimodal data)

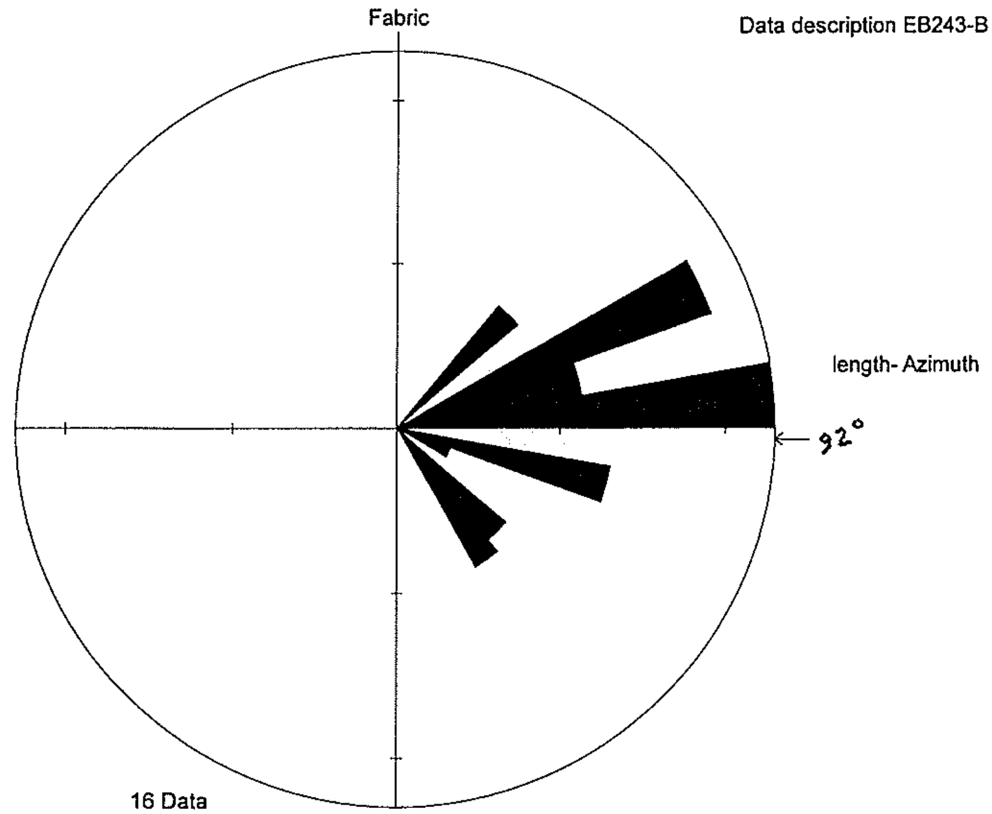
EB243-A
4



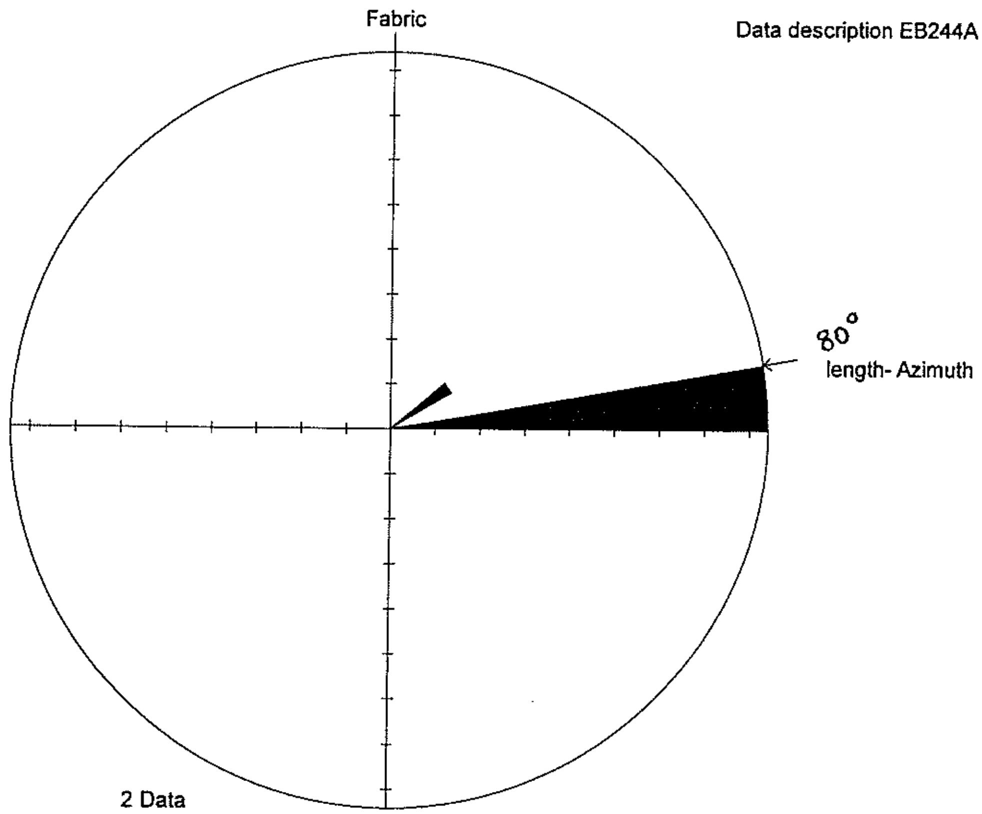
Data description EB243-A

length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 4.60]
Maximum = 41.3% [length: 19]
Total length = 46
Mean Resultant dir'n = 352
[Approx. 95% Confidence interval = ±12.
(valid only for unimodal data)

EB243-B
16

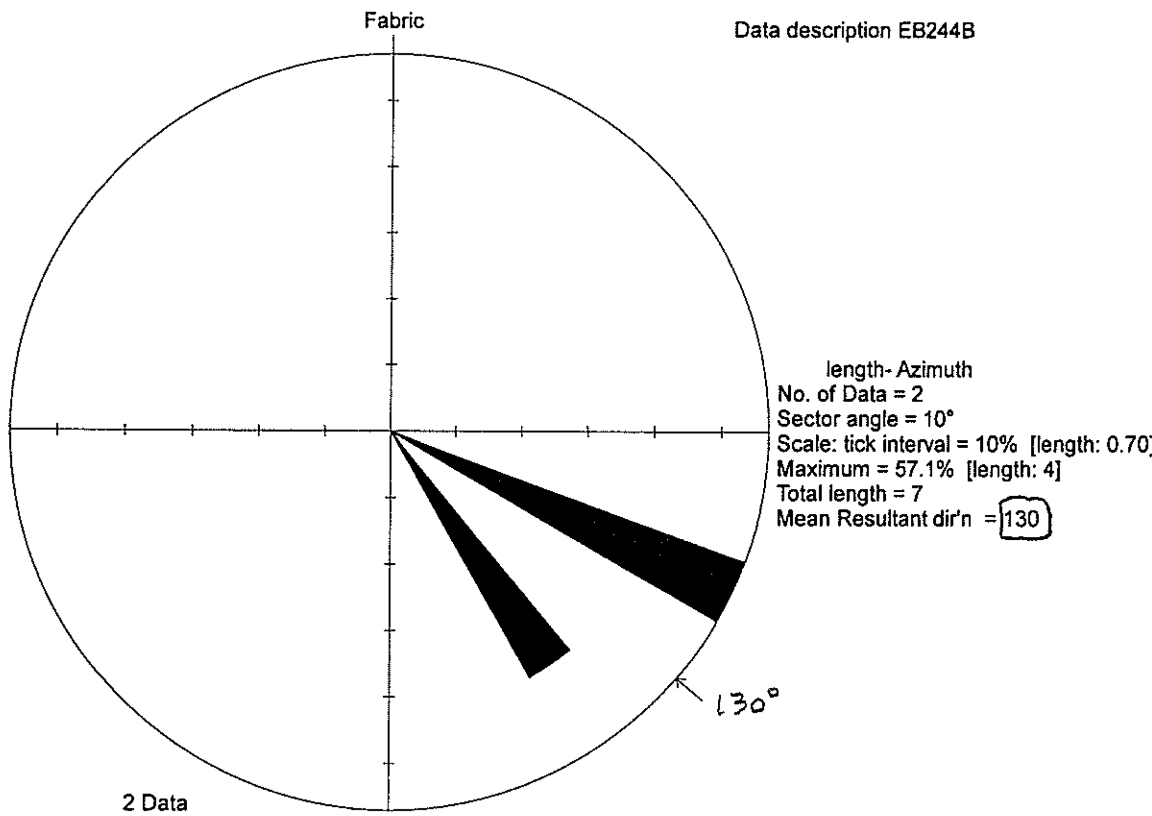


EB244A (new)
2



EB244B (new)

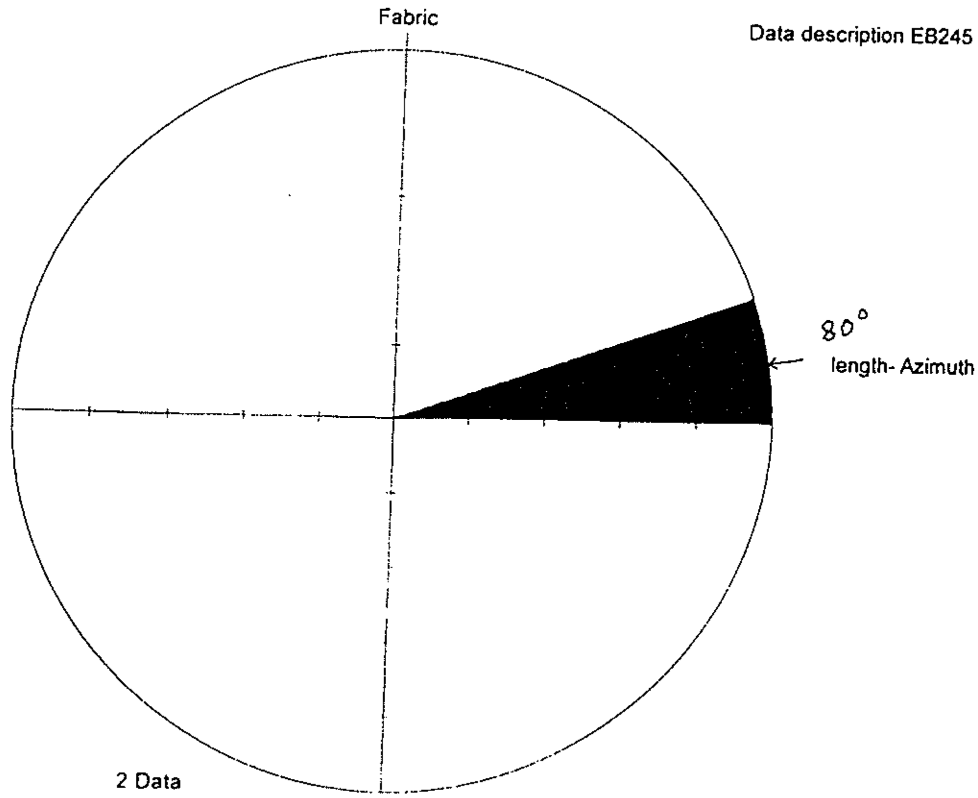
2



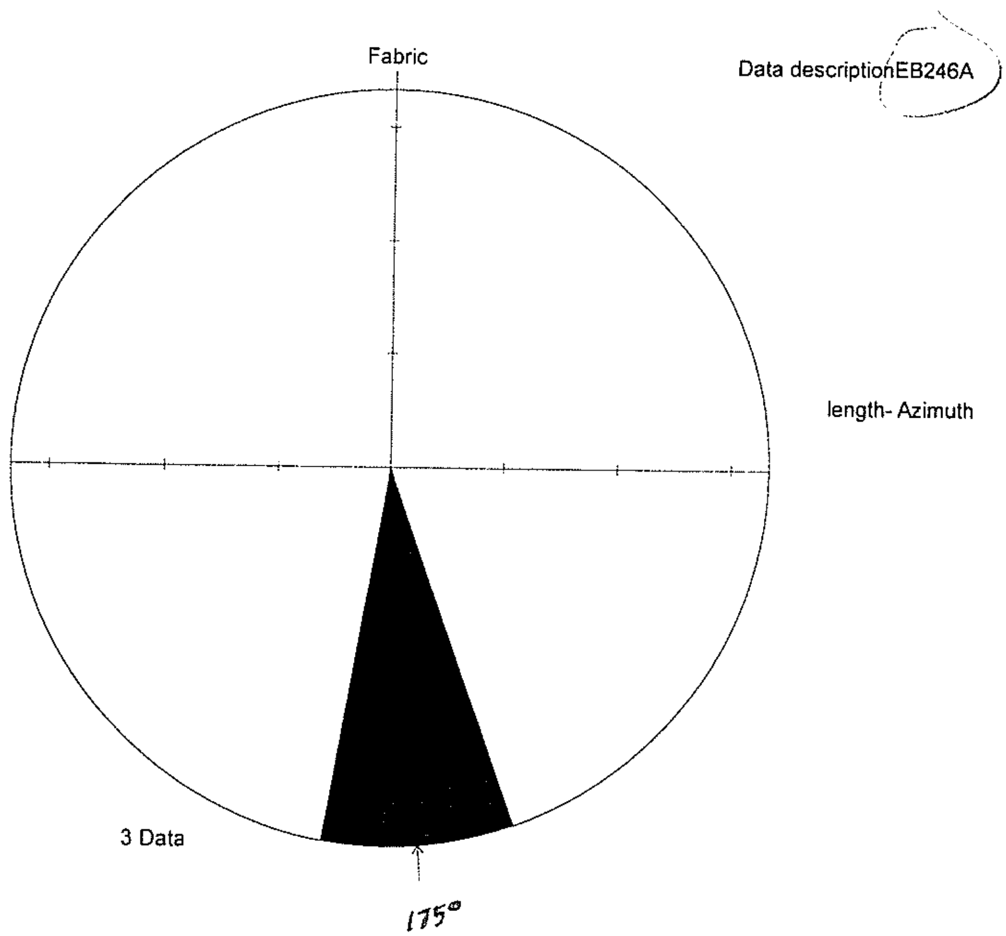
Fabric
Data description EB244B
length- Azimuth
No. of Data = 2
Sector angle = 10°
Scale: tick interval = 10% [length: 0.70]
Maximum = 57.1% [length: 4]
Total length = 7
Mean Resultant dir'n = 130
130°
2 Data

EB245

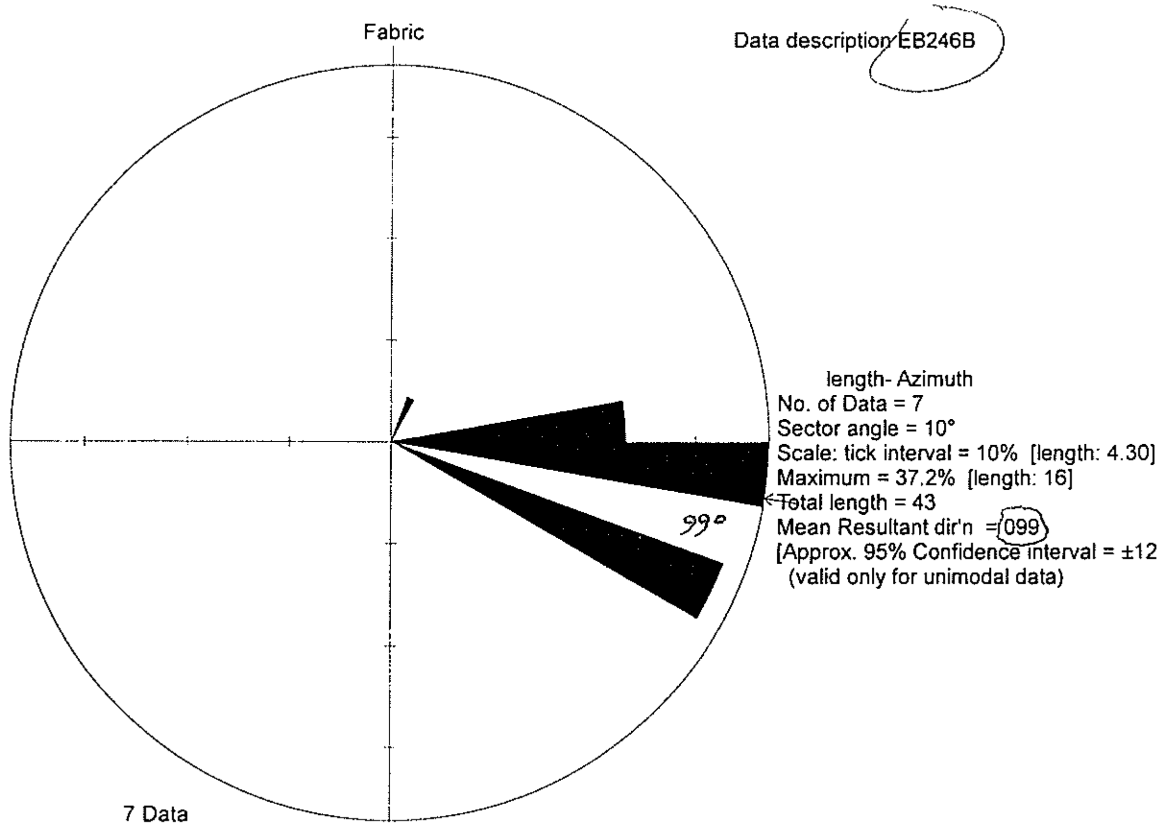
2



EB246A
3

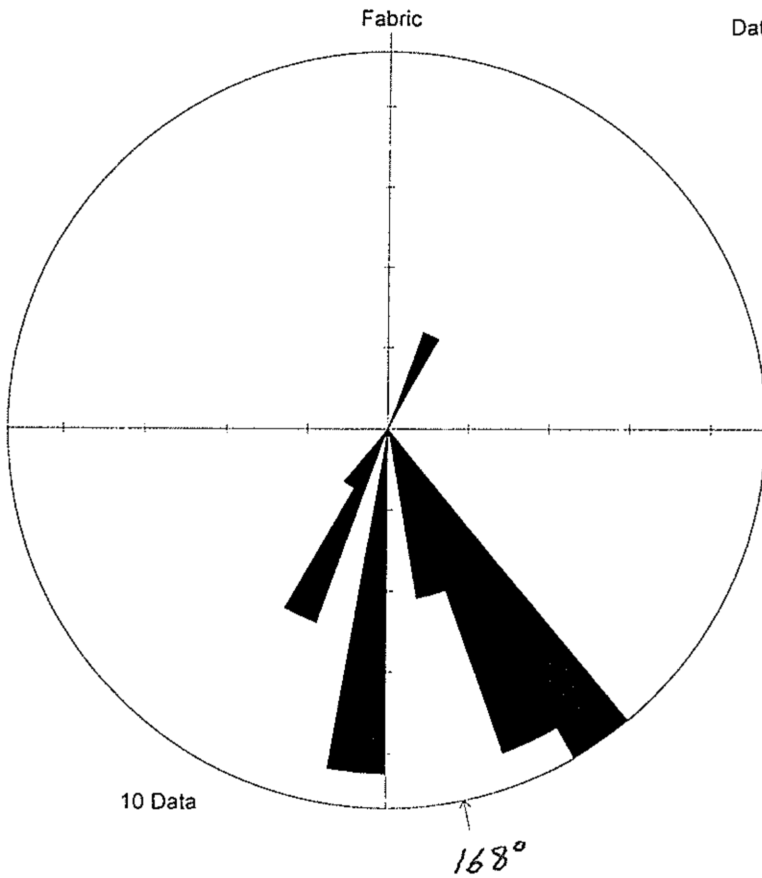


EB246B
7


Fabric
Data description EB246B
length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 10% [length: 4.30]
Maximum = 37.2% [length: 16]
Total length = 43
99°
Mean Resultant dir'n = 099
[Approx. 95% Confidence interval = ±12
(valid only for unimodal data)
7 Data

EB247A

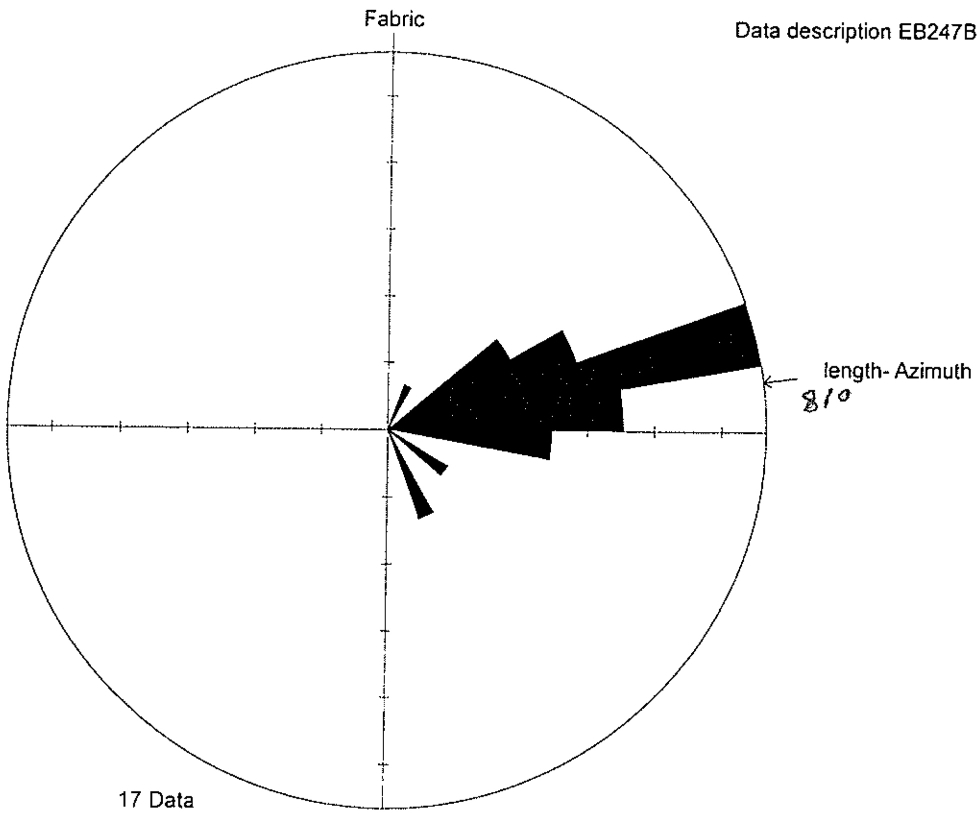
10



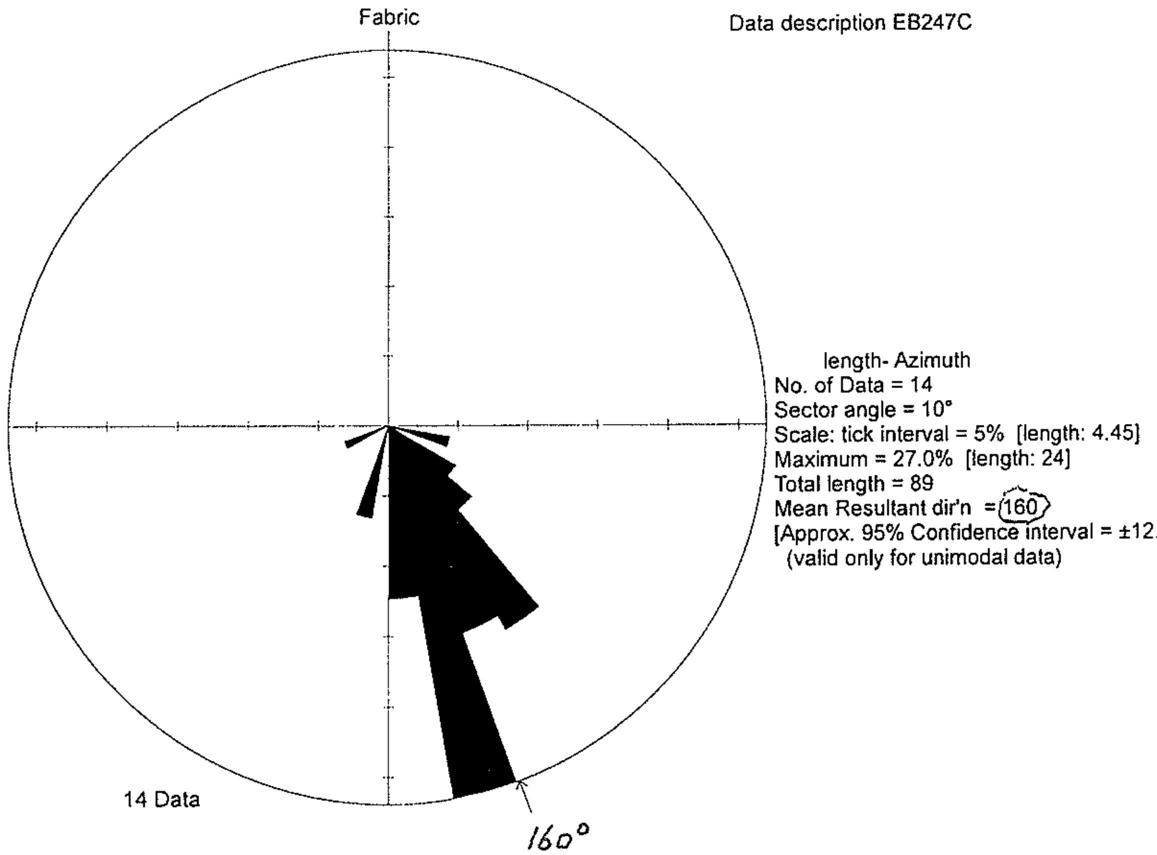
Data description EB247A

length- Azimuth
No. of Data = 10
Sector angle = 10°
Scale: tick interval = 5% [length: 2.35]
Maximum = 23.4% [length: 11]
Total length = 47
Mean Resultant dir'n = 168
[Approx. 95% Confidence interval = ±18.
(valid only for unimodal data)

EB247B
17

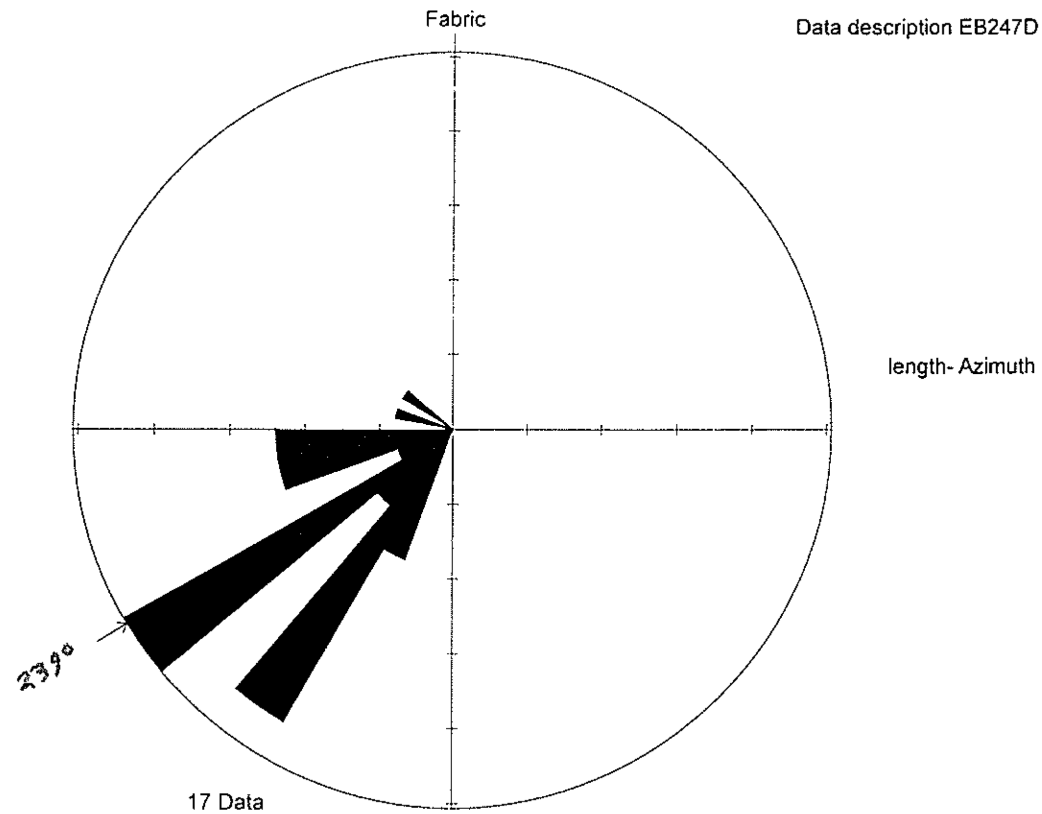


EB247C
14

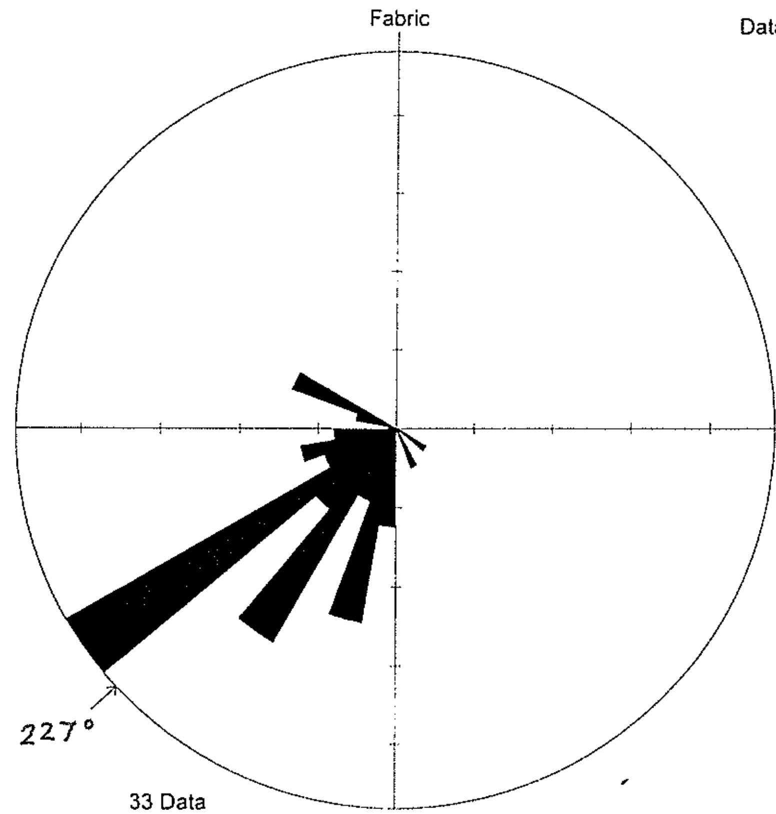


Fabric
Data description EB247C
length- Azimuth
No. of Data = 14
Sector angle = 10°
Scale: tick interval = 5% [length: 4.45]
Maximum = 27.0% [length: 24]
Total length = 89
Mean Resultant dir'n = 160
[Approx. 95% Confidence interval = ±12.
(valid only for unimodal data)
14 Data
160°

EB247D
17



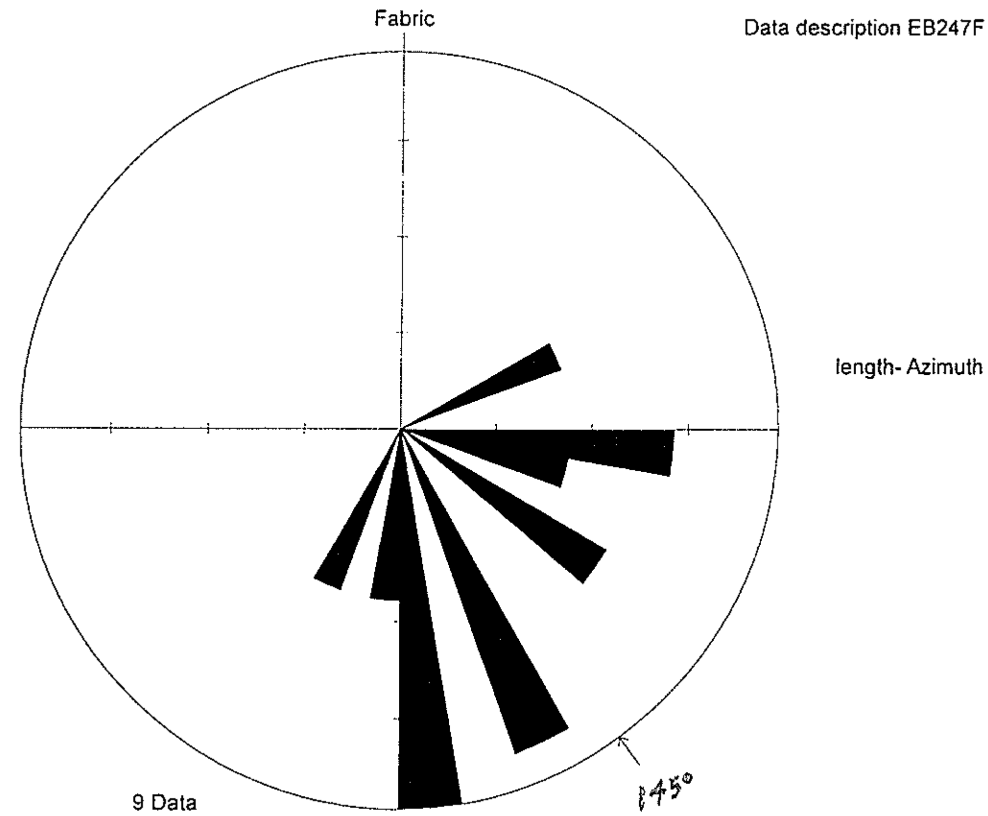
EB247E
33



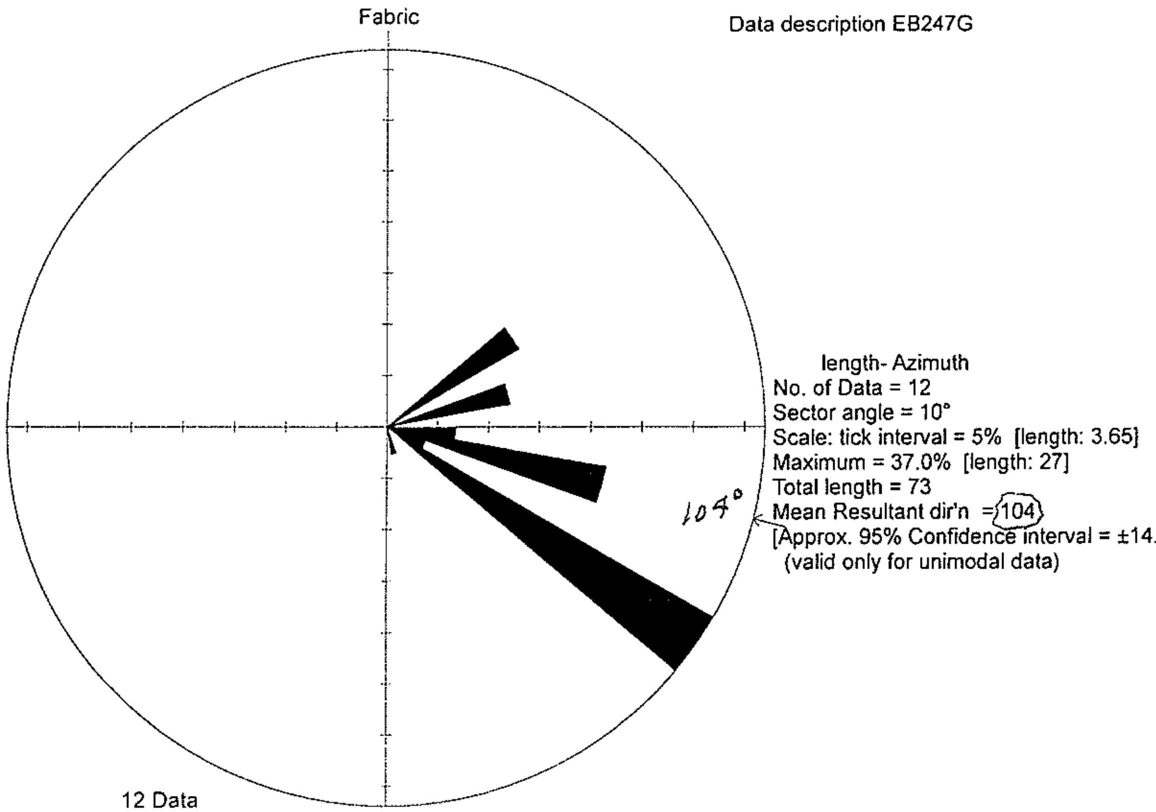
Data description EB247E

length- Azimuth
No. of Data = 33
Sector angle = 10°
Scale: tick interval = 5% [length: 11.20]
Maximum = 24.1% [length: 54]
Total length = 224
Mean Resultant dir'n = 227
[Approx. 95% Confidence interval = ±11.
(valid only for unimodal data)

EB247F
9

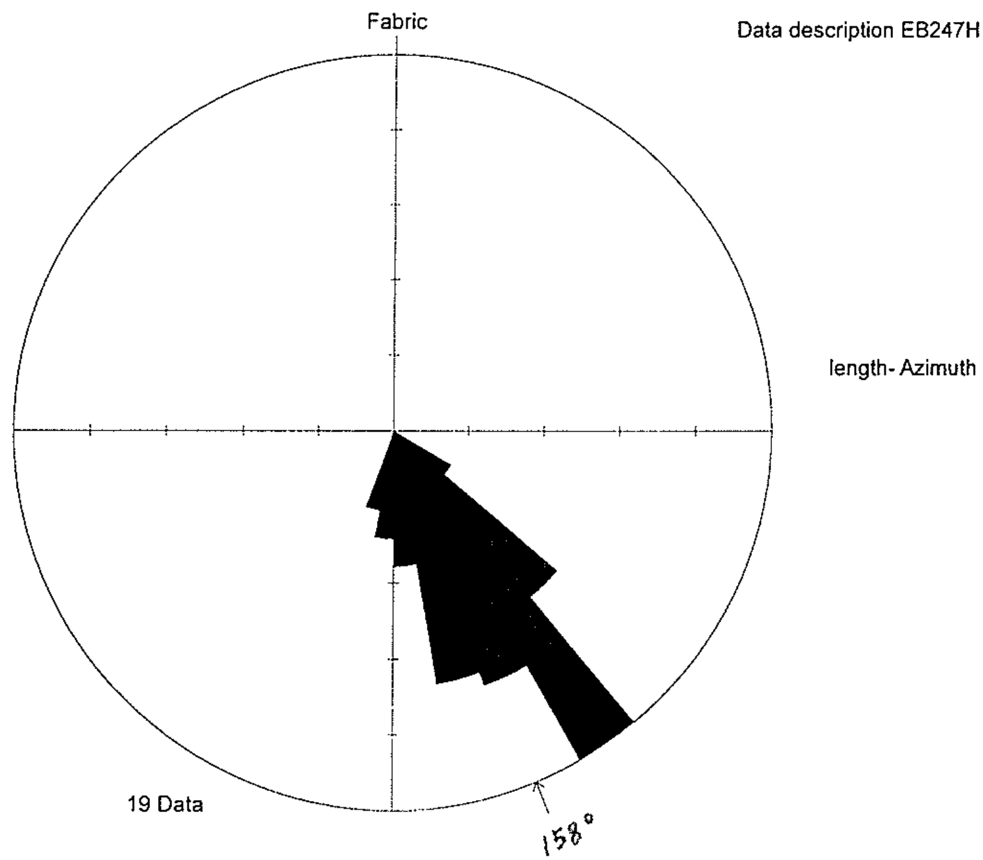


EB247G
12



Fabric
Data description EB247G
length- Azimuth
No. of Data = 12
Sector angle = 10°
Scale: tick interval = 5% [length: 3.65]
Maximum = 37.0% [length: 27]
Total length = 73
104°
Mean Resultant dir'n = 104
[Approx. 95% Confidence interval = ±14.
(valid only for unimodal data)
12 Data

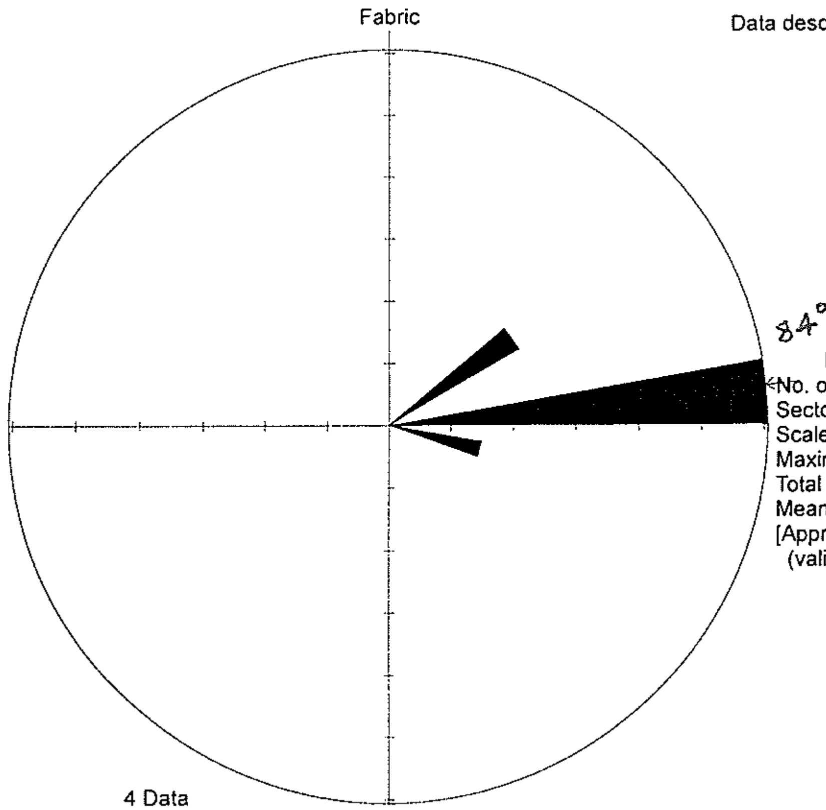
EB247H
19



EB247I

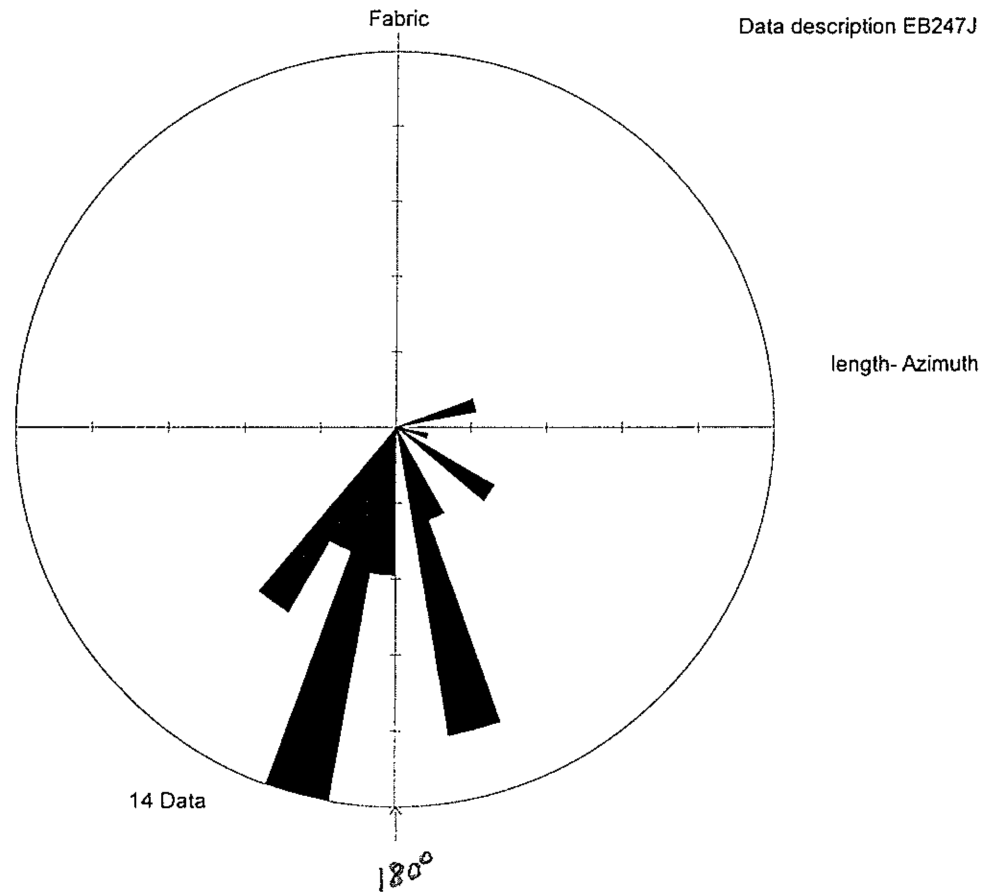
4

Data description EB247I



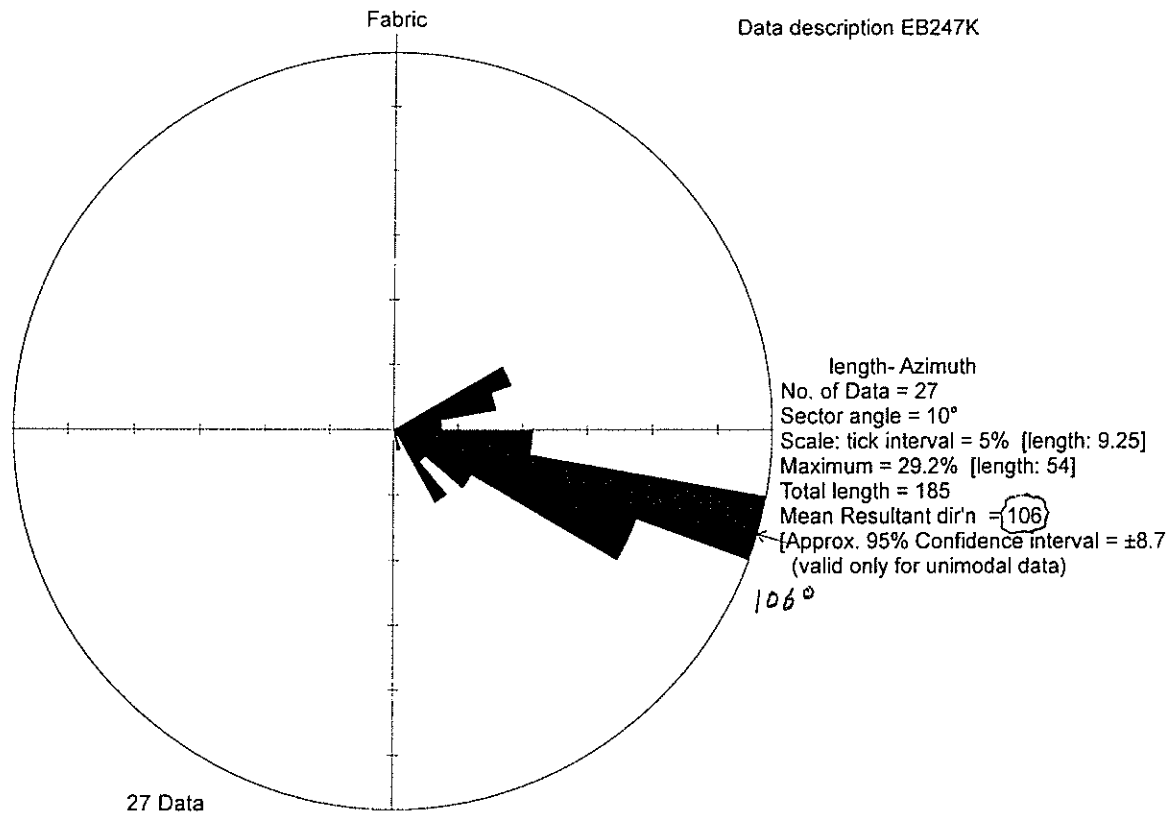
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 3.30]
Maximum = 60.6% [length: 20]
Total length = 33
Mean Resultant dir'n = 084
[Approx. 95% Confidence interval = ±17.
(valid only for unimodal data)

EB247J
14

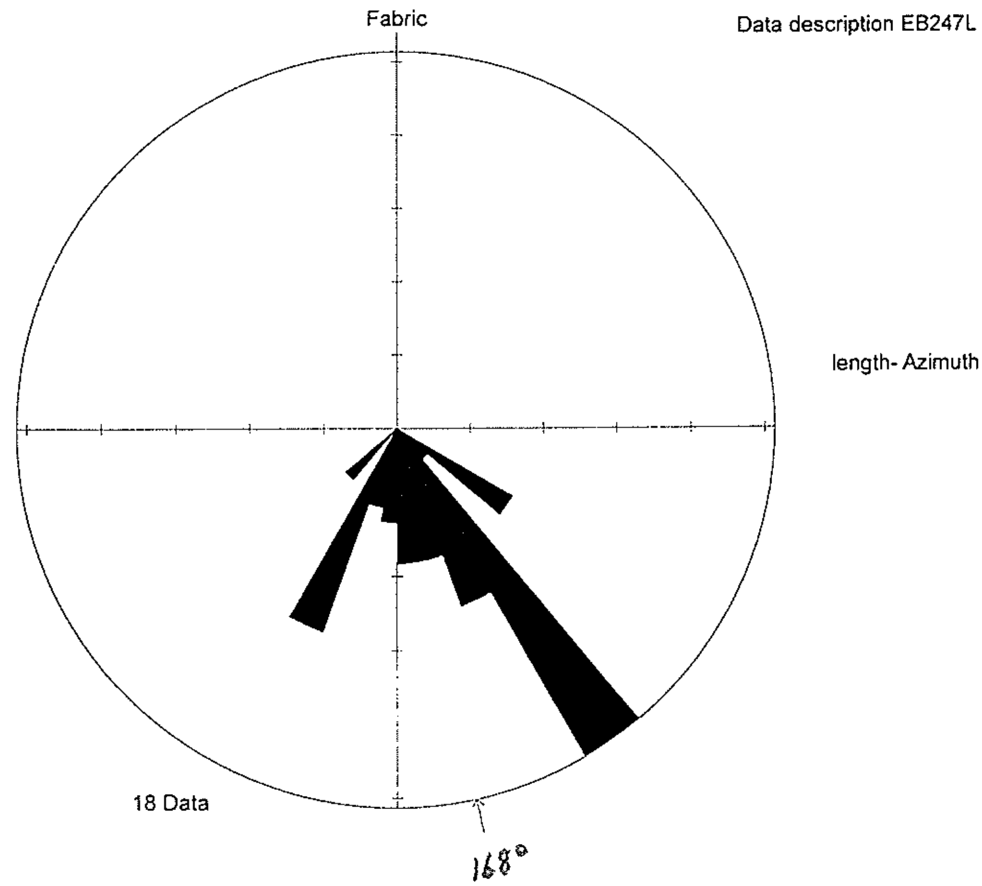


EB247K

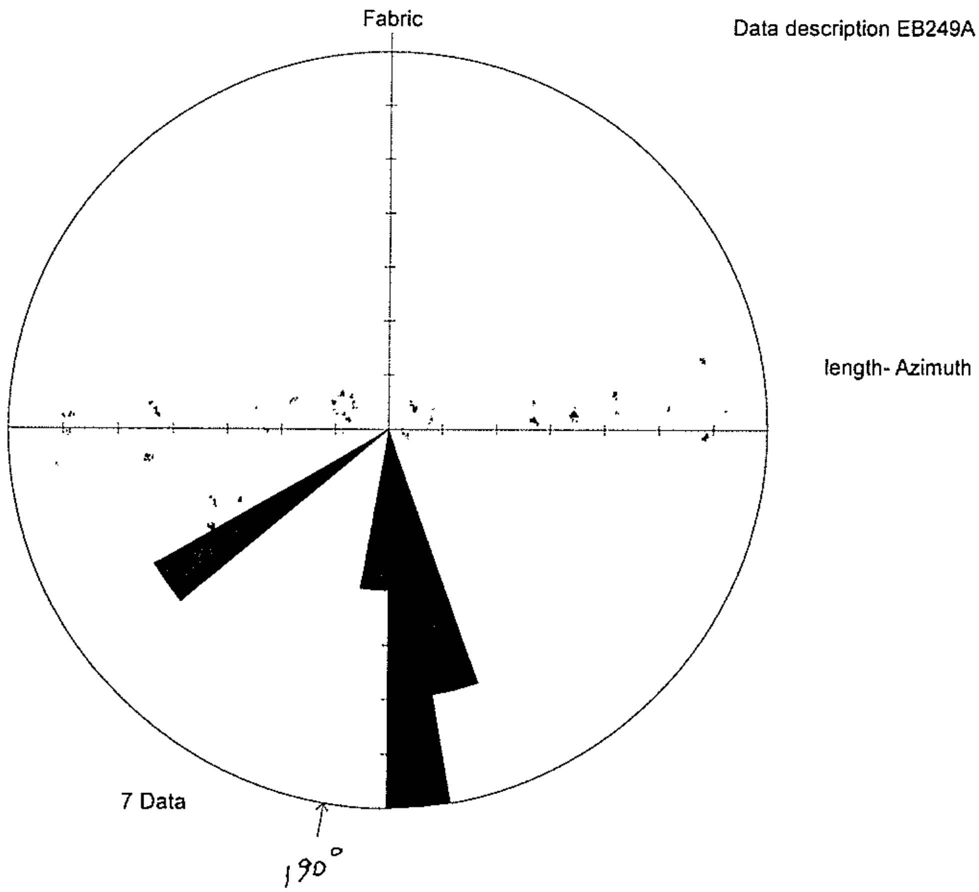
27


Fabric
Data description EB247K
length- Azimuth
No. of Data = 27
Sector angle = 10°
Scale: tick interval = 5% [length: 9.25]
Maximum = 29.2% [length: 54]
Total length = 185
Mean Resultant dir'n = 106
[Approx. 95% Confidence interval = ±8.7
(valid only for unimodal data)
106°
27 Data

EB247L
18

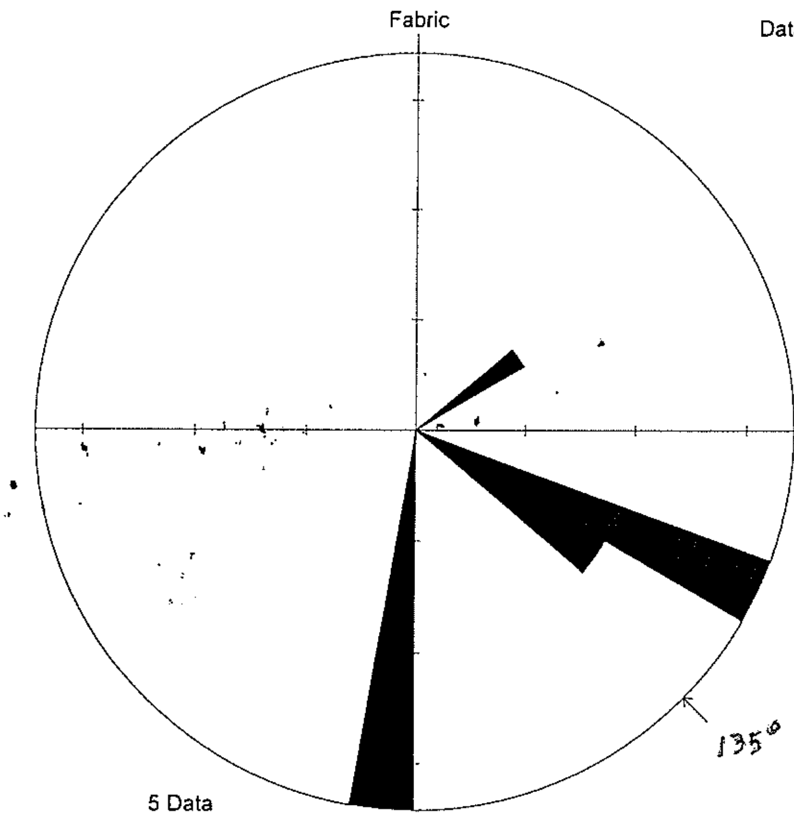


EB249A (rvsd)
7



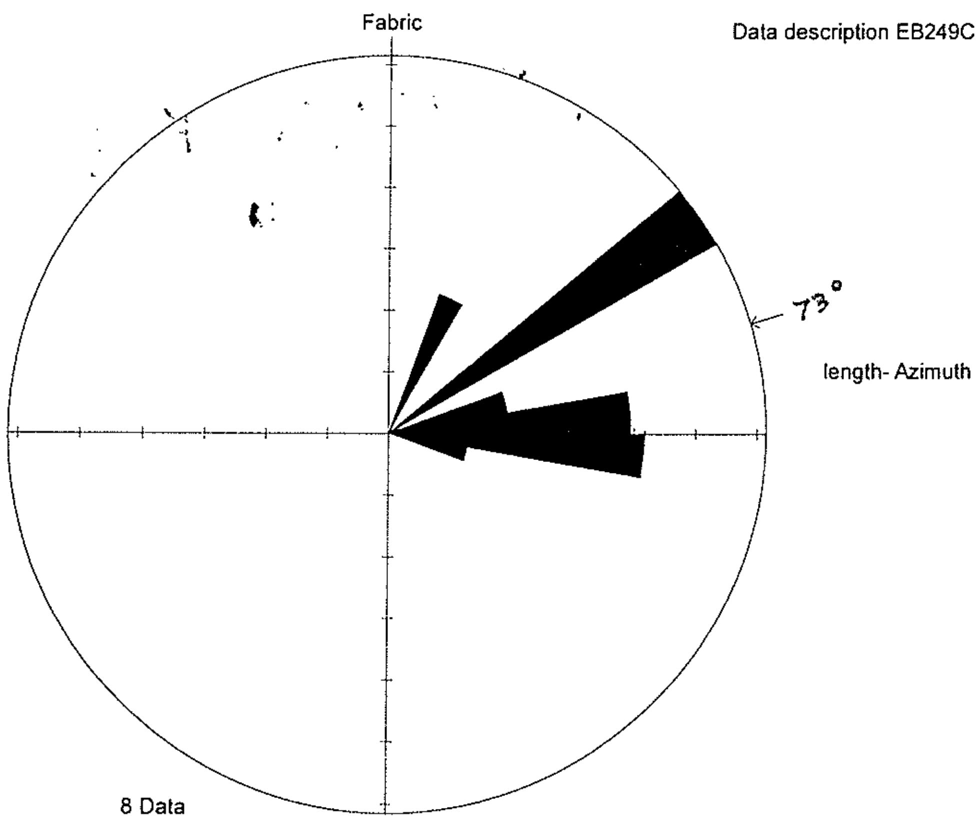
EB249B (rvsd)
5

Data description EB249B



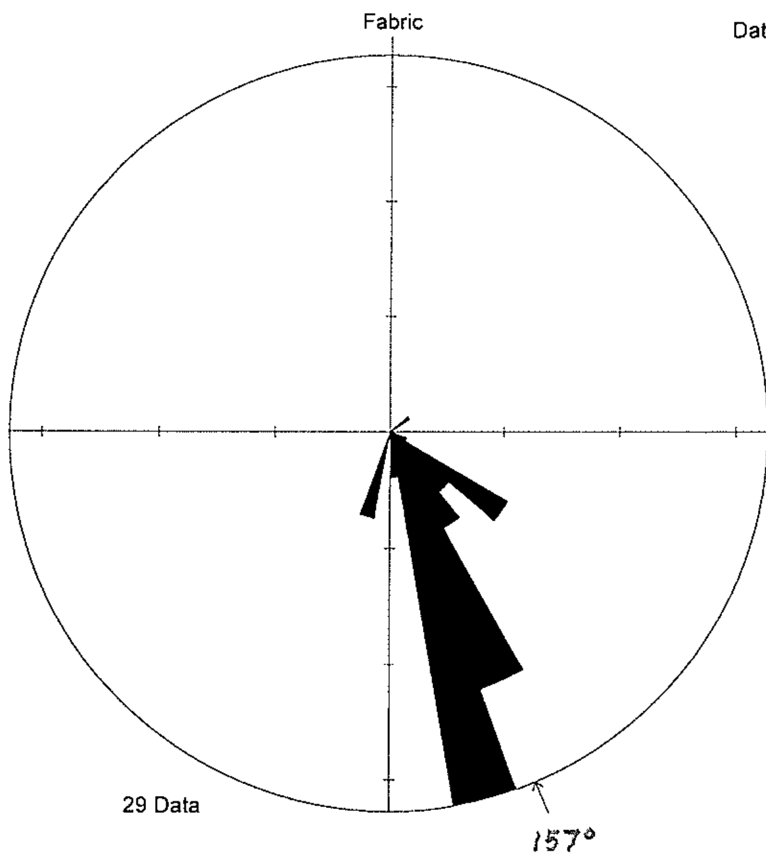
length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 3.50
Maximum = 34.3% [length: 12]
Total length = 35
Mean Resultant dir'n = 135
[Approx. 95% Confidence Interval = ±3
(valid only for unimodal data)

EB249C (rvsd)
8



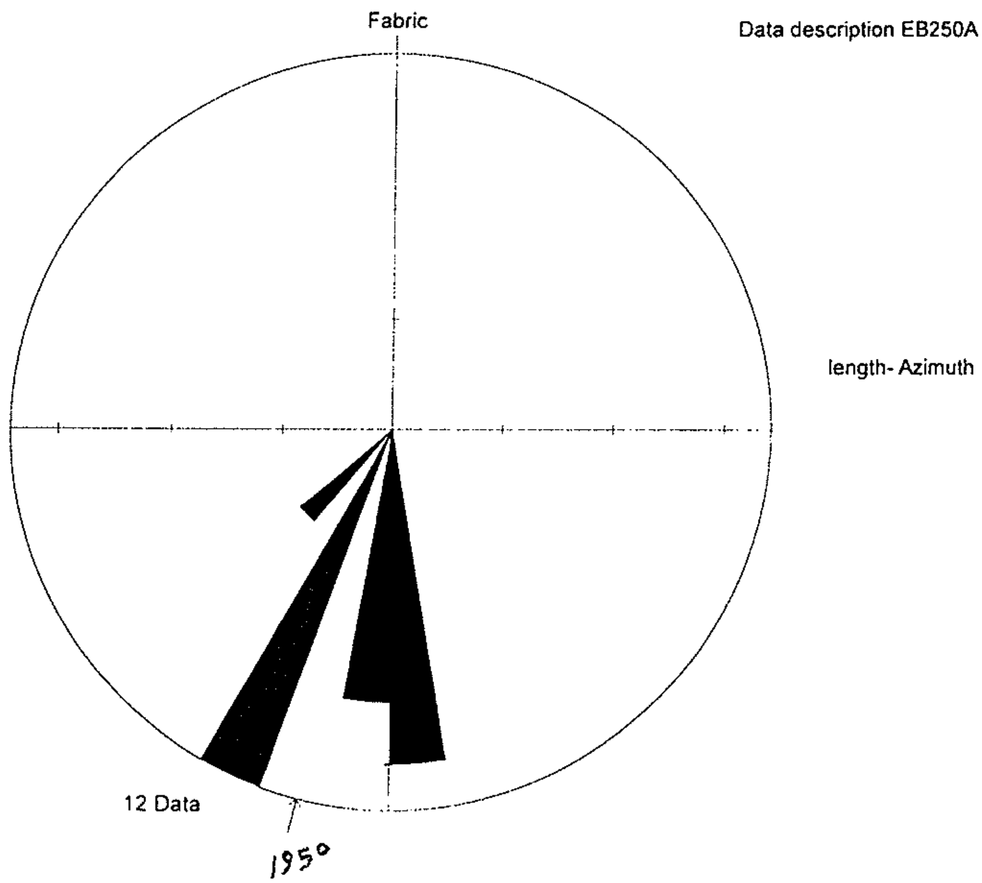
EB249D (trod)
29

Data description EB249D



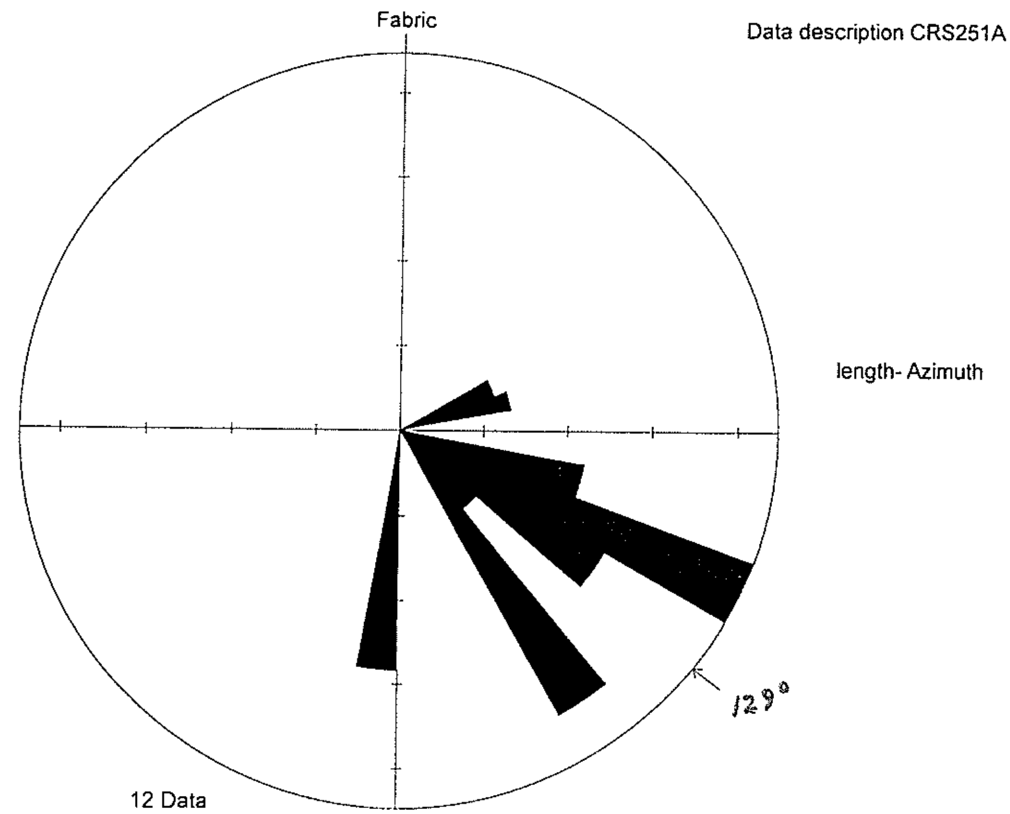
length- Azimuth
No. of Data = 29
Sector angle = 10°
Scale: tick interval = 10% [length: 25.0
Maximum = 32.8% [length: 82]
Total length = 250
Mean Resultant dir'n = 157
[Approx. 95% Confidence Interval = ±7.
(valid only for unimodal data)

EB250A
12

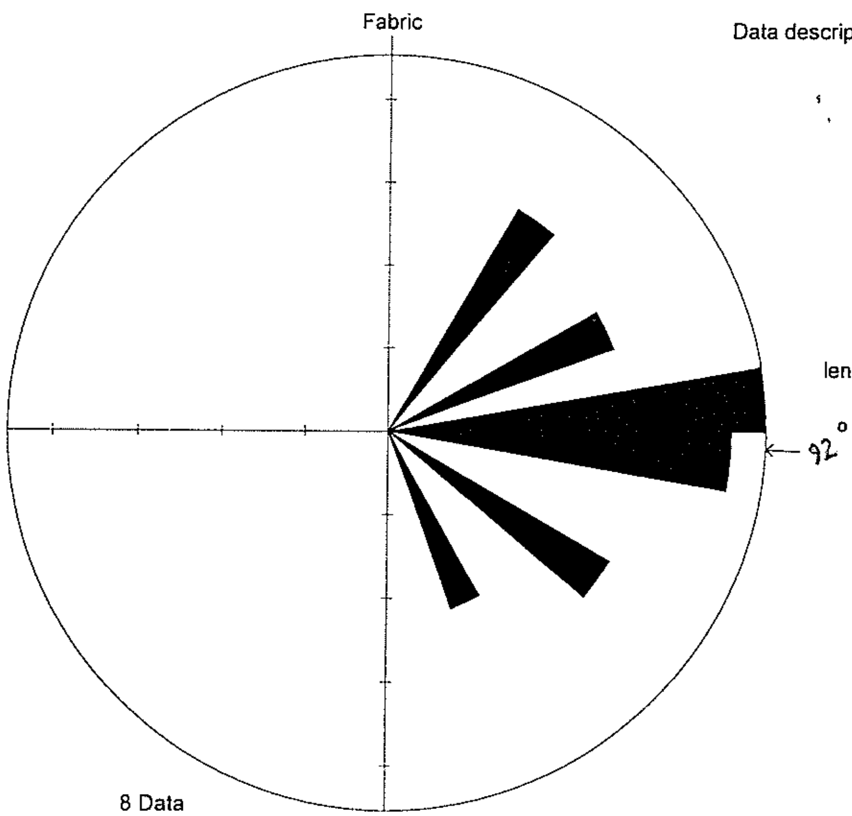


CRS251A

12

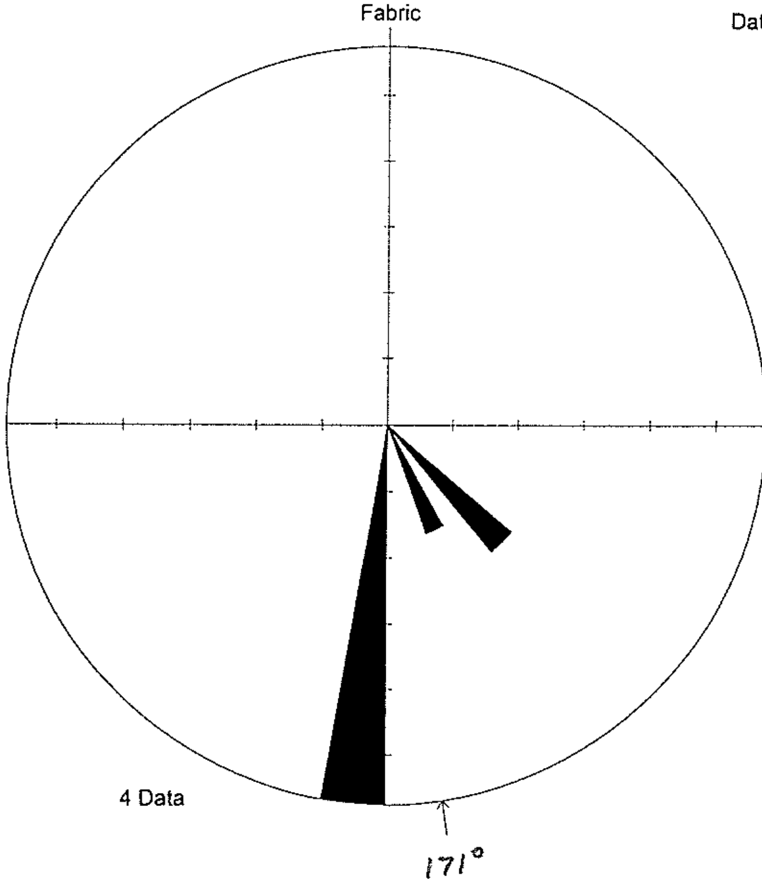

Fabric
Data description CRS251A
length- Azimuth
129°
12 Data

CRS251B (rvsd)
8



CRS251C (rvsd)

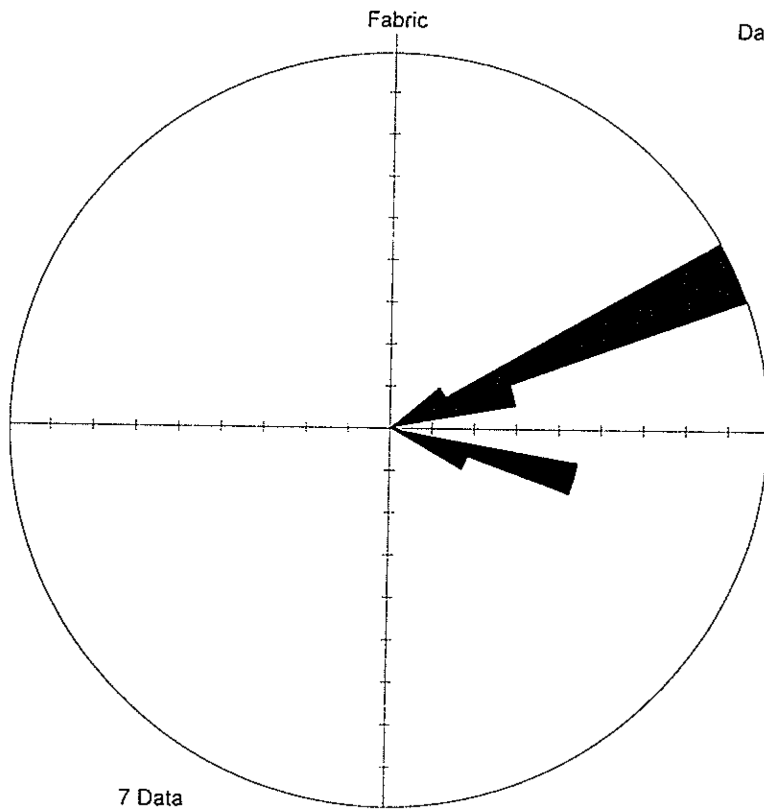
4



Data description CRS251C

length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 10% [length: 4.00]
Maximum = 57.5% [length: 23]
Total length = 40
Mean Resultant dir'n = 171
[Approx. 95% Confidence interval = ±21
(valid only for unimodal data)

CRS251D
7



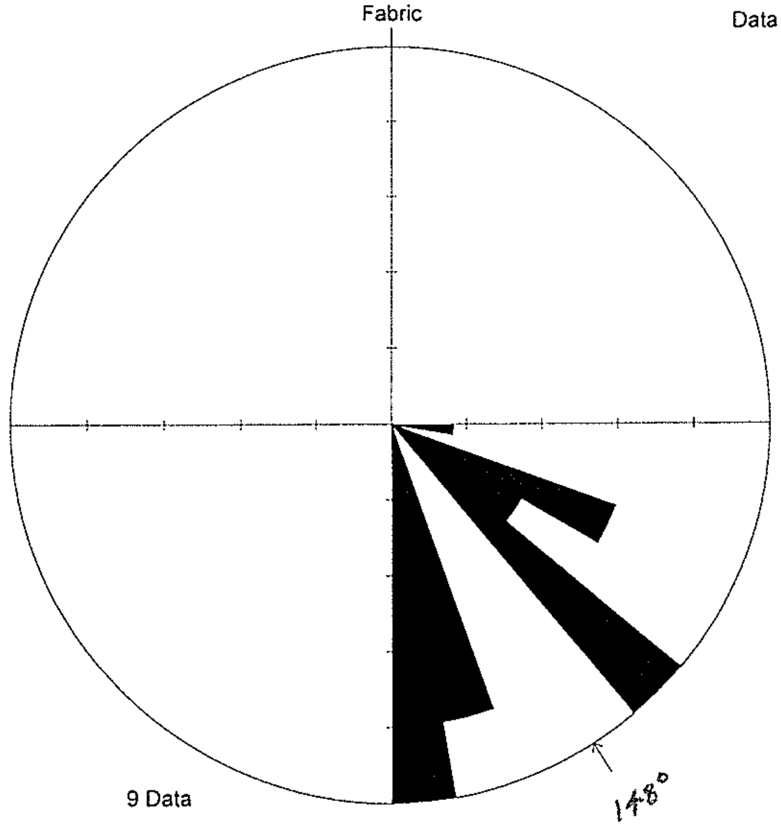
2
Data description CRS~~1~~51D

80°

length- Azimuth
No. of Data = 7
Sector angle = 10°
Scale: tick interval = 5% [length: 6.60]
Maximum = 44.7% [length: 59]
Total length = [illegible]
Mean Resultant dir'n = 080
[Approx. 95% Confidence interval = ±1
(valid only for unimodal data)

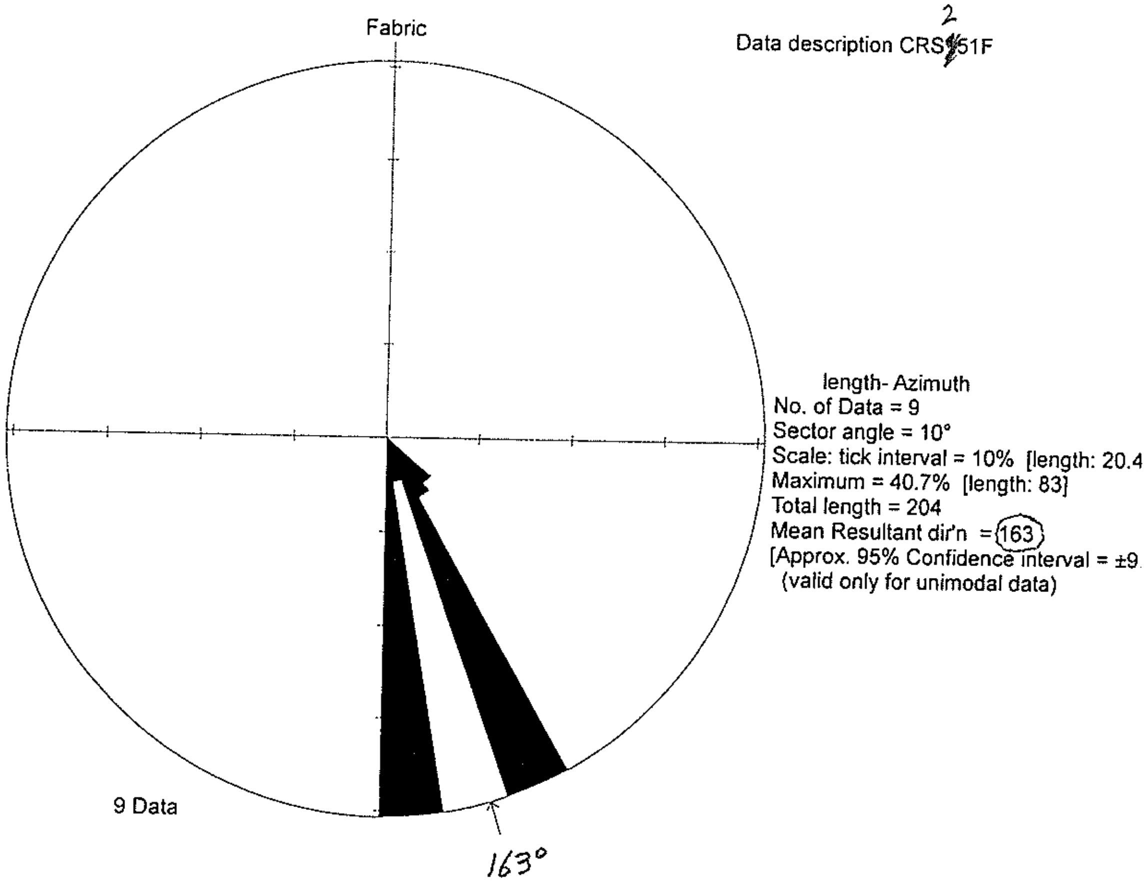
CRS251E

9



CRS251F

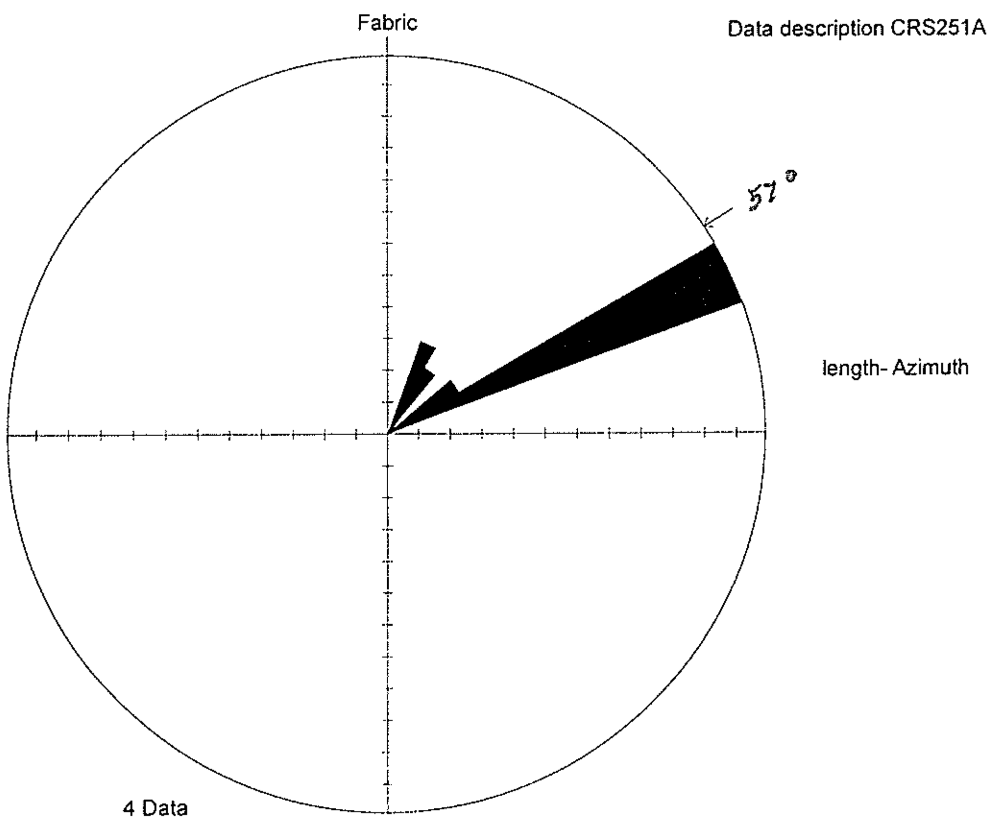
9



Fabric
Data description CRS~~1~~251F
length- Azimuth
No. of Data = 9
Sector angle = 10°
Scale: tick interval = 10% [length: 20.4
Maximum = 40.7% [length: 83]
Total length = 204
Mean Resultant dir'n = 163
[Approx. 95% Confidence interval = ±9.
(valid only for unimodal data)
9 Data
163°

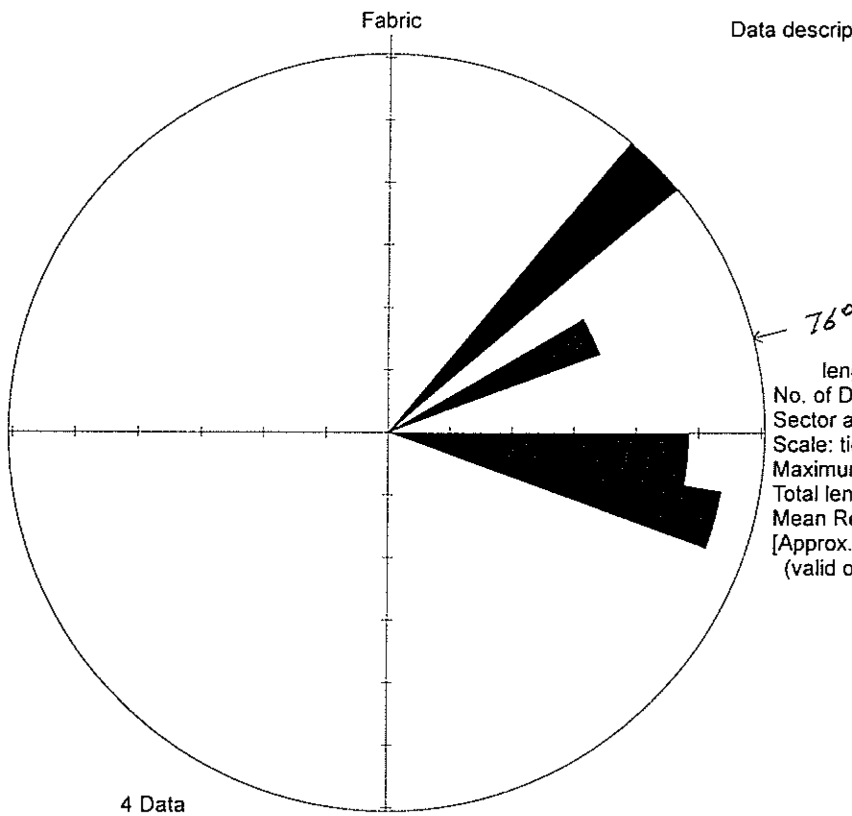
CRS252A

4



CRS252B
4

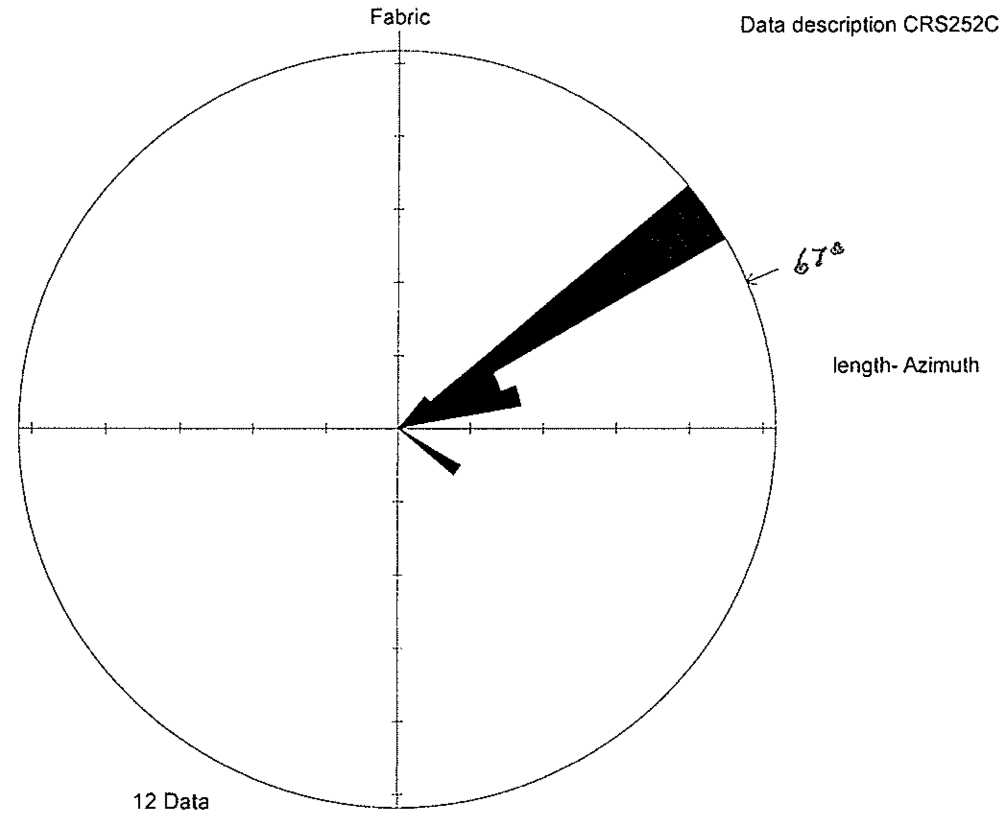
Data description CRS252B



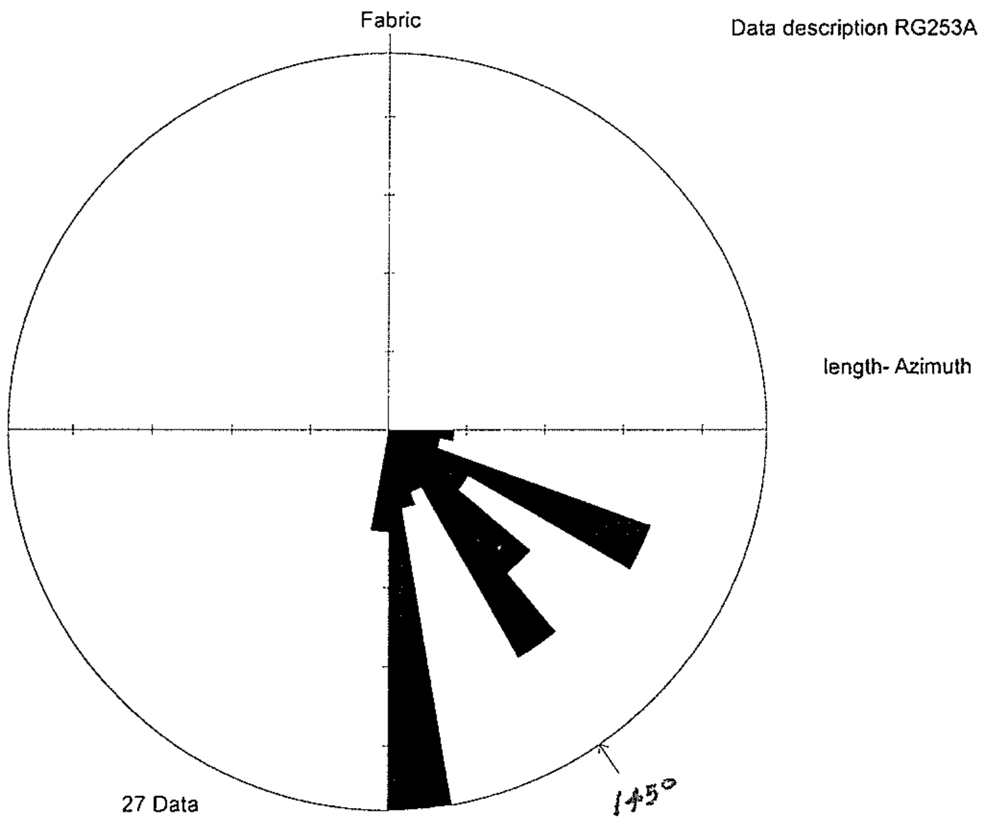
length- Azimuth
No. of Data = 4
Sector angle = 10°
Scale: tick interval = 5% [length: 3.30]
Maximum = 30.3% [length: 20]
Total length = 66
Mean Resultant dir'n = 076
[Approx. 95% Confidence interval = ±29
(valid only for unimodal data)

CRS252C

12

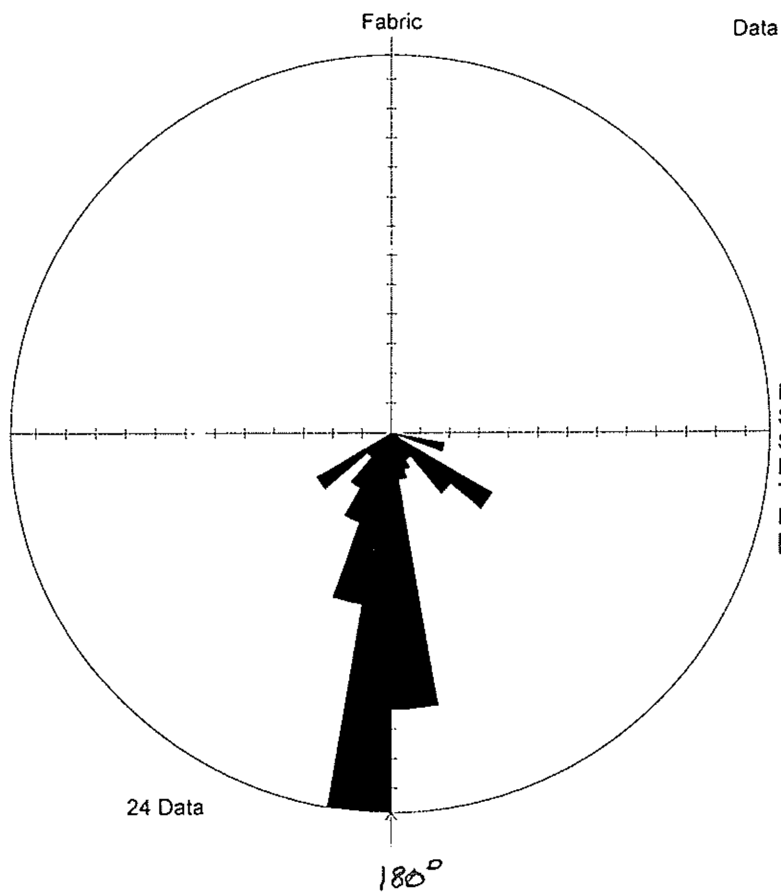


RG253A
27



RG253B

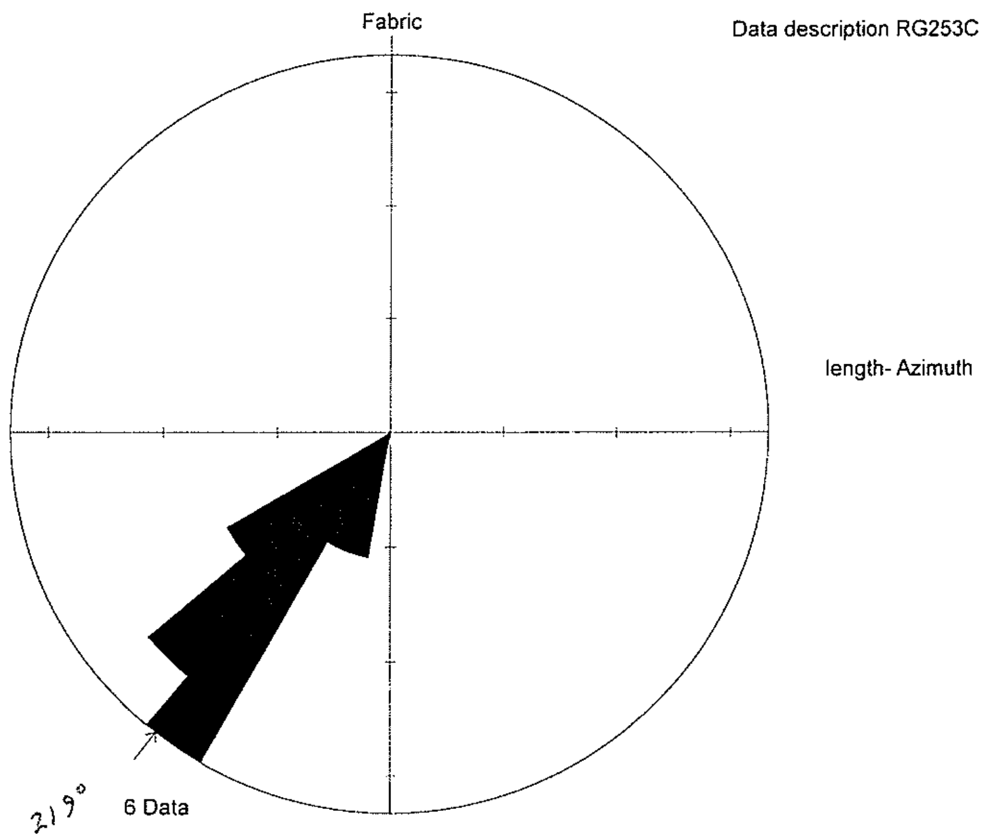
24



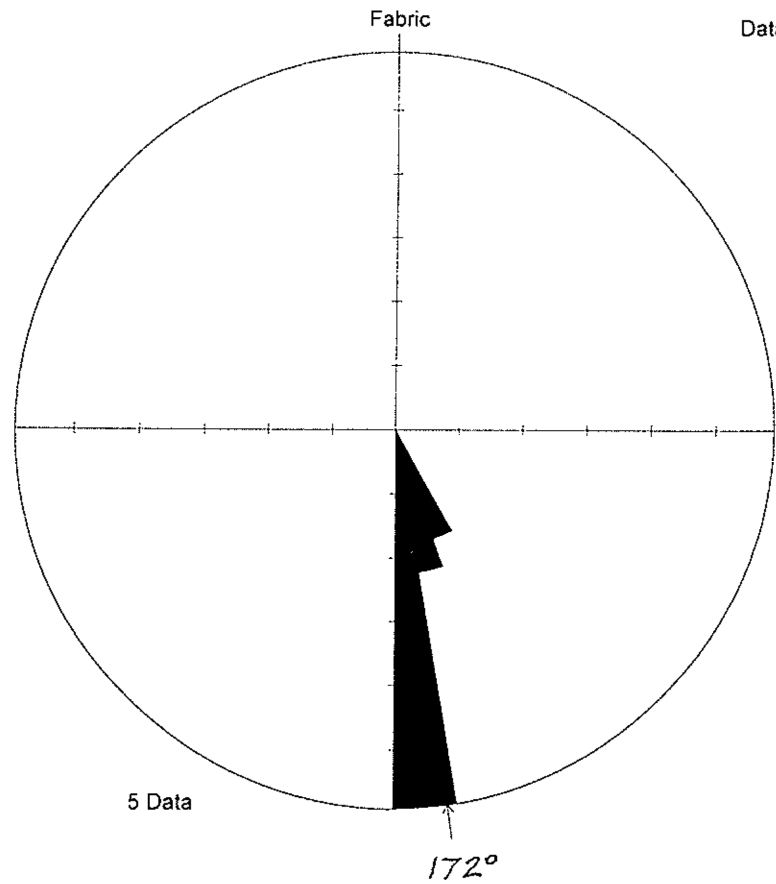
Data description RG253B

length- Azimuth
No. of Data = 24
Sector angle = 10°
Scale: tick interval = 2% [length: 3.74]
Maximum = 25.7% [length: 48]
Total length = 187
Mean Resultant dir'n = 180
[Approx. 95% Confidence interval = ±12
(valid only for unimodal data)

RG253C
6



BB254
5

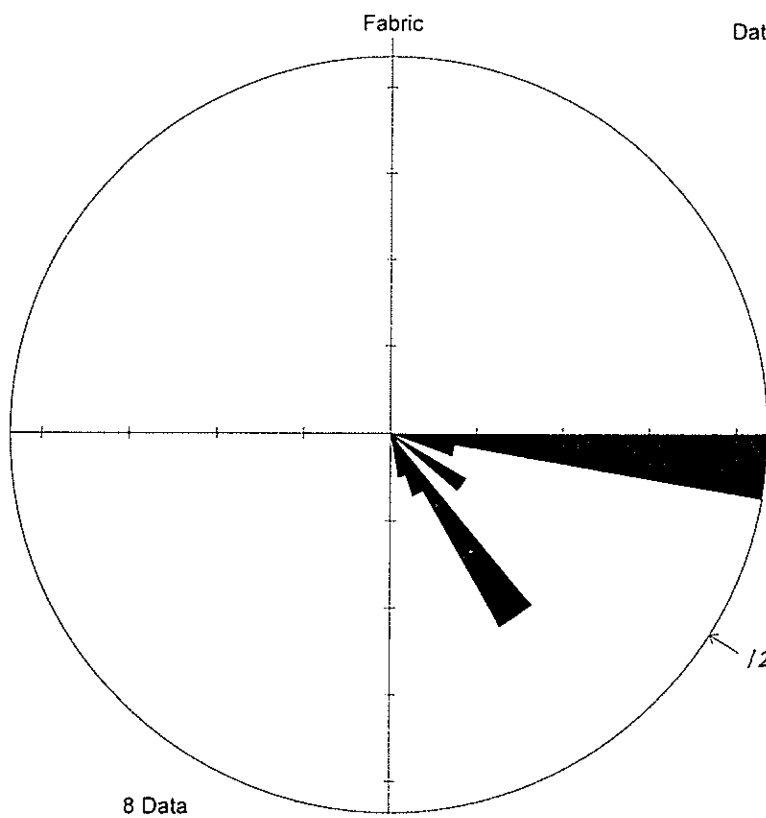


Data description BB254

length- Azimuth
No. of Data = 5
Sector angle = 10°
Scale: tick interval = 10% [length: 2.20]
Maximum = 59.1% [length: 13]
Total length = 22
Mean Resultant dir'n = 172

BB255A (rvsd)
8

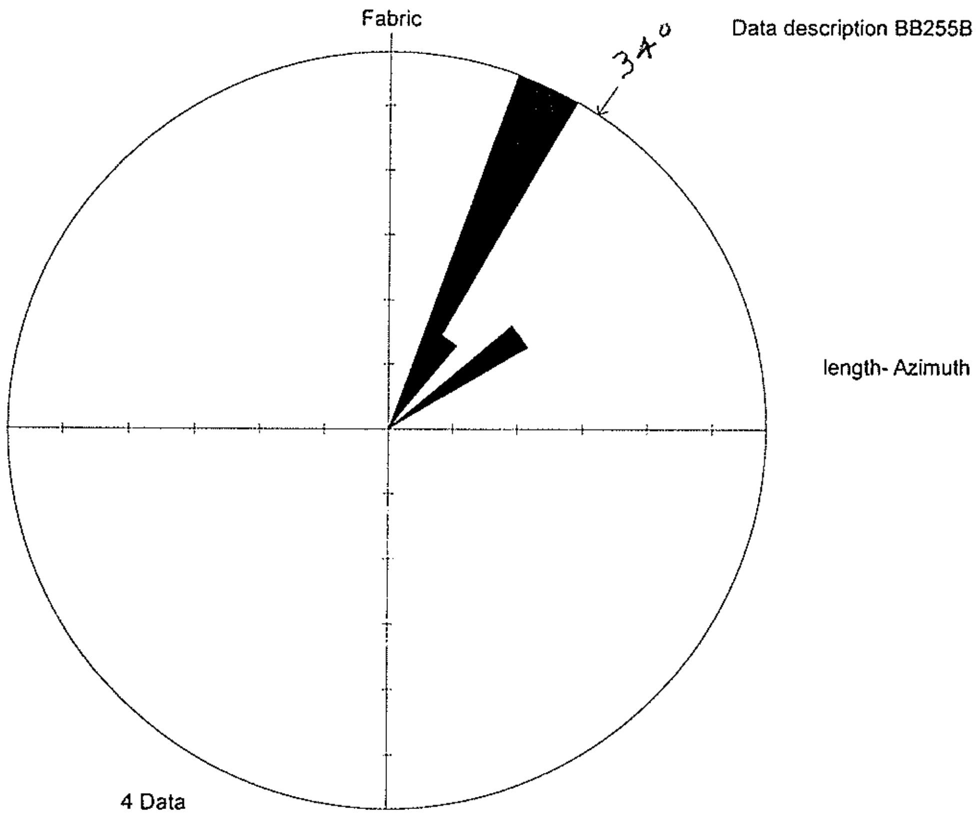
Data description BB255A



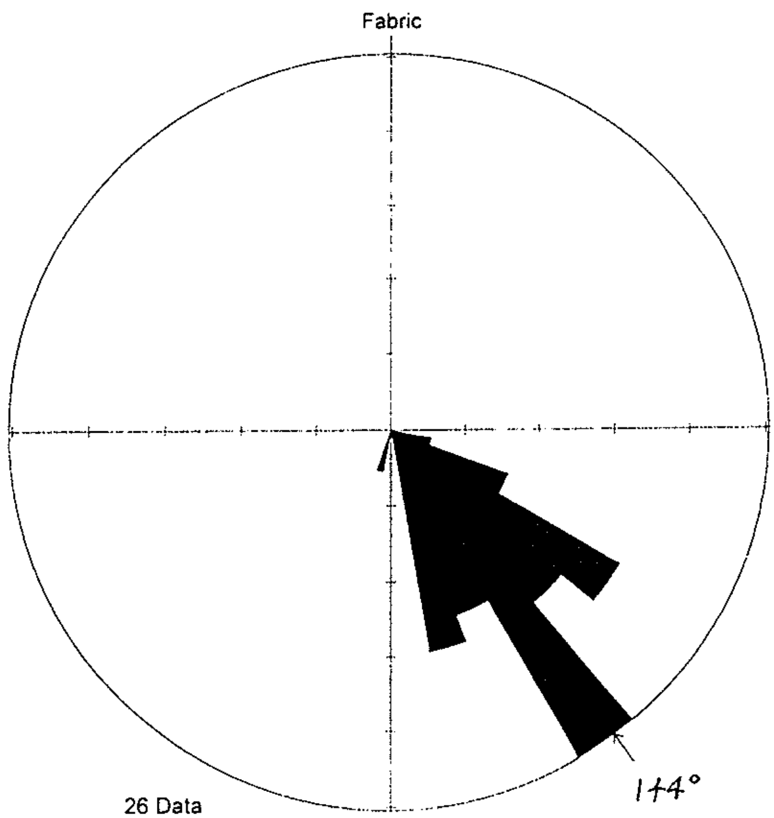
length- Azimuth
No. of Data = 8
Sector angle = 10°
Scale: tick interval = 10% [length: 3.90]
Maximum = 43.6% [length: 17]
Total length = 39
Mean Resultant dir'n = 122
[Approx. 95% Confidence interval = ±19.
(valid only for unimodal data)

122°

BB255B (rusd)
4



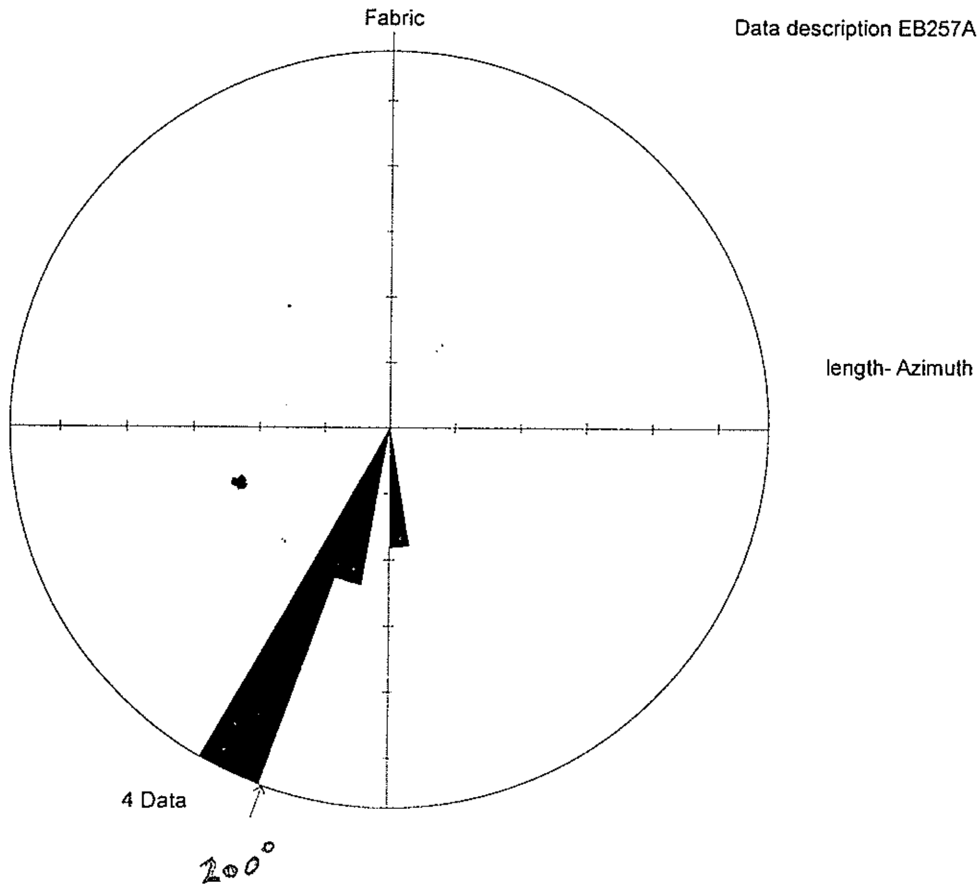
RG256B
26



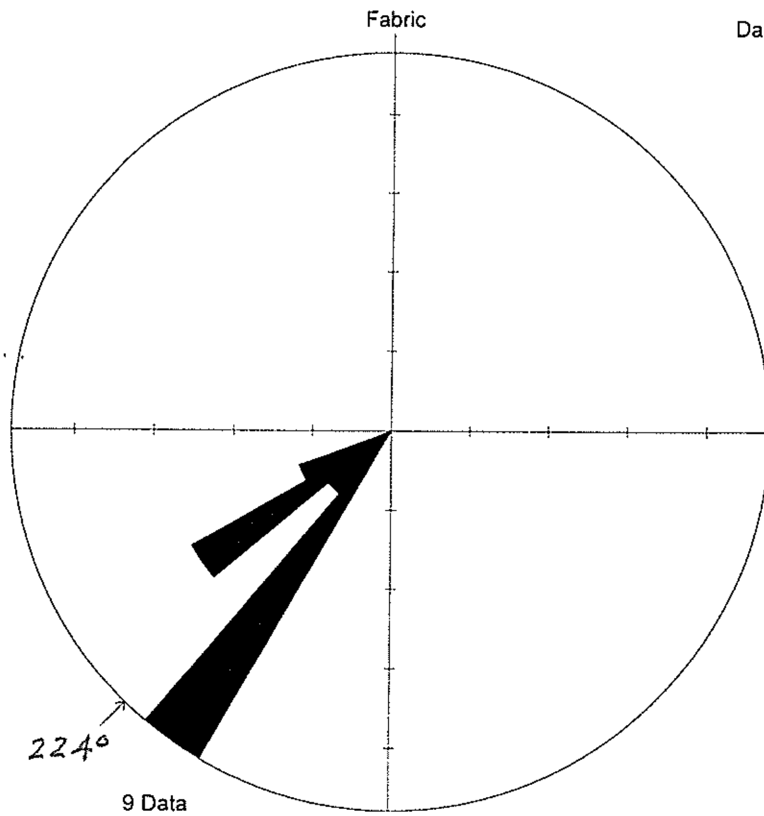
length- Azimuth
No. of Data = 26
Sector angle = 10°
Scale: tick interval = 5% [length: 5.35]
Maximum = 25.2% [length: 27]
Total length = 107
Mean Resultant dir'n = 144
[Approx. 95% Confidence interval = ±7.'
(valid only for unimodal data)

:

EB257A
4



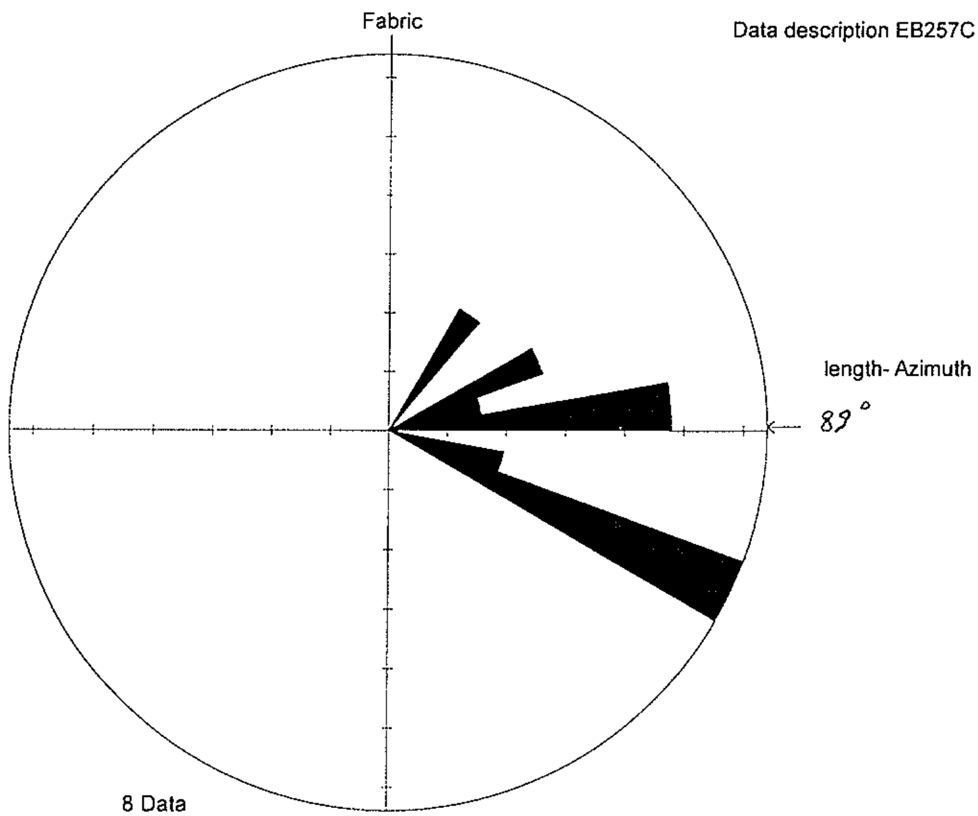
EB257B
9



Data description EB257B

length- Azimuth
No. of Data = 9
Sector angle = 10°
Scale: tick interval = 10% [length: 9.60]
Maximum = 47.9% [length: 46]
Total length = 96
Mean Resultant dir'n = 224
[Approx. 95% Confidence interval = ±7.
(valid only for unimodal data)

EB257C
8



APPENDIX 3 - CONSOLIDATED PALEOCURRENT DIRECTIONS

411 GROUPED PALEOCURRENT LOCATIONS

Pink = trending east-southeast to southeast, blue = trending northeast to east, NA = not available (for single paleocurrent measurements)

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
CV005	522902	4333710	39	19	3	160	7
CV006	523490	4333643	322	NA	1	NA	NA
CV007	522070	4333479	20	NA	1	NA	NA
CV008	522830	4333623	4	NA	1	NA	NA
CV009X	528212	4332956	35	NA	1	NA	NA
CV011	528835	4333270	120	34	4	2100	26
CV012	528487	4333354	62	39	3	80	5
CV013	528569	4333411	113	98	4	200	8
CV014	528645	4333467	73	41	2	40	4
CV015A	528790	4333541	136	33	4	750	15
CV015B	528770	4333560	50	NA	1	NA	NA
CV016A	528790	4333630	95	135	3	4000	36
CV016B	528822	4333652	35	21	3	90	5
CV017	528298	4332627	102	NA	1	NA	NA
CV018A	532234	4333468	222	21	2	80	5
CV018B	532295	4333482	85	57	9	380	11
CV019A	532220	4333480	53	13	3	300	10
CV019B	532265	4333459	232	40	3	20	3
CV020A	532151	4333430	162	6	2	150	7
CV020B	532103	4333467	15	NA	1	NA	NA
CV020X	528460	4334210	53	34	2	200	8
CV021	527820	4344050	95	44	10	19800	79
CV022A	528171	4343696	106	84	4	10000	56
CV022B	528144	4343536	79	25	4	3800	35
CV023	529688	4344055	124	NA	1	NA	NA
CV024	530820	4342560	123	56	3	2700	29
RG025A	526106	4345185	182	153	5	41000	114
RG025B	526557	4344436	125	151	16	372600	344
RG026	528600	4344400	147	26	2	2300	27
RG027	526020	4345320	193	36	4	1500	22
RG028	526062	4346029	160	54	11	6300	45
RG029B	525979	4348032	359	25	2	20	3
CRS031A	511196	4346844	313	46	9	11900	62
CRS031B	511186	4346604	341	71	8	450	12

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
CRS032	511239	4347096	346	21	4	1750	24
CRS033	511899	4347730	325	61	10	1800	24
CRS035A	511100	4346560	127	173	5	3500	33
RG036A	527948	4346103	171	51	15	16250	72
RG036B	527965	4345768	177	100	21	36400	108
RG037	527910	4347550	147	15	4	2000	25
RG038	526288	4347980	150	74	7	400	11
RG039	526522	4349736	183	67	3	380	11
RG040A	525030	4349881	193	NA	1	NA	NA
RG040B	526044	4349748	166	82	16	64000	143
RG040C	526338	4349747	145	34	7	8000	50
RG041A	525697	4349826	182	64	5	3900	35
RG041B	526100	4349545	161	76	3	3000	31
RG042A	522596	4355275	57	58	3	2800	30
RG042B	522599	4355170	155	53	4	2550	28
RG042C	522740	4355068	132	85	9	11200	60
RG042D	522655	4354998	58	NA	1	NA	NA
RG043A	521671	4355282	117	93	6	6000	44
RG043B	521608	4355107	68	14	3	1050	18
CRS046	515728	4348829	122	62	7	1200	20
CRS047	515400	4348023	186	25	3	200	8
CRS048	515995	4349482	64	NA	1	NA	NA
CRS049	518034	4351692	52	67	3	4200	37
CRS050	518272	4351634	141	8	2	300	10
CRS051A	518099	4351366	11	61	3	2500	28
CRS051B	518167	4351464	76	9	2	600	14
CRS052	517768	4351132	115	NA	1	NA	NA
CRS053	515700	4350580	69	65	5	200	8
CRS054	516166	4352377	347	NA	1	NA	NA
CRS055	515313	4354055	25	NA	1	NA	NA
CRS056	515525	4354812	336	95	6	4000	36
CRS057	519116	4352924	31	2	2	70	5
CRS058	515674	4355524	54	85	5	5000	40
CRS059A	515067	4355611	0	5	2	125	6
CRS059B	515248	4355639	106	41	3	425	12
CRS060	515302	4355965	50	103	7	18680	77
CRS061	518894	4356933	186	96	8	12920	64
CRS062	518931	4357132	184	36	5	2000	25

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
CRS063	518520	4357855	217	32	2	550	13
CRS064	516660	4356160	116	58	5	3000	31
CRS065	516950	4355805	140	17	5	1500	22
CRS066	517460	4355780	130	39	6	249000	282
CRN067	518189	4358393	192	NA	1	NA	NA
CRN068	517982	4358798	173	96	6	17250	74
CRN069	518377	4358202	123	100	12	62500	141
CRS070	517715	4358372	125	36	3	200	8
CRS071	515424	4356803	122	41	2	100	6
CRN072	516708	4358399	38	114	12	6250	45
CRN073A	513666	4358837	105	20	3	450	12
CRN073B	513881	4358693	138	65	7	4500	38
CRN074	514090	4358180	125	50	4	250	9
CRS075	513419	4358090	232	13	4	1250	20
CRN076	514494	4358856	103	25	2	100	6
CRS077A	514703	4358140	149	87	8	1400	21
CRS077B	514890	4358002	125	13	3	3800	35
CRS078	515038	4357634	161	49	5	150	7
CRS079	515020	4357220	178	30	7	10200	57
CRN080A	515295	4358179	188	55	6	8700	53
CRN080B	515551	4357955	157	63	17	57600	135
CRN080C	515554	4357978	92	NA	1	NA	NA
CRN081	514392	4359367	115	NA	1	NA	NA
CRN082	517138	4363793	188	NA	1	NA	NA
CRN083	517427	4361271	178	NA	1	NA	NA
CRN084	517270	4361286	167	85	3	25	3
CRN087	518041	4361574	148	58	5	12750	64
CRN089	517549	4360892	38	60	3	6420	45
CRN090	517352	4361025	132	55	12	10400	58
CRN091-093	516629	4358999	27	66	21	19400	79
CRN094A	516660	4359260	199	60	5	3400	33
CRN094B	516705	4359285	40	NA	1	NA	NA
CRN096	517369	4359696	154	NA	1	NA	NA
CRN097A	517591	4360124	59	33	3	150	7
CRN097B	517549	4360077	150	44	8	4600	38
CRN099	517830	4359937	178	20	2	15	2
CRN100	517953	4359749	205	62	5	1300	20
CRN103A	517740	4359380	44	28	4	2250	27

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
CRN103B	517760	4359300	143	64	7	8780	53
CRN104	517072	4359693	23	9	3	150	7
CRN105	515098	4358371	225	13	2	100	6
CRN106	516684	4359771	85	NA	1	NA	NA
CRS107A	518626	4357647	150	18	5	1120	19
CRS107B	518581	4357490	136	23	4	2880	30
CRS107C	518476	4357419	169	42	3	900	17
CRS108A	518742	4357429	166	28	5	2180	26
CRS108B	518787	4357421	208	22	3	800	16
CRN109	518404	4358491	122	59	13	1500	22
CRN110A	518457	4358936	146	31	3	250	9
CRN110C	518505	4358613	172	38	3	250	9
CRN110D	518563	4358622	83	1	2	150	7
CRN110E	518393	4358773	54	9	2	750	15
CRN111A	517377	4358436	112	15	2	250	9
CRN111B	517429	4358282	32	70	10	3120	32
CRS112	517450	4357900	90	27	3	10200	57
CRS113	517390	4357360	146	54	2	1400	21
CRN114	517234	4358507	57	52	5	2100	26
CRN116A	517400	4358700	73	52	5	20700	81
CRN116B	517500	4358750	138	31	3	5400	41
CRS122A	517587	4356027	38	50	4	2020	25
CRS122B	517792	4356028	23	53	8	16000	71
CRS129A	519060	4354850	86	5	2	650	14
CRS129B	519121	4354674	194	46	6	2600	29
CRS129C	519148	4354754	100	6	3	500	13
CV130A	529173	4343135	290	175	4	2280	27
CV130B	529350	4343017	41	10	2	80	5
RG131	524470	4350815	112	73	6	1500	22
RG132A	524604	4350788	60	74	5	3150	32
RG132B	524700	4350790	124	61	6	1700	23
RG132C	524797	4350796	109	102	6	2250	27
RG132D	524945	4350723	179	201	9	11700	61
RG132E	524835	4350642	168	117	13	12500	63
RG133A	524861	4351255	142	99	12	6300	45
RG133B	524910	4351131	155	115	26	23620	87
RG133C	525013	4351049	172	43	12	9000	54
RG134A	524715	4351487	162	34	10	4500	38

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
RG134B	524932	4351489	149	68	7	5400	41
RG135	524888	4351911	117	49	5	30600	99
RG136A	524237	4351773	170	106	11	52500	129
RG136B	524589	4351417	135	24	6	8000	50
RG136C	524665	4351393	80	24	5	5000	40
RG137B	524094	4351613	125	81	6	10400	58
RG137C	524243	4351355	182	66	17	54600	132
RG137D	524565	4351284	159	112	15	21600	83
RG137E	524738	4351183	138	44	6	6300	45
RG138A	524016	4351353	147	116	18	15000	69
RG138B	524486	4350960	125	69	13	11250	60
RG138D	524000	4351300	264	35	2	6000	44
RG139A	524951	4350426	176	4	2	20	3
RG139B	525252	4350360	53	140	21	10000	56
RG139C	525462	4350211	8	103	4	125	6
RG139D	525542	4350163	133	13	3	900	17
RG139E	525589	4350213	22	82	4	1500	22
RG139F	525663	4350157	195	78	15	8000	50
RG139G	525504	4350145	23	128	5	18000	76
RG139H	524861	4350488	55	83	4	1000	18
RG140A	524560	4350243	82	11	2	380	11
RG140B	525104	4349967	156	21	2	750	15
RG141	524113	4350931	130	52	4	320	10
RG142	523686	4350517	156	104	5	20250	80
RG143A	524483	4350637	164	26	4	5800	43
RG143B	524525	4350607	236	34	3	1300	20
CV144A	528850	4342858	92	82	9	2250	27
CV144B	529103	4342807	82	86	17	4200	37
CV145A	528620	4343265	50	16	3	100	6
CV145B	528674	4343131	138	72	5	1280	20
CV145C	528703	4342960	53	68	4	1600	23
CV146	528442	4343400	106	36	3	500	13
CV147	528840	4343580	144	143	7	20700	81
CV148	528843	4344091	126	137	14	9150	54
CV149A	531536	4343464	152	32	6	1500	22
CV149B	531493	4343390	49	44	4	2000	25
CV149C	531385	4343287	96	105	8	2400	28
CV149D	531372	4343220	174	103	7	1620	23

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
CV149E	531381	4343129	102	157	9	2620	29
CV150A	531224	4343445	105	164	22	14000	67
CV150B	531013	4343193	71	157	29	8250	51
RG151A	520988	4355491	48	148	11	116200	192
RG151B	521260	4354685	82	20	4	2000	25
RG151C	521796	4354124	133	167	5	1500	22
RG151D	521954	4354034	137	214	15	18030	76
RG151E	522212	4354022	127	166	11	4900	40
RG151F	522499	4353794	148	88	16	28980	96
RG151G	522891	4353495	156	57	7	12420	63
RG151H	522920	4353375	99	55	8	2070	26
RG151I	522898	4353294	165	63	6	1180	19
RG151J	522884	4353197	63	79	5	1180	19
CRS153A	521440	4355720	148	51	8	31050	99
RG154	521653	4355645	97	88	8	3150	32
CRS155A	519667	4355781	159	68	6	73500	153
CRS155B	519954	4355424	158	47	5	14000	67
CRS155C	520123	4354862	125	188	18	230300	271
CRS155D	520377	4354939	87	39	4	320	10
CRS155E	520398	4354887	144	59	8	4280	37
CRS155F	520548	4354799	155	93	13	15680	71
CRS155G	520672	4354755	342	190	11	3450	33
CRS155H	520524	4354553	0	34	2	75	5
CRS155I	520573	4354496	140	45	3	400	11
CRS155J	520601	4354650	146	65	10	1500	22
CRS155K	520820	4354670	29	100	6	4500	38
CRS155L	520750	4354550	67	64	4	3200	32
CRS155M	520282	4354915	54	38	4	45	4
CRS156A	521372	4354359	46	135	10	10850	59
CRS156B	521524	4354127	140	134	22	41880	115
CRS156C	522126	4354012	138	12	5	4500	38
CRS156D	521956	4354033	69	55	3	600	14
RG157A	521654	4353979	40	25	3	100	6
RG157B	521671	4353919	162	65	4	3750	35
RG157C	521761	4353901	119	91	5	4500	38
RG157D	521740	4353804	160	69	5	3750	35
RG157E	522026	4353986	164	135	22	20000	80
RG157F	522269	4353957	154	120	12	1200	20

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
RG157G	522256	4353834	100	68	3	400	11
RG157H	522376	4353769	173	95	14	22500	85
RG157I	522347	4353590	175	40	4	3000	31
RG157J	522489	4353694	66	114	8	10450	58
RG157K	522501	4353642	161	105	9	12000	62
RG157L	522651	4353518	95	100	14	14700	68
RG157M	521753	4353891	37	15	2	70	5
RG157O	521802	4353904	142	NA	1	NA	NA
RG158A	522748	4353339	108	140	13	6300	45
RG158B	522709	4353218	98	160	18	26780	92
RG158C	522766	4353053	86	21	4	4000	36
RG158D	522773	4352939	125	50	9	3000	31
EL159A	533088	4344808	261	95	2	9000	54
EL159B	533324	4344815	96	75	5	16500	72
EL159C	533610	4344811	35	135	8	39980	113
EL159D	533564	4345535	105	NA	1	NA	NA
EL160	532500	4347350	93	180	11	38400	111
EL161A	538821	4344818	74	53	4	157500	224
EL161B	539140	4344556	138	32	5	82500	162
EL161C	539263	4344621	72	2	2	3000	31
EL161D	539392	4344441	120	NA	1	NA	NA
CRN162A	512426	4358853	43	95	11	1420	21
CRN162B	512432	4358786	150	15	2	75	5
CRN162C	512397	4358820	232	NA	1	NA	NA
EB163A	535800	4342800	115	120	9	1299400	643
EB163B	536342	4342125	202	5	2	70	5
EB164	534540	4337500	132	170	3	1700	23
EB165A	541080	4338517	179	55	7	1200	20
EB165B	541099	4338326	92	90	5	820	16
EB165C	541190	4338474	171	55	4	900	17
EB165D	541429	4338507	90	83	11	6600	46
EB165E	541586	4338295	144	136	20	16580	73
EB165F	540813	4337900	240	16	2	420	12
EB165G	540789	4338143	66	105	3	1050	18
EB165H	542371	4336801	125	159	10	114980	191
EB166A	542434	4336313	42	50	7	50000	126
EB166B	542585	4335844	116	14	4	7500	49
EB166C	542706	4335622	56	30	7	8000	50

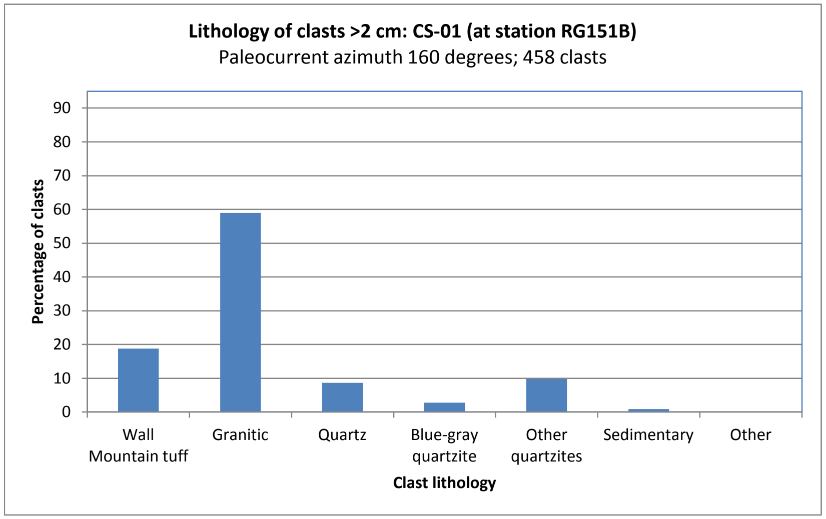
Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
EB167A	542497	4335136	99	94	4	30000	98
EB167B	541292	4335023	90	NA	1	NA	NA
EB167C	540764	4335705	63	35	2	1000	18
SD168A	505461	4366560	36	15	2	100	6
SD168B	505516	4366461	87	90	10	20000	80
EB169	532593	4343850	10	6	2	40	4
CV170	531357	4342998	64	130	10	12000	62
RG171	522300	4348480	148	41	6	12900	64
EA171X	533042	4329656	121	70	4	280	9
RG172A	522831	4347895	180	24	3	500	13
RG172B	523070	4347278	197	27	4	7200	48
RG172C	523439	4347588	63	8	2	800	16
RG172D	523573	4347415	184	29	4	10800	59
RG172E	524031	4347758	73	NA	1	NA	NA
CV173A	524989	4332866	110	27	2	86100	166
CV173B	525468	4332665	26	62	5	4000	36
EB189upperA	532612	4342186	213	45	5	2550	28
EB189upperB	532480	4342073	308	24	3	250	9
EB189upperC	532437	4341968	267	83	7	1120	19
EB189upperD	532454	4341886	207	24	3	350	11
EB189upperE	532432	4341550	194	117	25	22500	85
EB189upperF	532516	4341223	165	59	10	9900	56
EB189upperG	532593	4340893	121	127	13	24000	87
EB189lowerA	532468	4342212	53	18	4	22000	84
EB189lowerB	532549	4342021	123	127	4	2800	30
EB189lowerC	532458	4341660	212	74	13	8000	50
EB189lowerD	532619	4342075	170	47	6	3250	32
EB189lowerE	532528	4341497	211	20	4	1500	22
EB189lowerF	532535	4341283	178	100	19	14250	67
EB190A	533020	4340690	113	113	11	10450	58
EB190B	533271	4340041	109	46	4	13480	66
EB190C	533738	4339747	224	153	7	62700	141
EB190D	534166	4339400	127	118	7	45600	121
EB191A	534746	4341212	20	25	3	550	13
EB191B	534994	4341312	165	100	31	18450	77
EB191C	535165	4341259	44	36	5	1000	18
EB191D	534848	4340987	66	146	7	1650	23
EB191E	534976	4341202	160	45	4	100	6

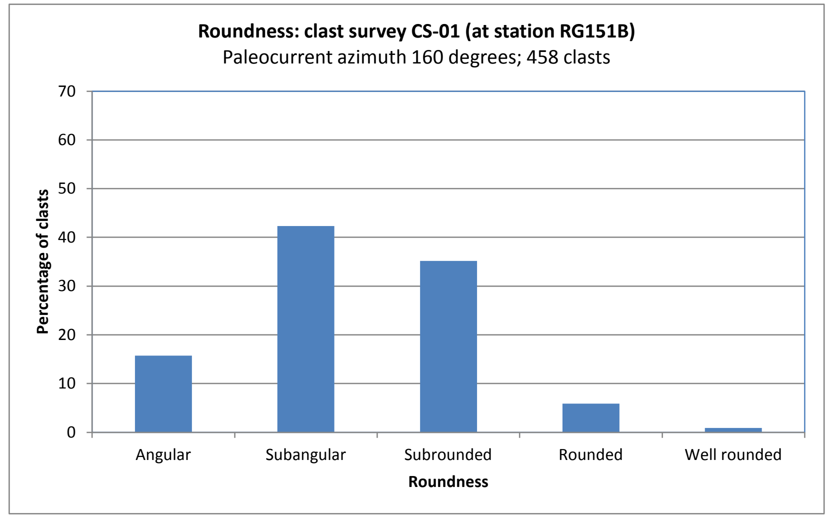
Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
EB192A	534246	4342020	141	64	6	12650	63
EB192B	534300	4341650	11	104	12	31620	100
EB192C	534645	4341514	123	112	16	18220	76
EB192D	534464	4341541	78	43	3	550	13
EB193A	532141	4344368	199	93	37	56250	134
EB193B	532533	4344370	146	15	3	2500	28
EB193C	532350	4344100	113	33	7	33300	103
EB193D	532253	4344324	194	140	6	15000	69
EB194A	534550	4338650	226	88	2	2850	30
EB194B	534288	4338021	214	20	2	550	13
EB204A	538117	4342203	56	20	2	5175	41
EB204B	537866	4341963	123	12	3	70	5
EB204C	538077	4341930	83	32	3	1400	21
EB205	537743	4342610	160	103	3	80	5
EB206	538925	4343276	86	NA	1	NA	NA
CV207	524546	4332962	192	NA	1	NA	NA
RG209A	527670	4345076	145	2	2	20	3
RG209B	527711	4344969	52	31	3	360	11
RG210	528071	4345176	128	65	16	17250	74
EL212A	535445	4345806	36	15	3	520	13
EL212B	535911	4345018	118	1	1	NA	NA
EL213	535707	4346137	117	62	9	3380	33
CRS215	518320	4354380	340	108	8	14720	68
CRS219A	520282	4354403	67	34	2	1100	19
CRS219B	520556	4354505	159	5	2	850	16
CRN220A	513513	4372475	152	NA	1	NA	NA
CRN220B	513512	4372021	22	NA	1	NA	NA
CRN220C	513250	4371800	155	53	4	84980	165
EB221	542947	4333841	150	NA	1	NA	NA
CRS227	519164	4352090	210	28	2	20	3
CRS228A	518073	4354934	78	25	2	17880	75
CRS228B	518138	4355088	322	85	12	150	7
CRS229A	517096	4353785	7	34	4	450	12
CRS229B	517291	4353651	6	25	2	150	7
CRS230	516810	4355097	317	61	3	500	13
RG231A	523057	4352892	131	129	20	50750	127
RG231B	523281	4352735	174	59	9	16000	71
RG231C	523014	4352656	165	40	3	1200	20

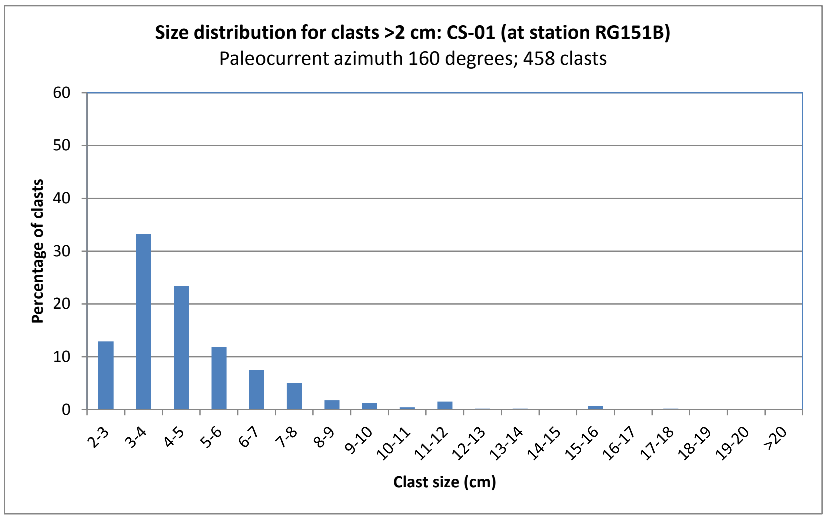
Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
RG231D	523327	4352573	163	62	17	4880	39
RG231E	523122	4352500	145	138	9	3620	34
RG231F	523182	4352351	164	90	8	5000	40
RG231G	523121	4352147	130	157	13	14580	68
RG231H	523206	4351938	120	76	5	19520	79
RG231I	523461	4352625	136	73	10	4000	36
RG231J	523056	4352907	51	11	2	100	6
RG232A	522999	4353152	93	22	4	12800	64
RG232B	523243	4353252	147	86	25	56000	134
RG232C	523441	4353282	159	13	5	4000	36
RG232D	523389	4353000	167	62	16	30800	99
RG232E	523766	4353051	152	128	25	60000	138
RG232F	523665	4352740	100	96	10	22500	85
RG232G	524096	4352718	145	145	30	103720	182
RG232H	524466	4352632	160	53	20	156250	223
RG232I	523493	4352302	192	24	2	700	15
RG232J	523638	4352183	134	10	3	350	11
RG232K	523800	4352050	205	16	3	2150	26
RG232L	523966	4352204	96	32	5	22580	85
RG232M	524315	4352126	154	93	16	62400	141
RG232N	524498	4352286	151	47	18	22500	85
RG232O	523049	4352743	164	NA	1	NA	NA
PY235A	553343	4328856	205	NA	1	NA	NA
PY235B	552420	4329144	168	98	5	50400	127
BB236A	546777	4333922	260	214	14	30000	98
BB236B	547558	4333653	109	51	5	15450	70
BB237	544700	4332980	141	87	12	13500	66
BB238	545002	4333834	144	91	2	700	15
EB239A	535253	4340868	147	62	32	37520	109
EB239B	535544	4340521	123	77	10	8000	50
EB243A	538900	4337420	352	30	4	3600	34
EB243B	538860	4337360	92	104	16	4200	37
EB244A	539062	4337926	80	33	2	250	9
EB244B	539182	4337953	130	34	2	4500	38
EB245	539197	4338411	80	1	2	600	14
EB246A	539650	4339100	175	20	3	29700	97
EB246B	539500	4339100	99	88	7	178480	238
EB247A	532656	4342484	168	185	10	7200	48

Location Number	Easting of Approximate Center of Location (UTM, NAD27 CONUS)	Northing of Approximate Center of Location (UTM, NAD27 CONUS)	Mean Resultant Azimuth from Rose Diagram for Location (degrees)	Range of Azimuth Values in Rose Diagram for Location (degrees)	Number of Measure-ments in Location	Approx. Area of Location (square meters)	Approx. Size of Location Expressed as Radius of an Equivalent Circle (meters)
EB247B	532699	4342368	81	121	17	4900	40
EB247C	532598	4342269	160	141	14	24680	89
EB247D	532827	4342353	239	99	17	44180	119
EB247E	532649	4342098	227	165	33	178350	238
EB247F	532836	4341662	145	133	9	33600	103
EB247G	532780	4341400	104	101	12	52800	130
EB247H	532829	4341026	158	70	19	101850	180
EB247I	532892	4340908	84	50	4	5750	43
EB247J	532951	4340798	180	140	14	41600	115
EB247K	533044	4340735	106	106	27	85200	165
EB247L	533132	4340569	168	97	18	67420	147
EB249A	533600	4342300	190	71	7	49000	125
EB249B	533300	4342300	135	121	5	6000	44
EB249C	533690	4342443	73	80	8	20000	80
EB249D	534029	4342373	157	148	29	40000	113
EB250	534144	4338162	195	41	12	30400	98
CRS251A	518640	4355799	129	112	12	28750	96
CRS251B	518688	4356072	92	117	8	5800	43
CRS251C	518998	4355978	171	50	4	13800	66
CRS251D	519127	4355853	132	57	7	8920	53
CRS251E	519432	4356234	148	80	9	36250	107
CRS251F	519500	4356700	163	41	9	152250	220
CRS252A	517931	4356426	57	48	4	5620	42
CRS252B	517968	4356575	76	61	4	6820	47
CRS252C	518239	4356577	67	75	12	110050	187
RG253A	523156	4352501	145	92	27	201250	253
RG253B	523424	4351920	180	131	24	114000	191
RG253C	523535	4351205	219	43	6	18150	76
BB254	547804	4338783	172	19	5	680	15
BB255A	545375	4337272	122	76	8	15000	69
BB255B	545604	4337185	34	31	4	14500	68
RG256	527903	4345645	144	85	26	12500	63
EB257A	537519	4339334	200	38	4	4500	38
EB257B	537665	4339113	224	30	9	4500	38
EB257C	537312	4339004	89	79	8	35000	106

CS-01: LITHOLOGY, CLAST SIZE, AND ROUNDING





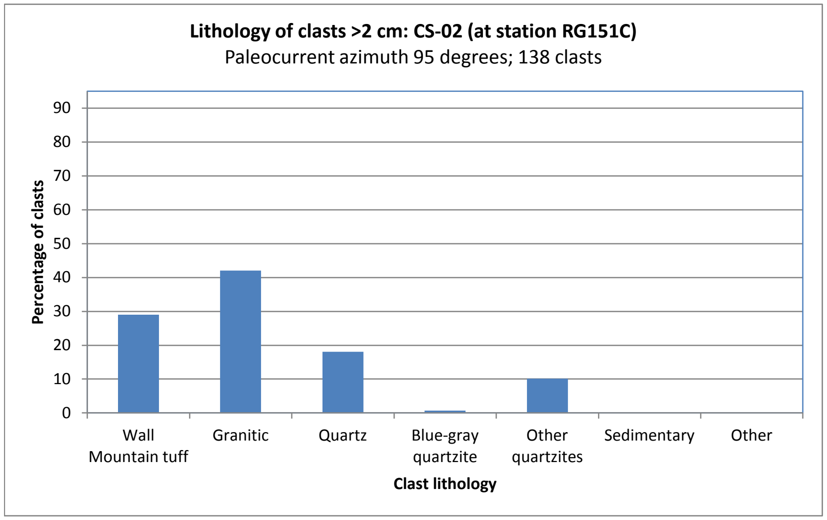


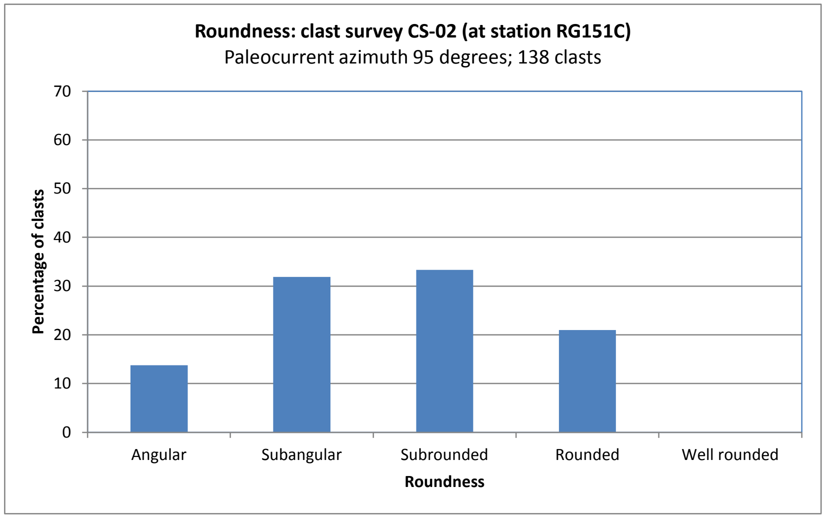
Weighted average clast size = 4.7 centimeters

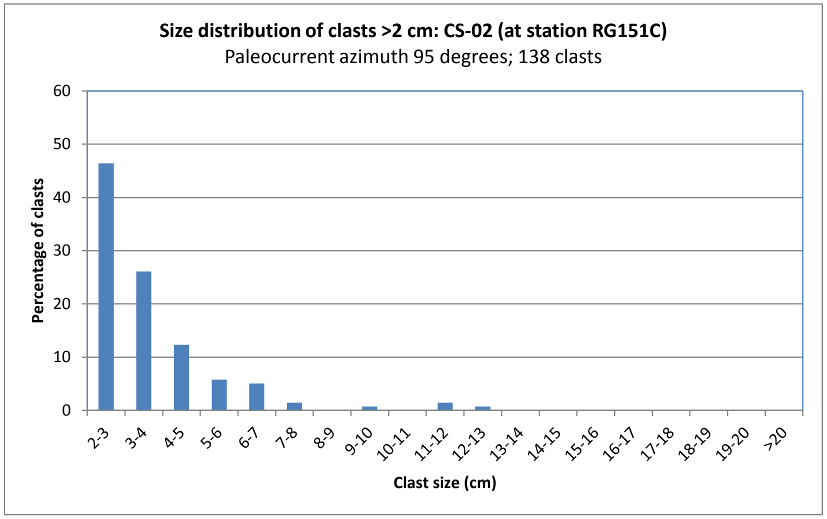
Rounding index = 2.3 (subangular)

Clast population = 4.1 clasts per square meter

CS-02: LITHOLOGY, CLAST SIZE, AND ROUNDING





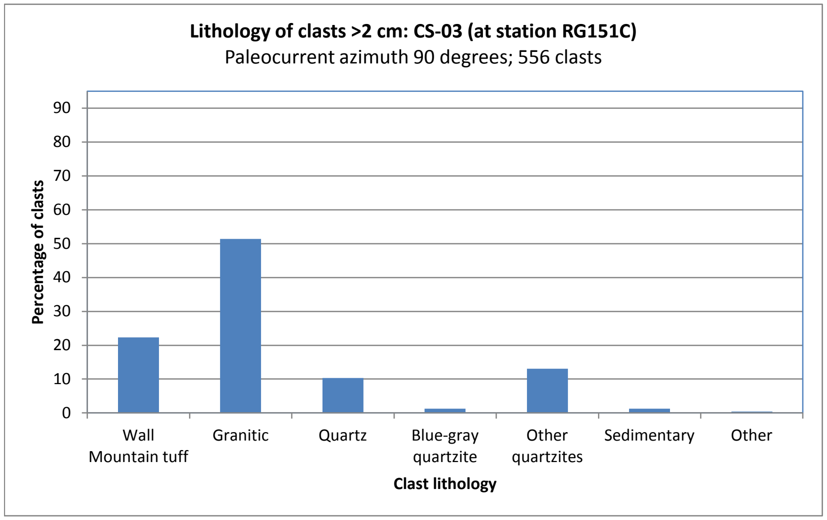


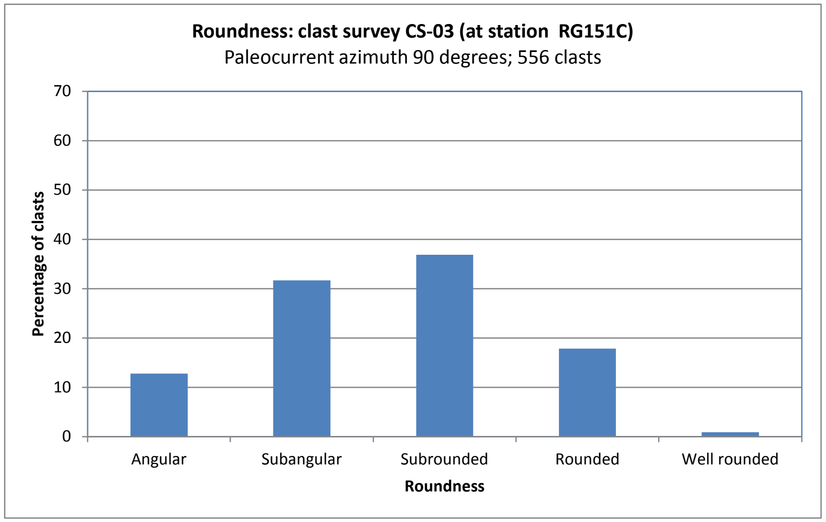
Weighted average clast size = 3.7 centimeters

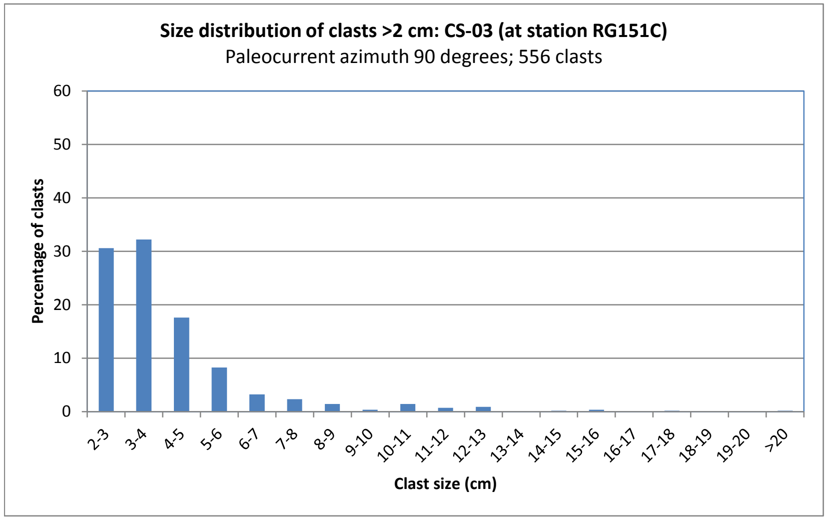
Rounding index = 2.6 (subrounded)

Clast population = 2.3 clasts per square meter

CS-03: LITHOLOGY, CLAST SIZE, AND ROUNDING





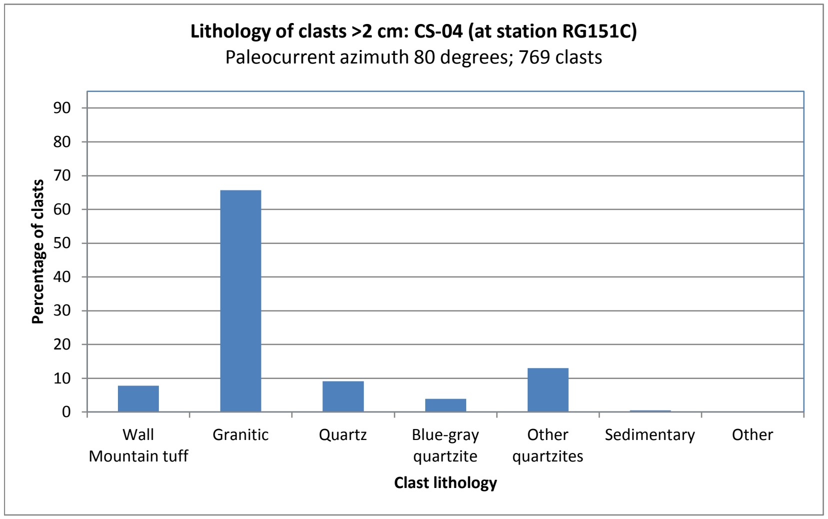


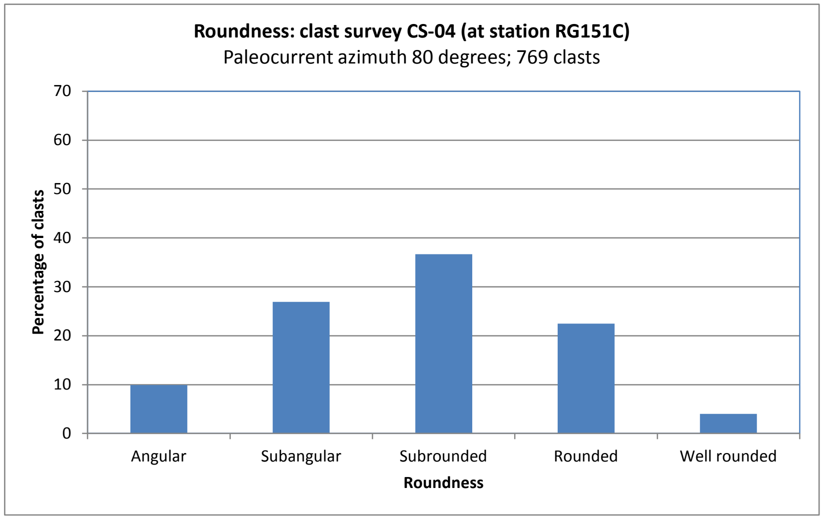
Weighted average clast size = 4.2 centimeters

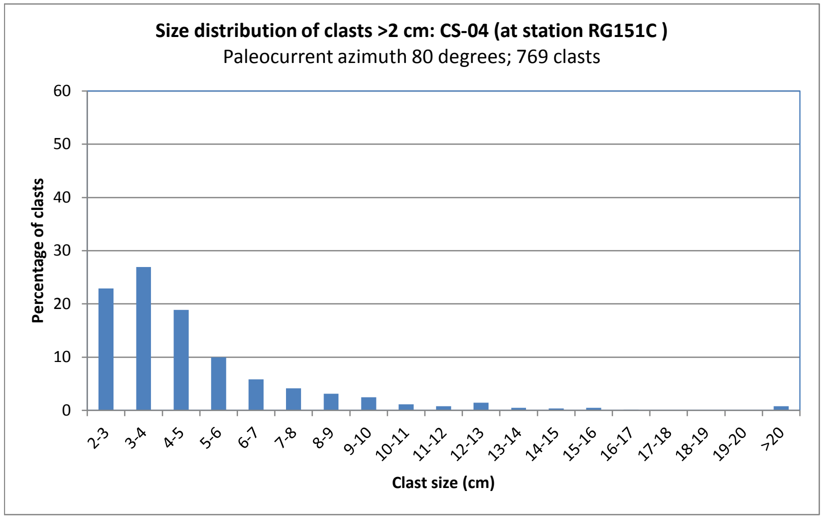
Rounding index = 2.6 (subrounded)

Clast population = 4.5 clasts per square meter

CS-04: LITHOLOGY, CLAST SIZE, AND ROUNDING





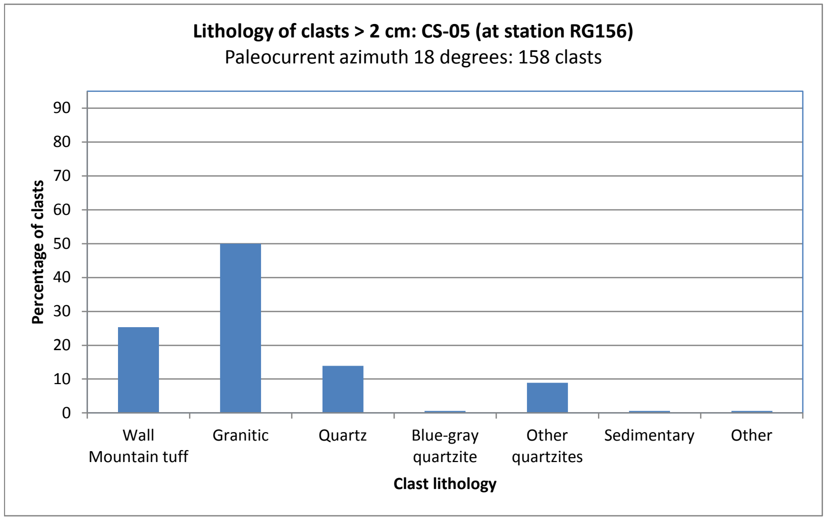


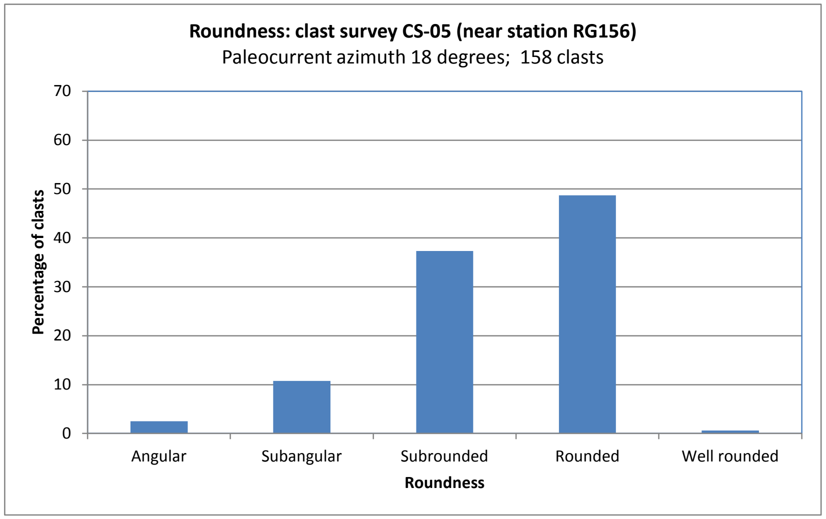
Weighted average clast size = 4.9 centimeters

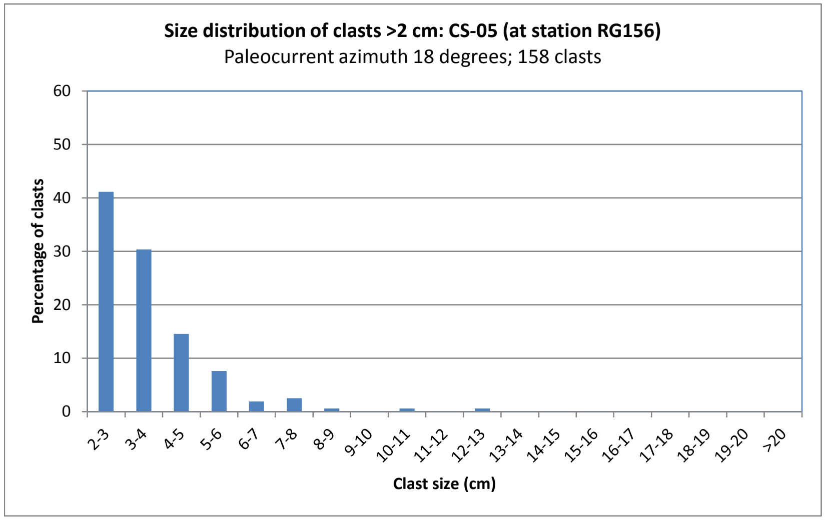
Rounding index = 2.8 (subrounded)

Clast population = 8.4 clasts per square meter

CS-05: LITHOLOGY, CLAST SIZE, AND ROUNDING





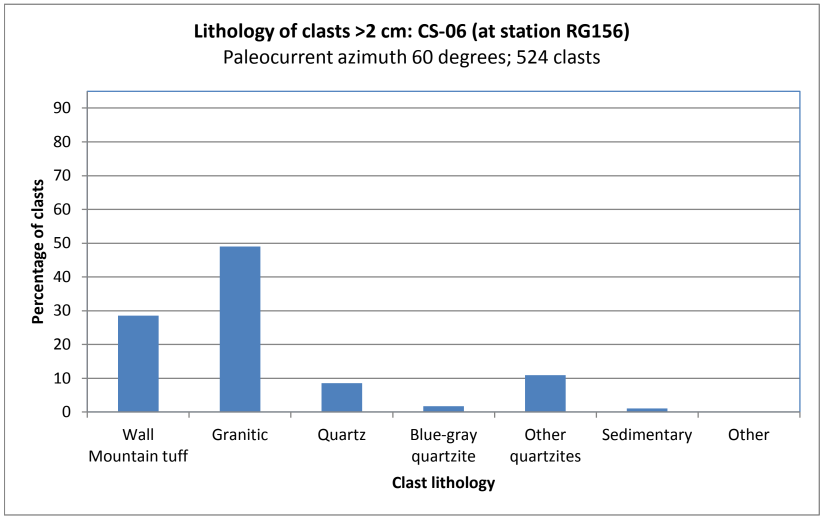


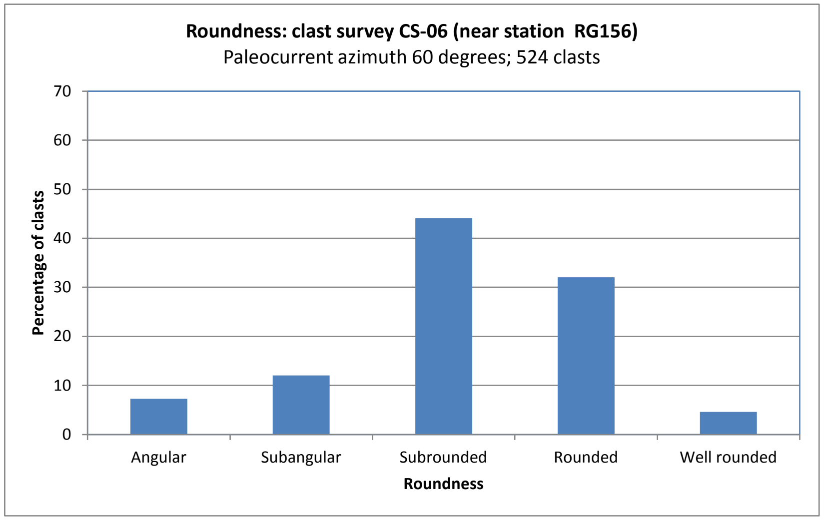
Weighted average clast size = 3.7 centimeters

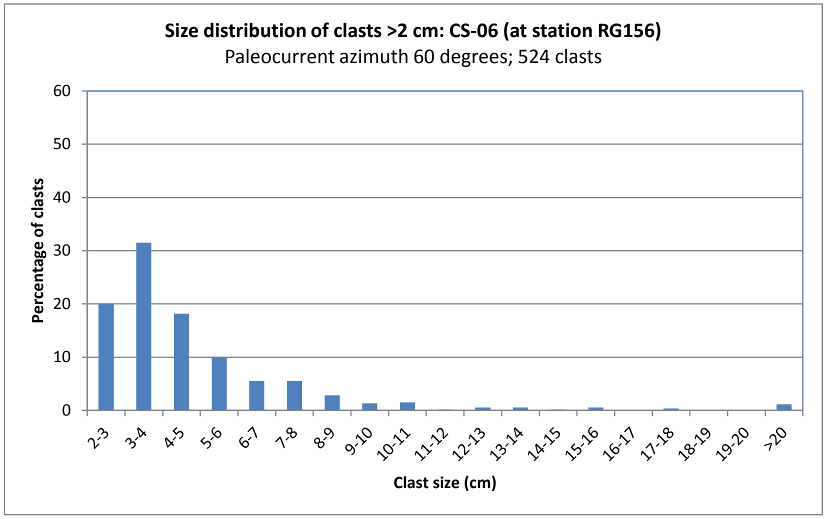
Rounding index = 3.3 (subrounded)

Clast population = 2.4 clasts per square meter

CS-06: LITHOLOGY, CLAST SIZE, AND ROUNDING





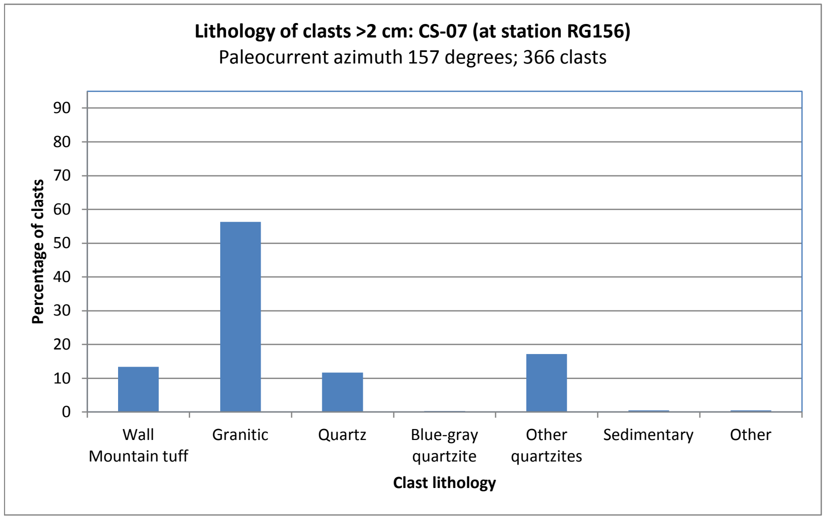


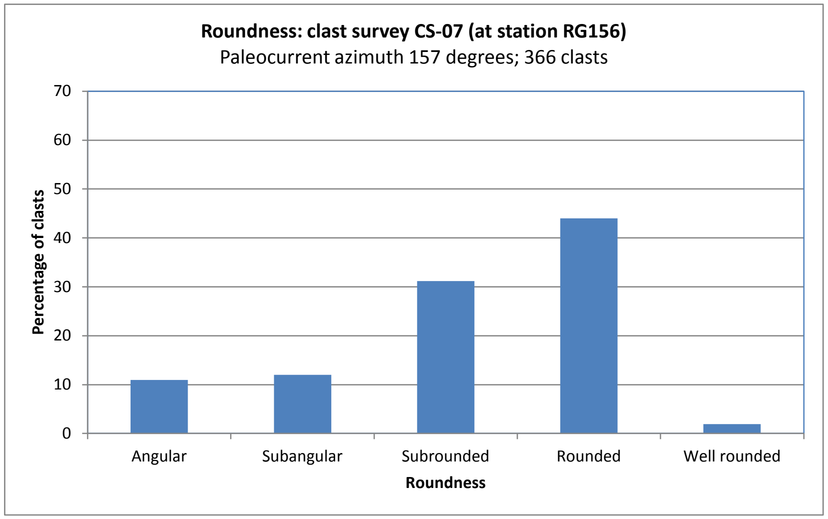
Weighted average clast size = 5.2 centimeters

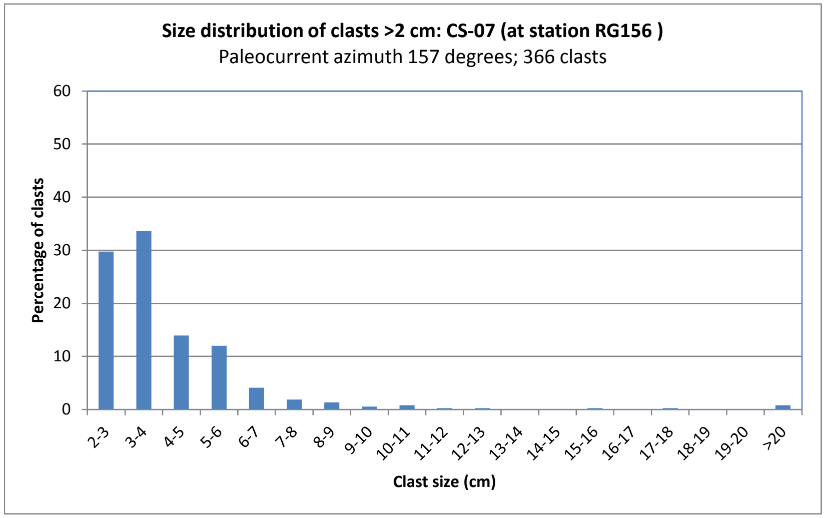
Rounding index = 3.1 (subrounded)

Clast population = 4.1 clasts per square meter

CS-07: LITHOLOGY, CLAST SIZE, AND ROUNDING





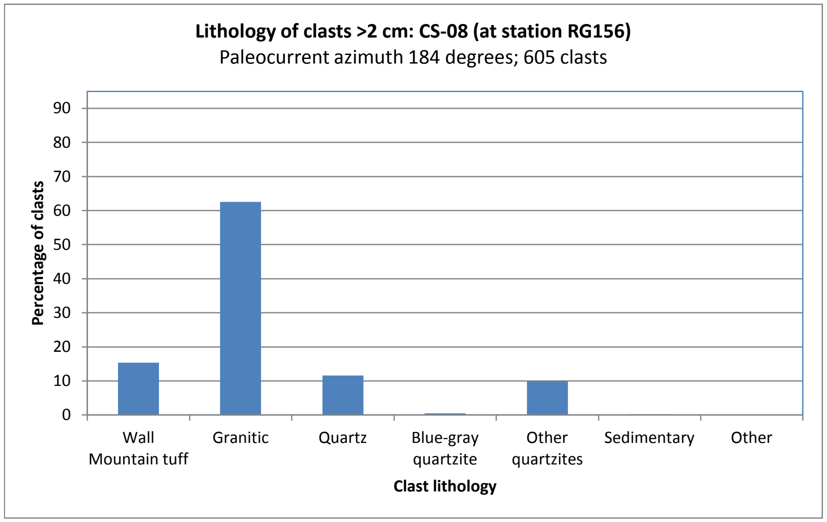


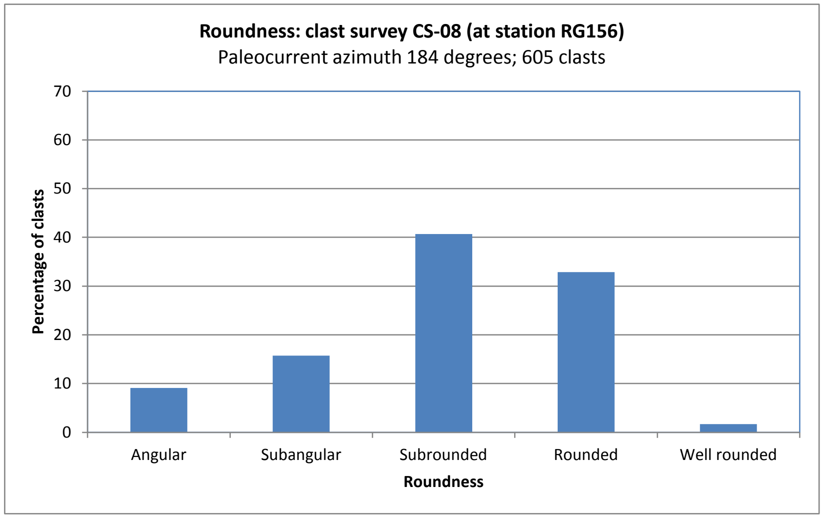
Weighted average clast size = 4.2 centimeters

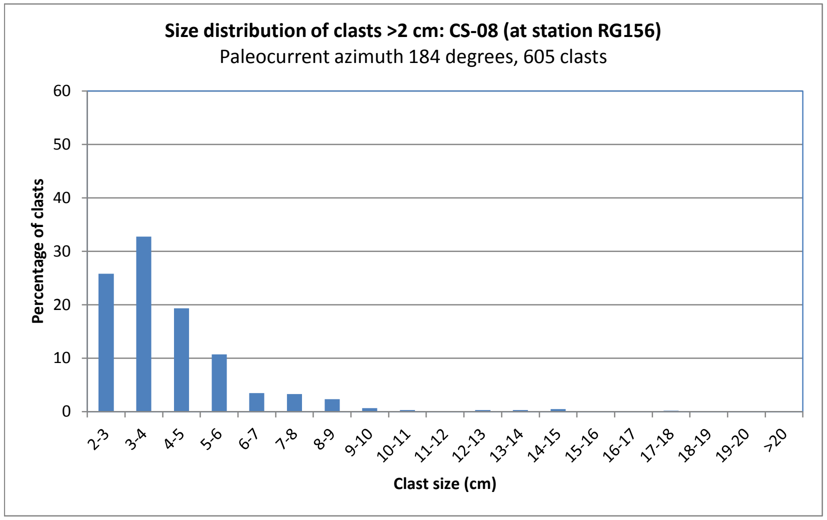
Rounding index = 3.1 (subrounded)

Clast population = 6.1 clasts per square meter

CS-08: LITHOLOGY, CLAST SIZE, AND ROUNDING





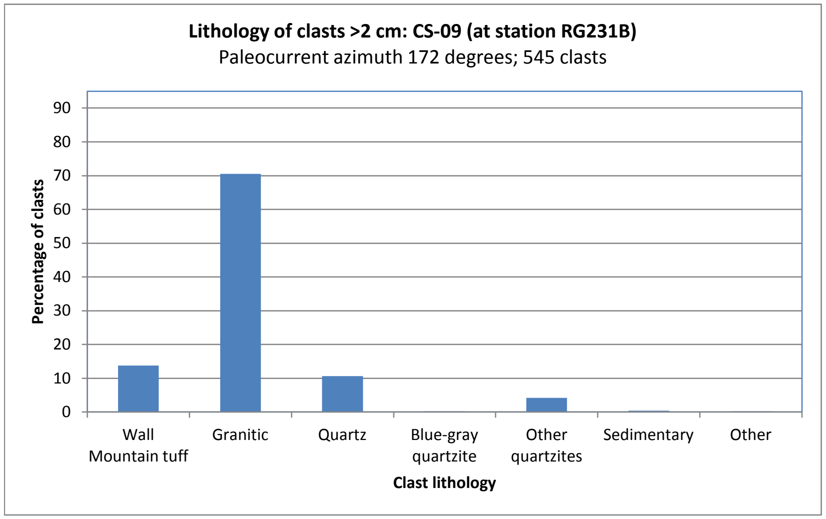


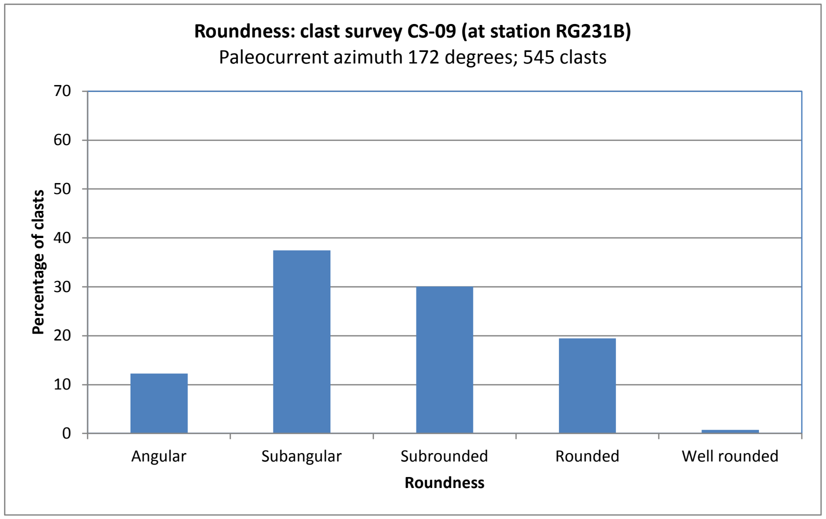
Weighted average clast size = 4.2 centimeters

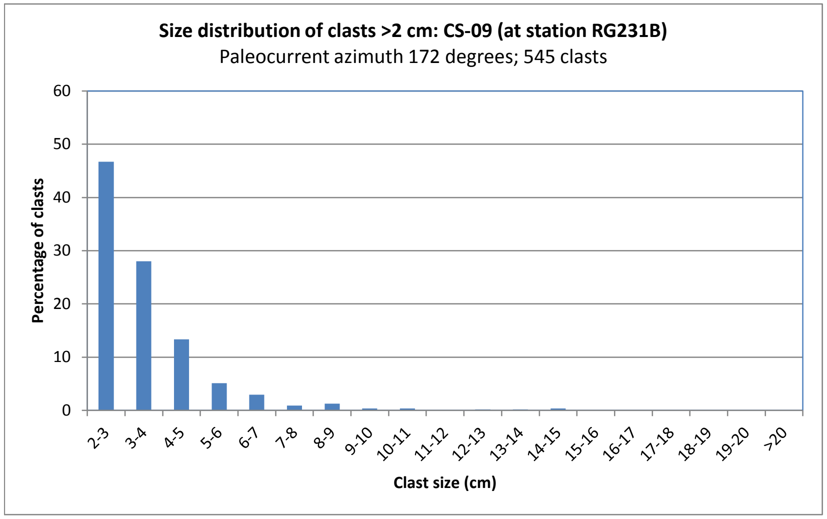
Rounding index = 3.0 (subrounded)

Clast population = 8.1 clasts per square meter

CS-09: LITHOLOGY, CLAST SIZE, AND ROUNDING





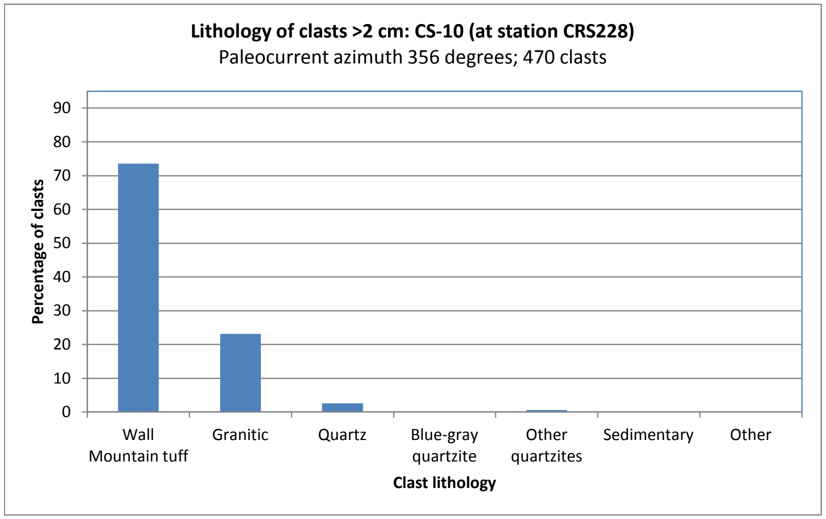


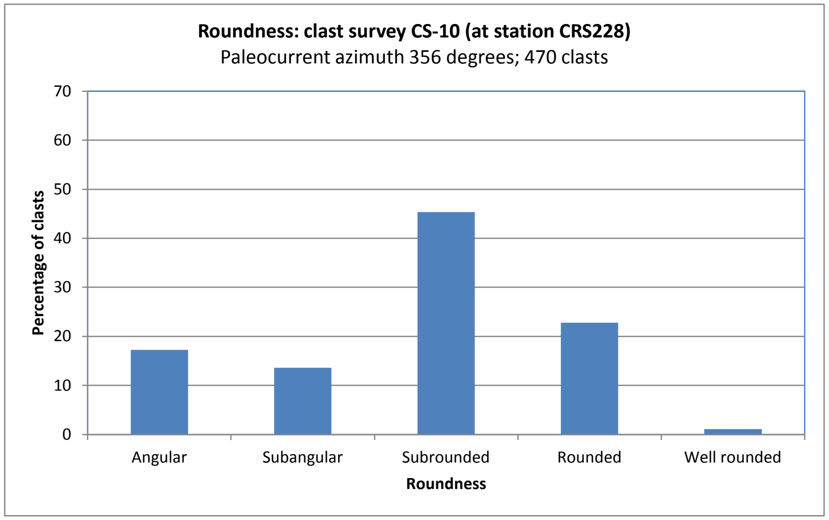
Weighted average clast size = 3.6 centimeters

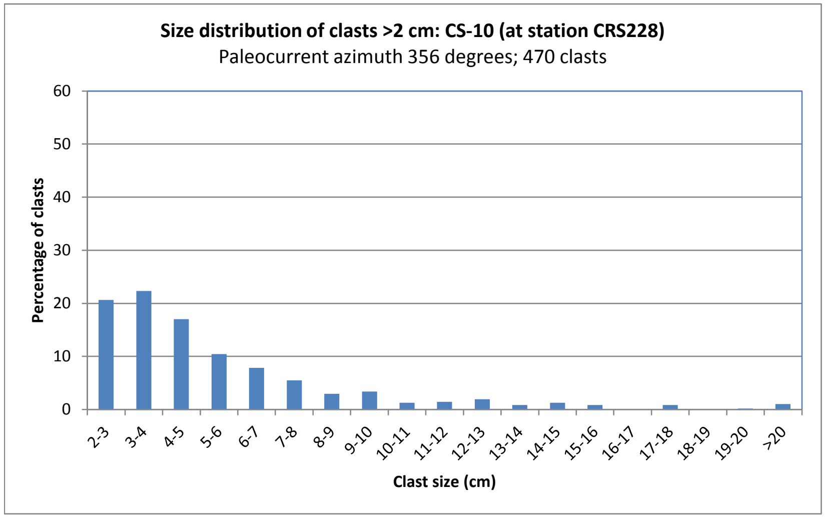
Rounding index = 2.6 (subrounded)

Clast population = 4.4 clasts per square meter

CS-10: LITHOLOGY, CLAST SIZE, AND ROUNDING





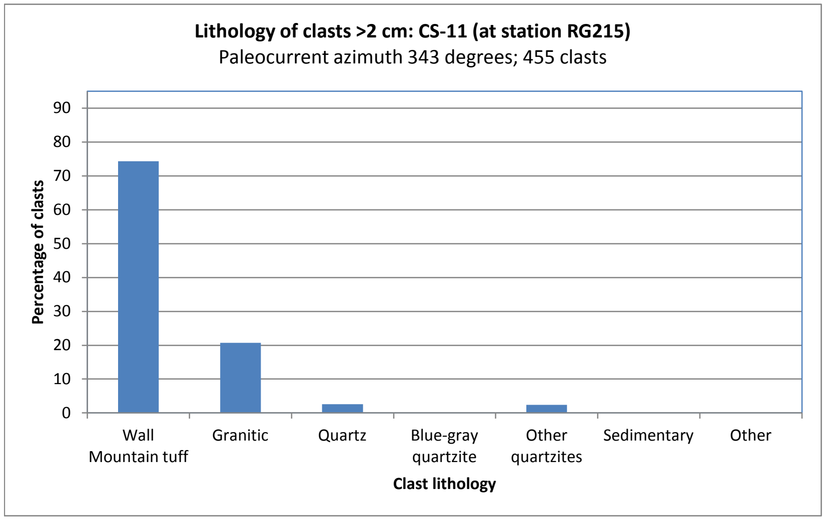


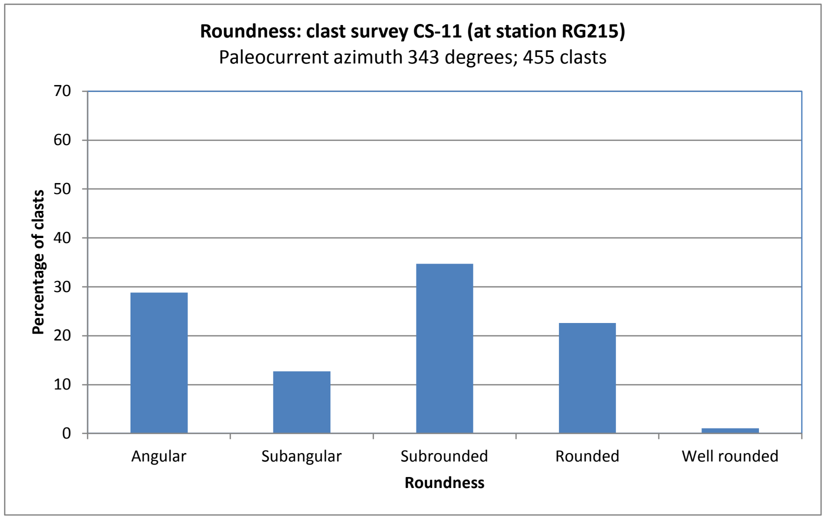
Weighted average clast size = 5.6 centimeters

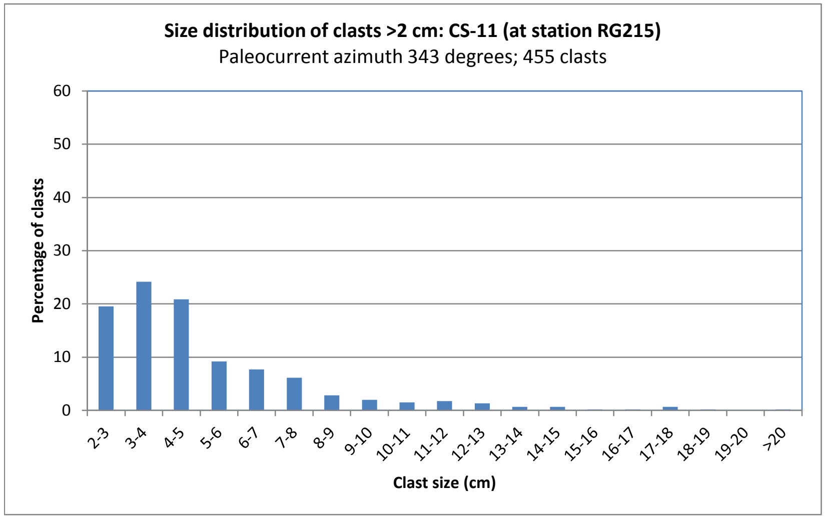
Rounding index = 2.8 (subrounded)

Clast population = 6.5 clasts per square meter

CS-11: LITHOLOGY, CLAST SIZE, AND ROUNDING





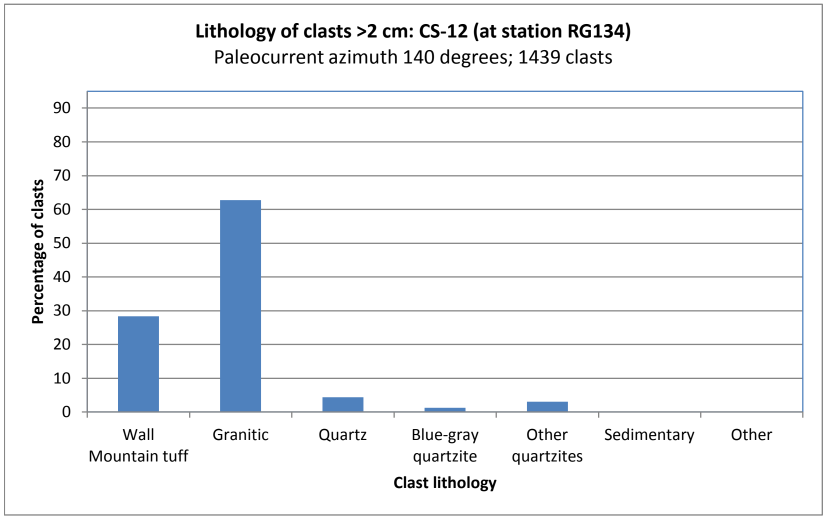


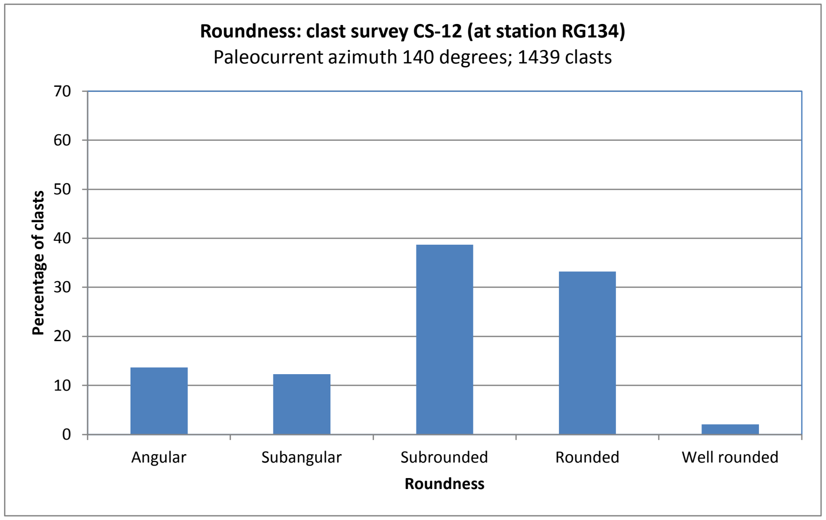
Weighted average clast size = 5.2 centimeters

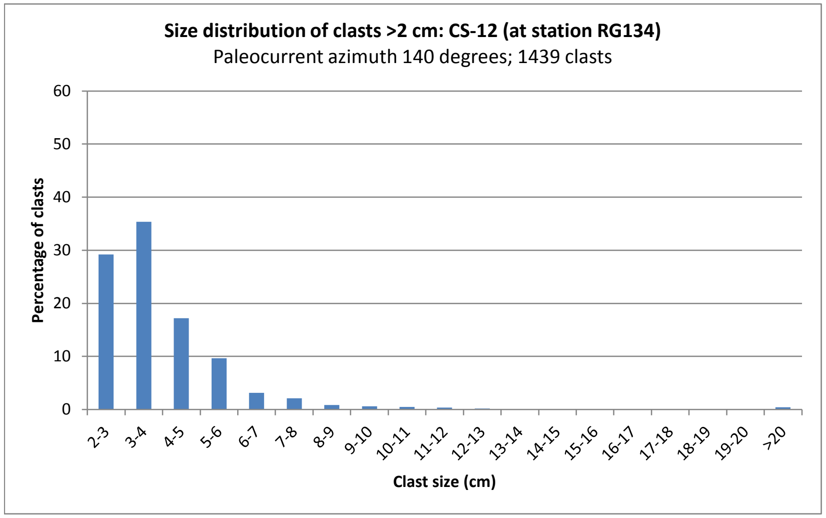
Rounding index = 2.5 (subrounded)

Clast population = 9.9 clasts per square meter

CS-12: LITHOLOGY, CLAST SIZE, AND ROUNDING





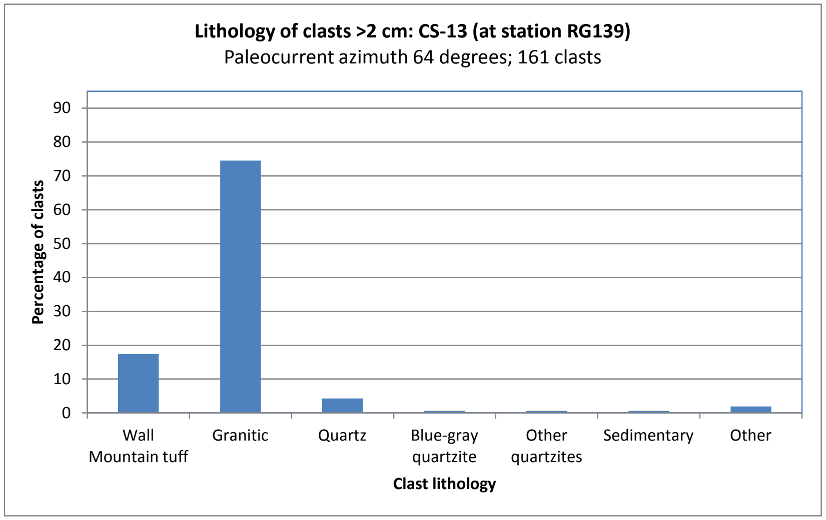


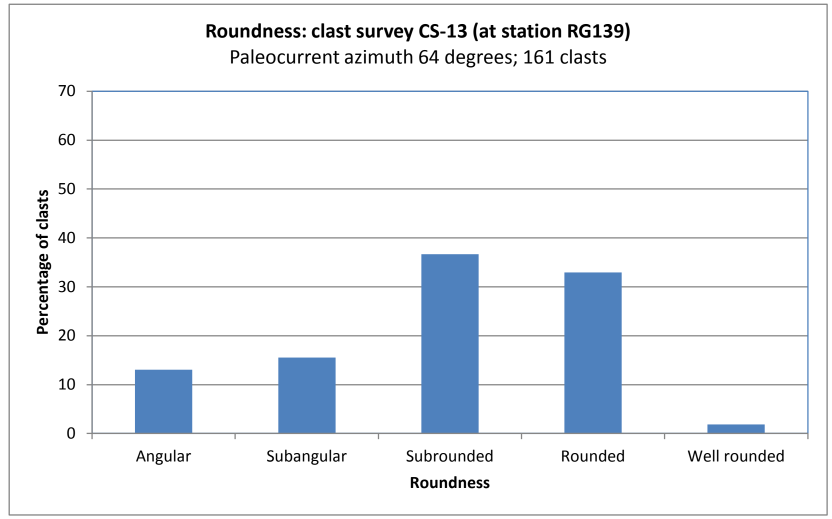
Weighted average clast size = 4.0 centimeters

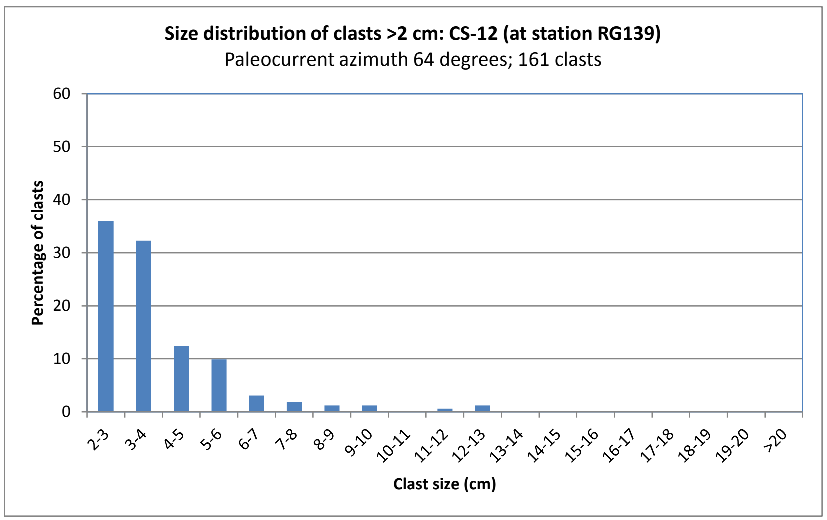
Rounding index = 3.0 (subrounded)

Clast population = 10.8 clasts per square meter

CS-13: LITHOLOGY, CLAST SIZE, AND ROUNDING





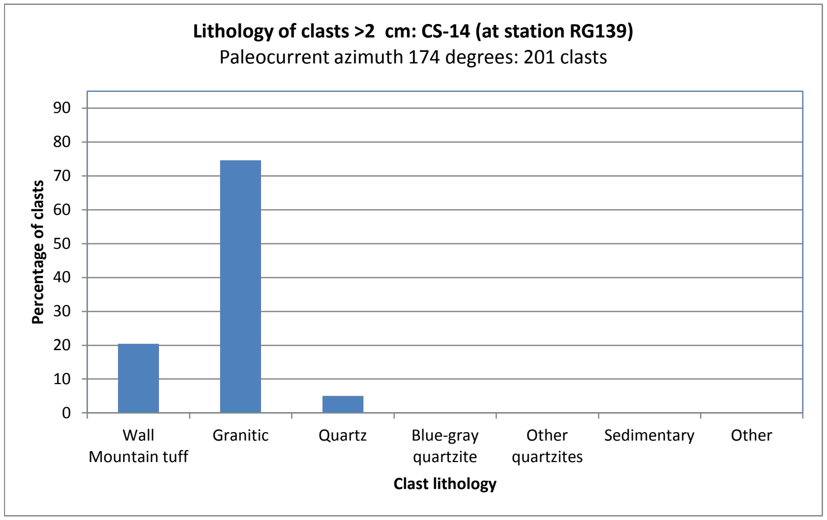


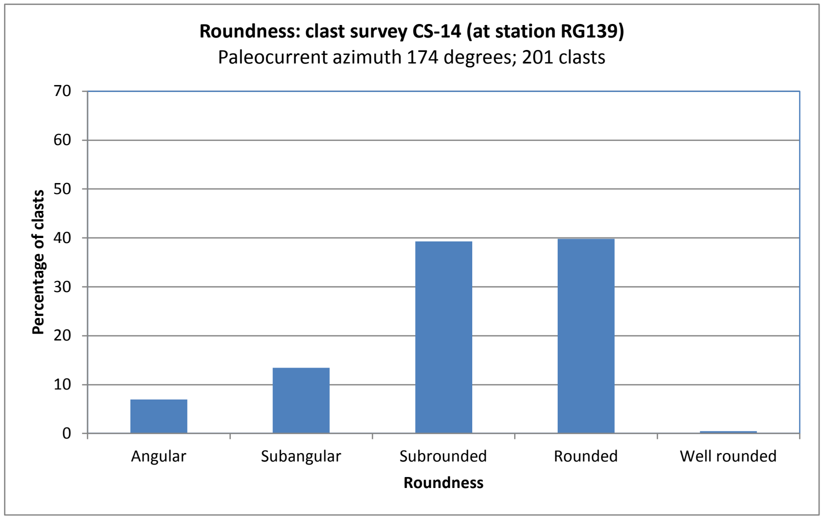
Weighted average clast size = 3.9 centimeters

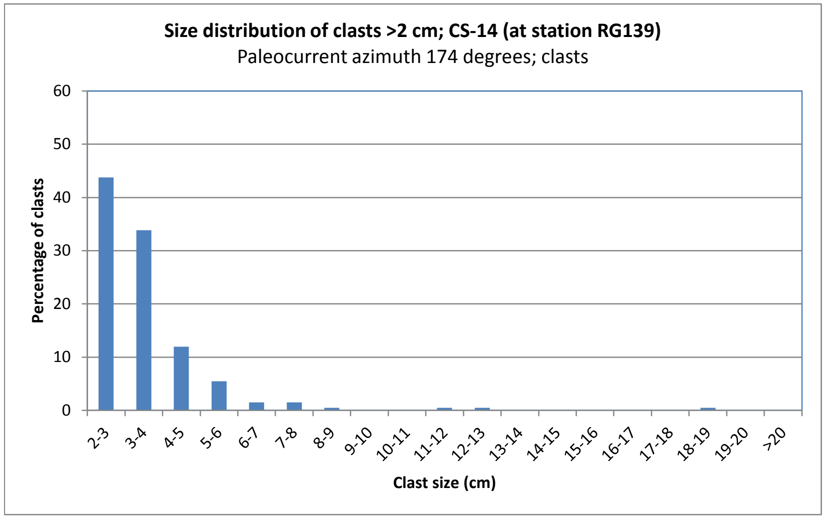
Rounding index = 3.0 (subrounded)

Clast population = 5.2 clasts per square meter

CS-14: LITHOLOGY, CLAST SIZE, AND ROUNDING





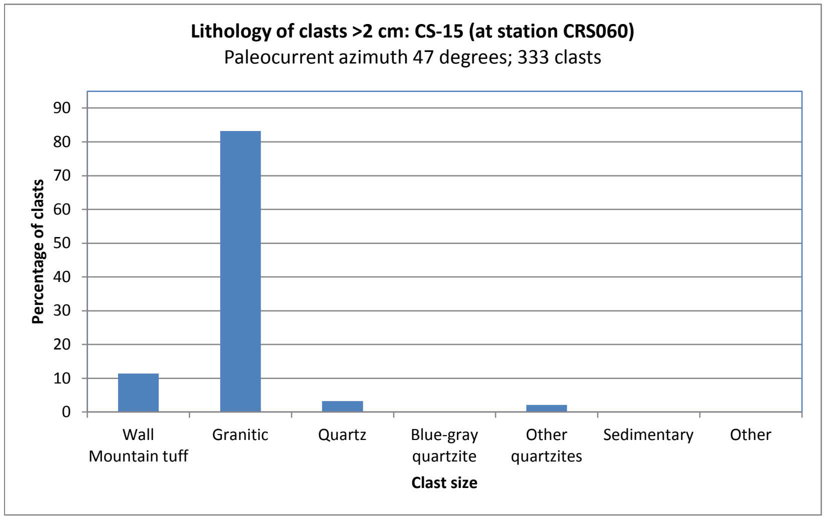


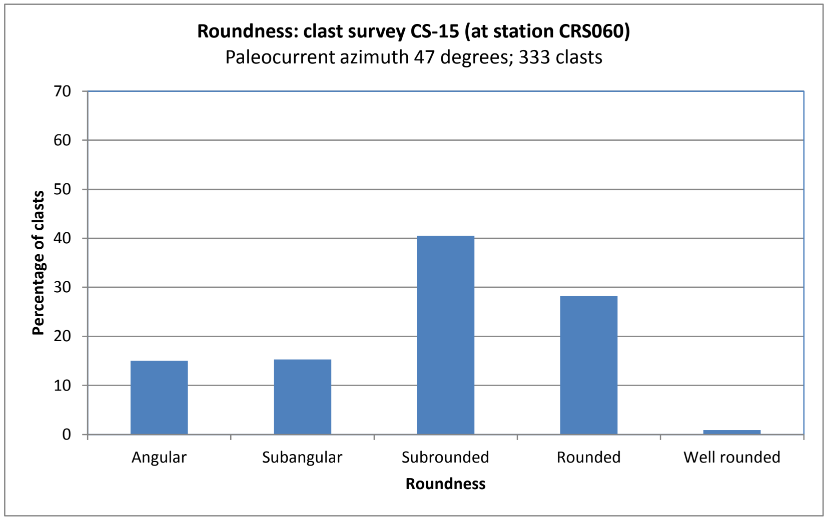
Weighted average clast size = 3.6 centimeters

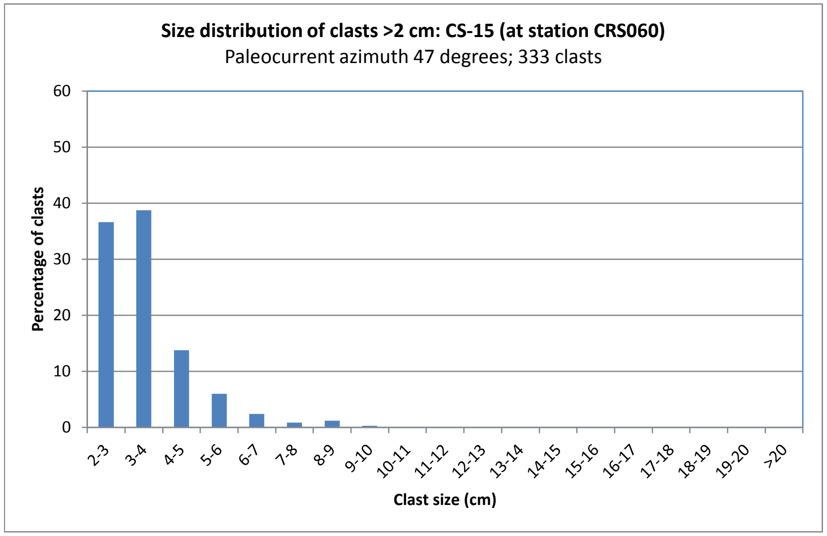
Rounding index = 3.1 (subrounded)

Clast population = 2.9 clasts per square meter

CS-15: LITHOLOGY, CLAST SIZE, AND ROUNDING





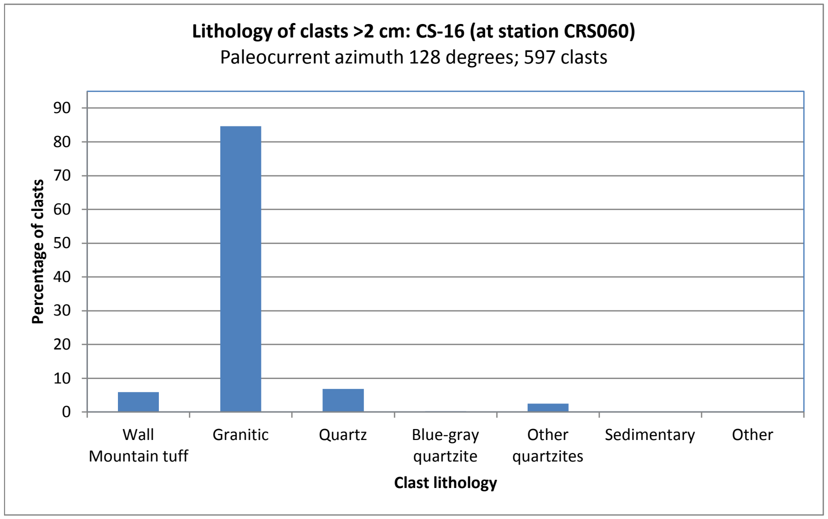


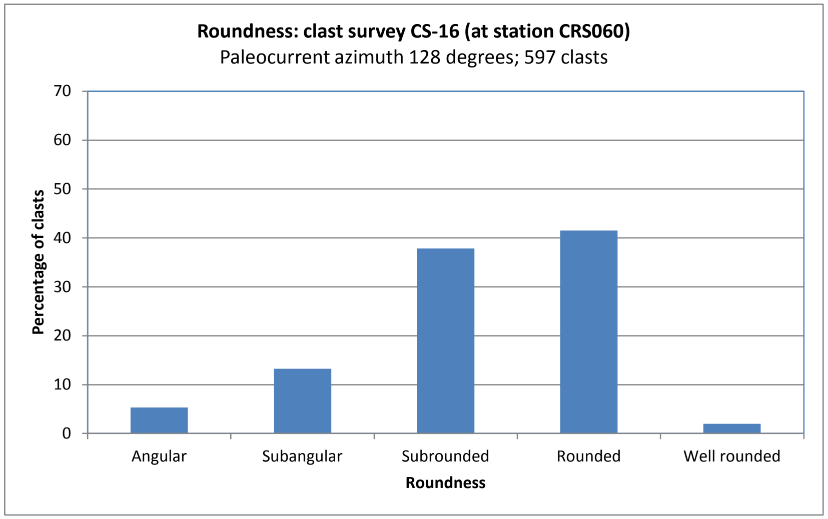
Weighted average clast size = 3.6 centimeters

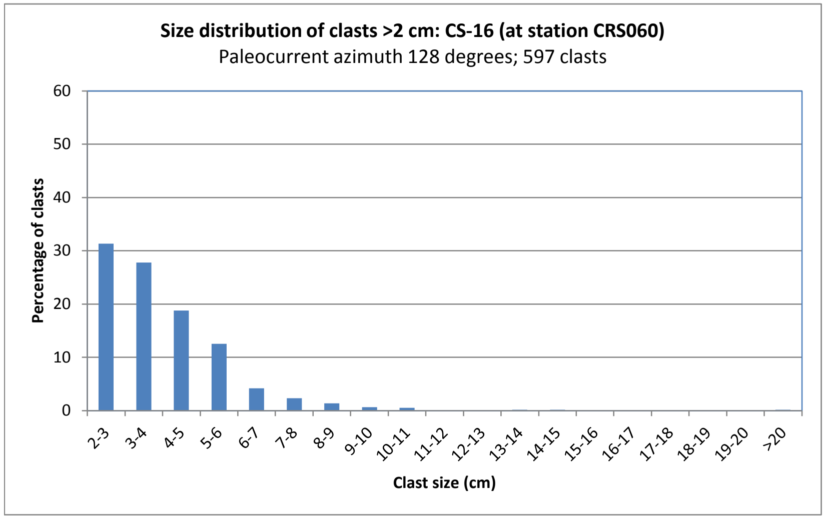
Rounding index = 2.8 (subrounded)

Clast population = 5.2 clasts per square meter

CS-16: LITHOLOGY, CLAST SIZE, AND ROUNDING





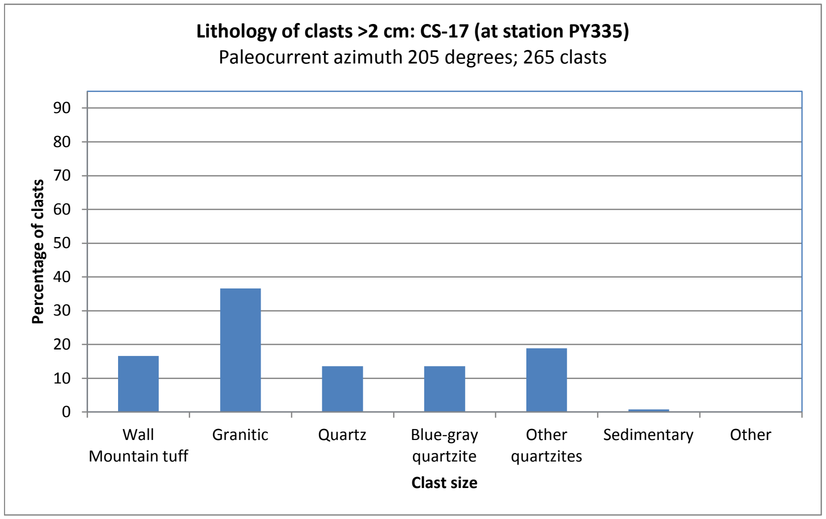


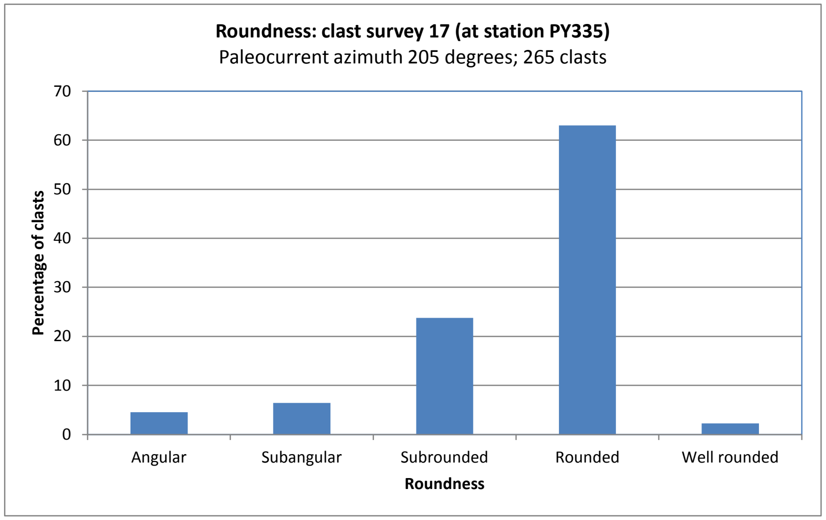
Weighted average clast size = 4.1 centimeters

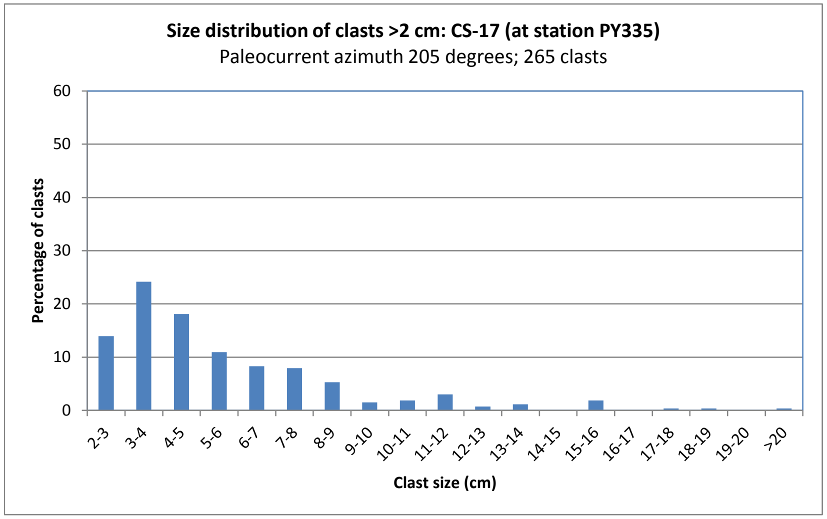
Rounding index = 3.2 (subrounded)

Clast population = 3.9 clasts per square meter

CS-17: LITHOLOGY, CLAST SIZE, AND ROUNDING





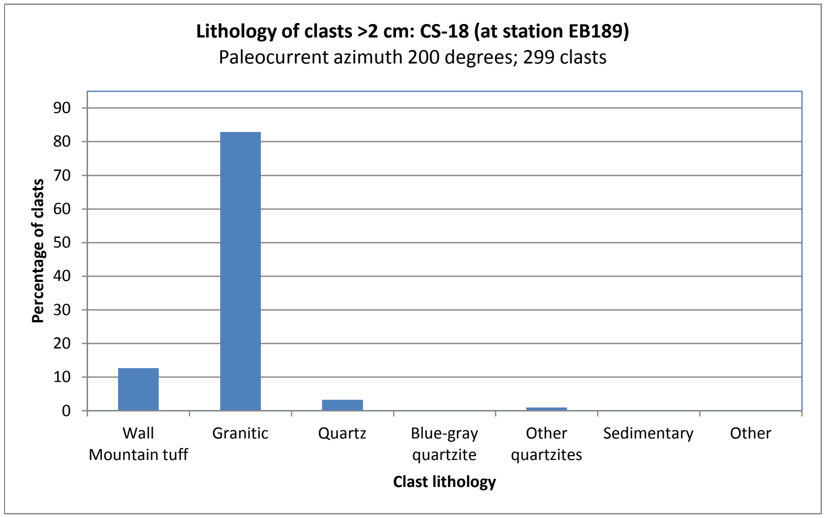


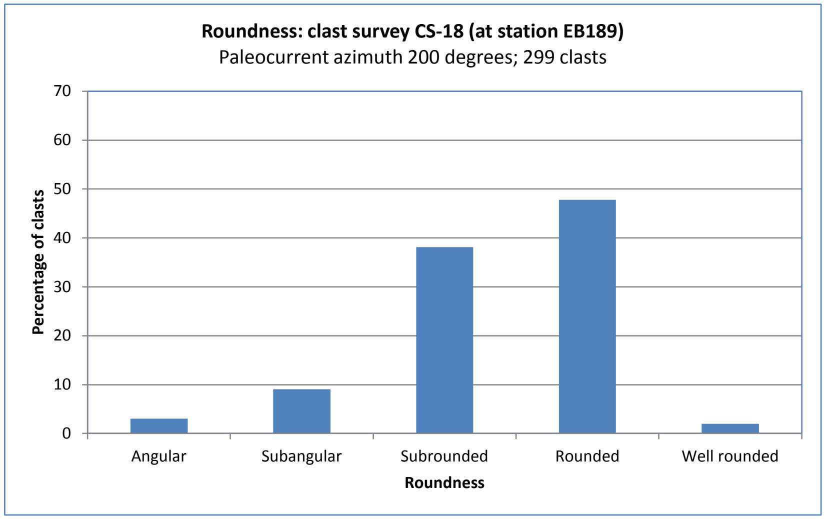
Weighted average clast size = 5.6 centimeters

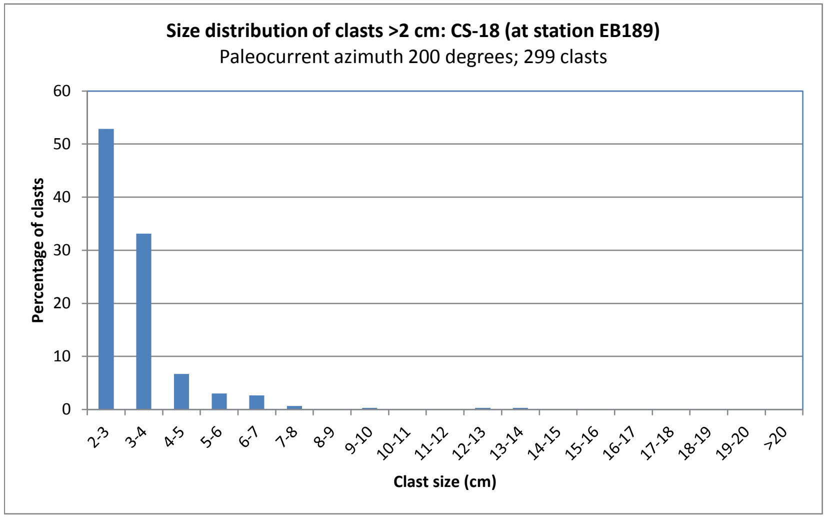
Rounding index = 3.5 (subrounded)

Clast population = 13.3 clasts per square meter

CS-18: LITHOLOGY, CLAST SIZE, AND ROUNDING





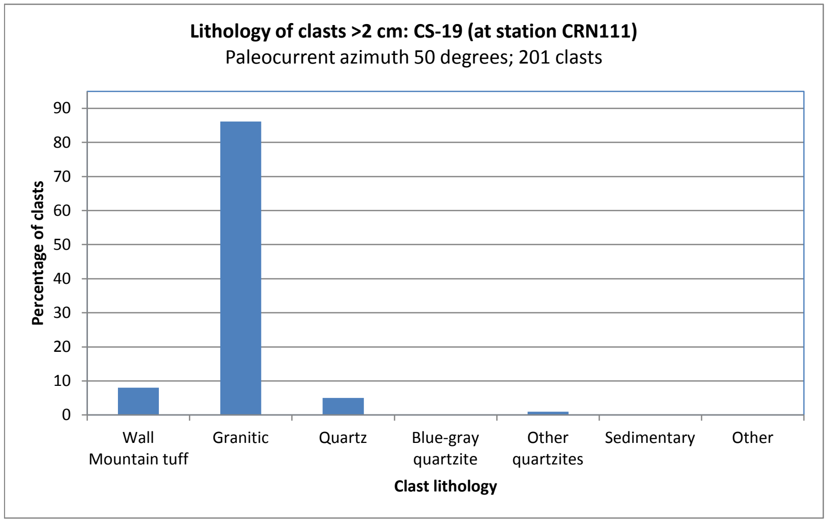


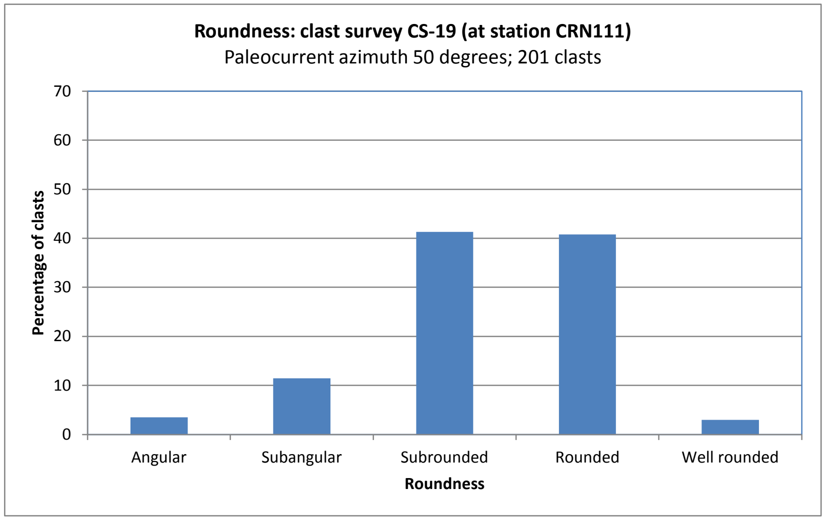
Weighted average clast size = 3.3 centimeters

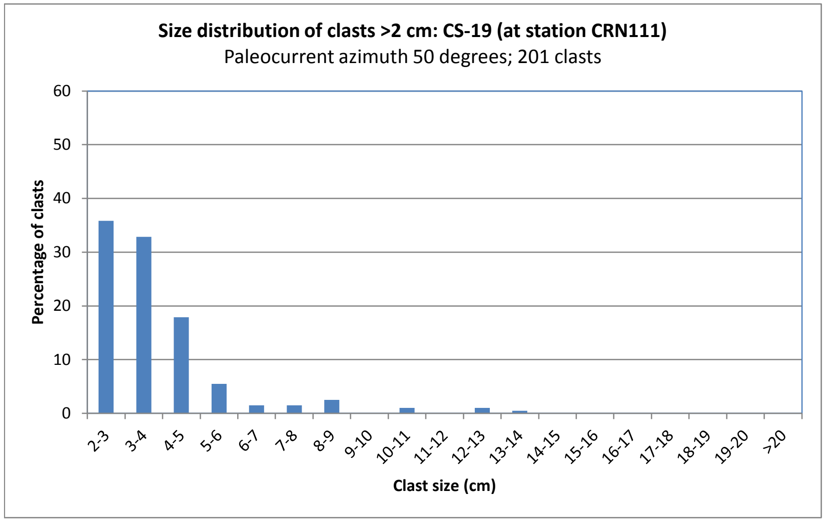
Rounding index = 3.4 (subrounded)

Clast population = 3.3 clasts per square meter

CS-19: LITHOLOGY, CLAST SIZE, AND ROUNDING





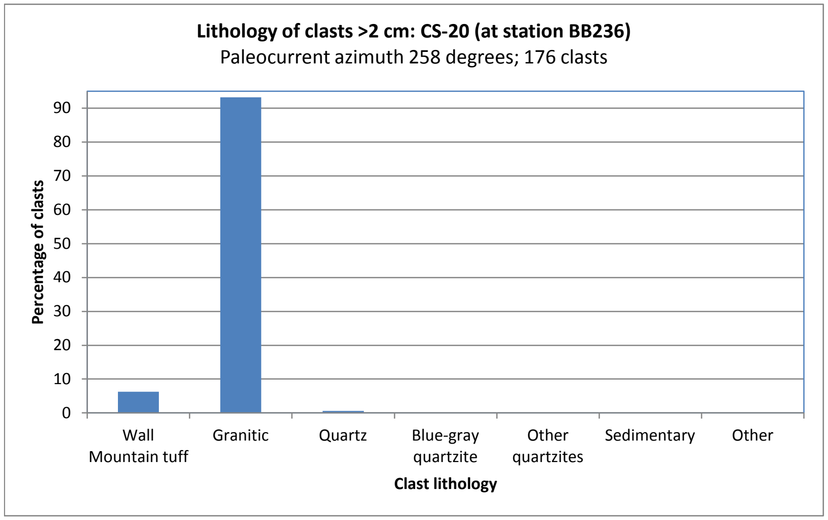


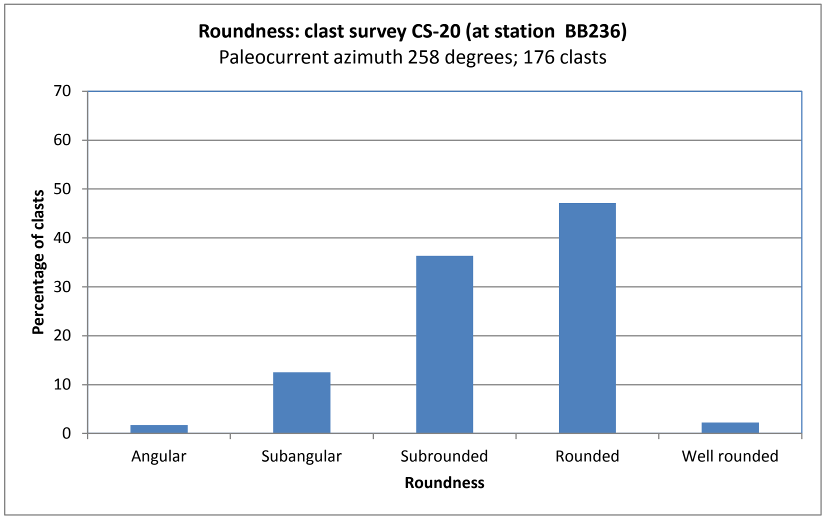
Weighted average clast size = 3.9 centimeters

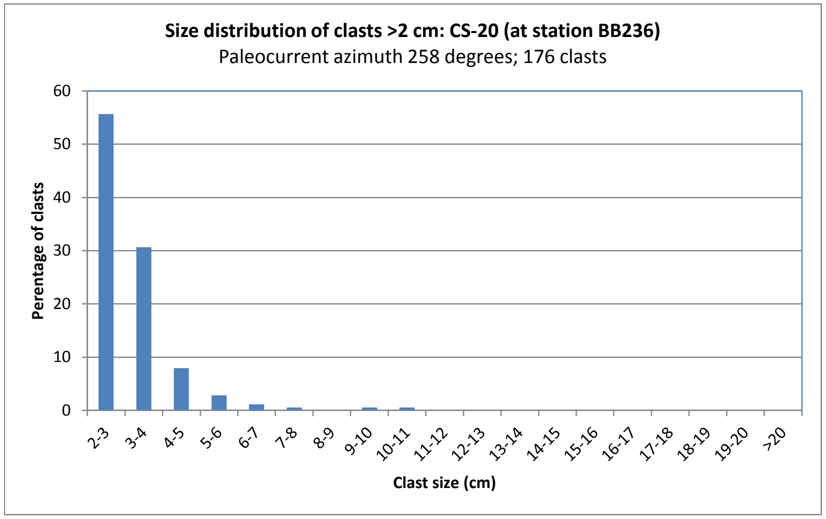
Rounding index = 3.3 (subrounded)

Clast population = 4.3 clasts per square meter

CS-20: LITHOLOGY, CLAST SIZE, AND ROUNDING





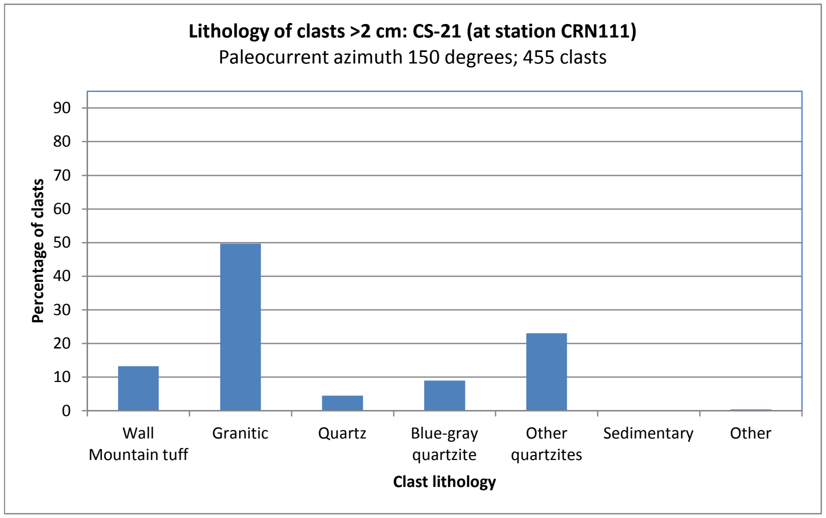


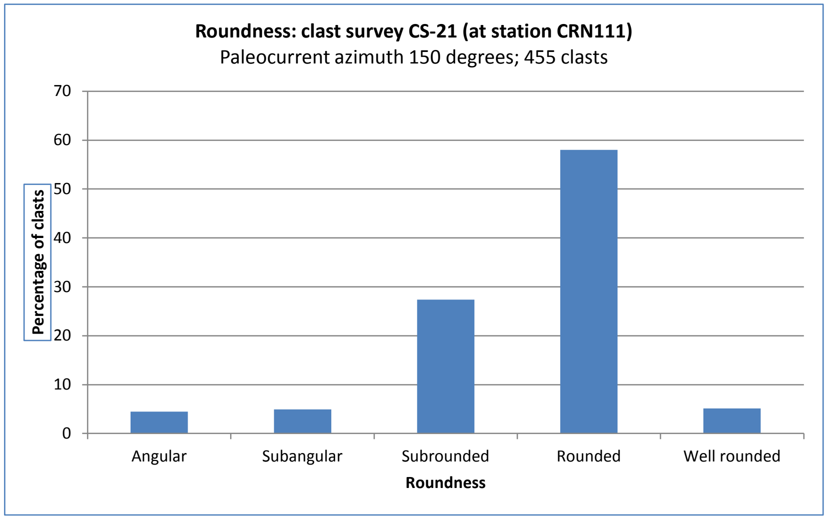
Weighted average clast size = 3.2 centimeters

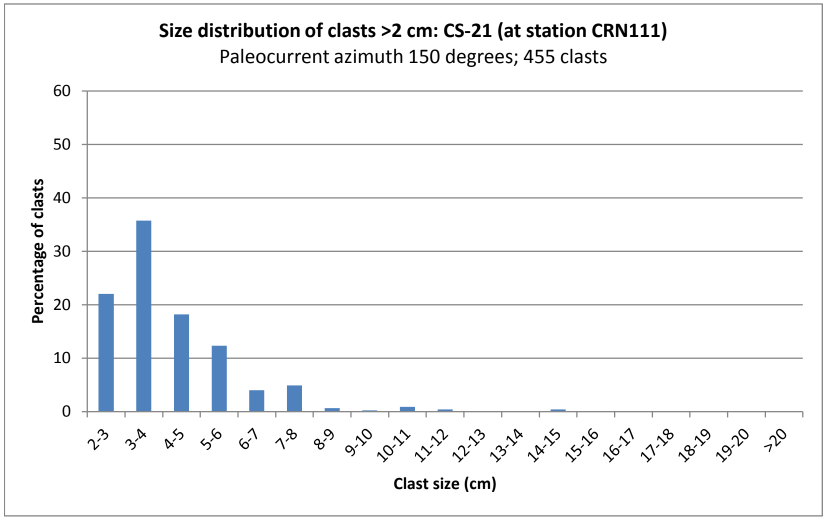
Rounding index = 3.4 (subrounded)

Clast population = 3.4 clasts per square meter

CS-21: LITHOLOGY, CLAST SIZE, AND ROUNDING





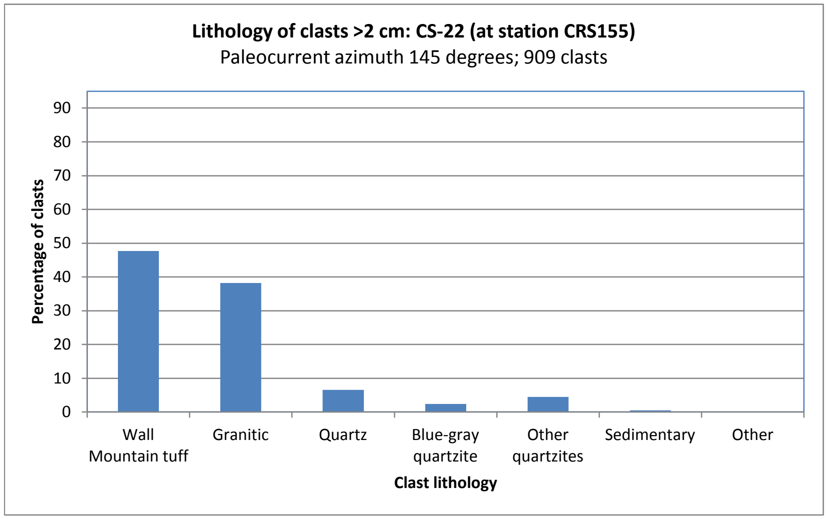


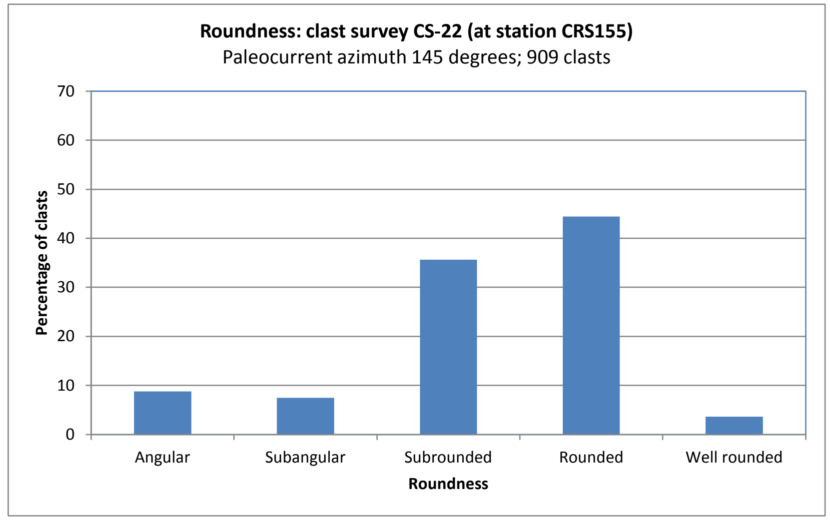
Weighted average clast size = 4.2 centimeters

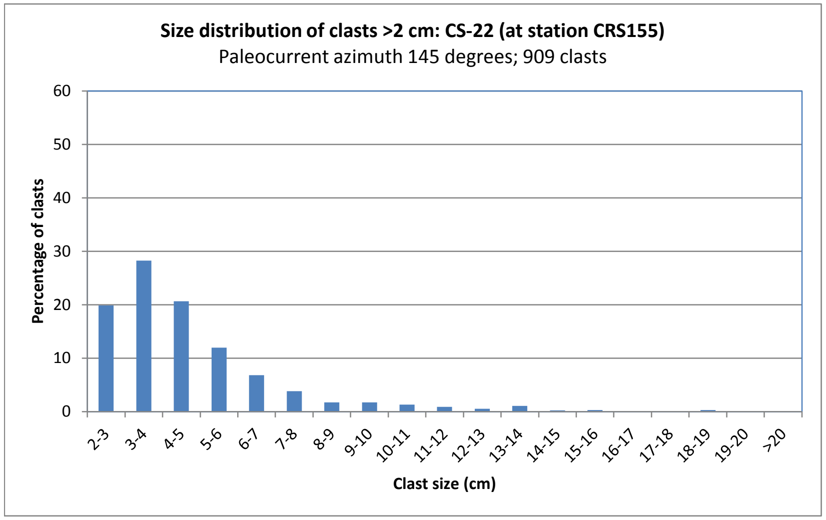
Rounding index = 3.5 (subrounded)

Clast population = 4.8 clasts per square meter

CS-22: LITHOLOGY, CLAST SIZE, AND ROUNDING





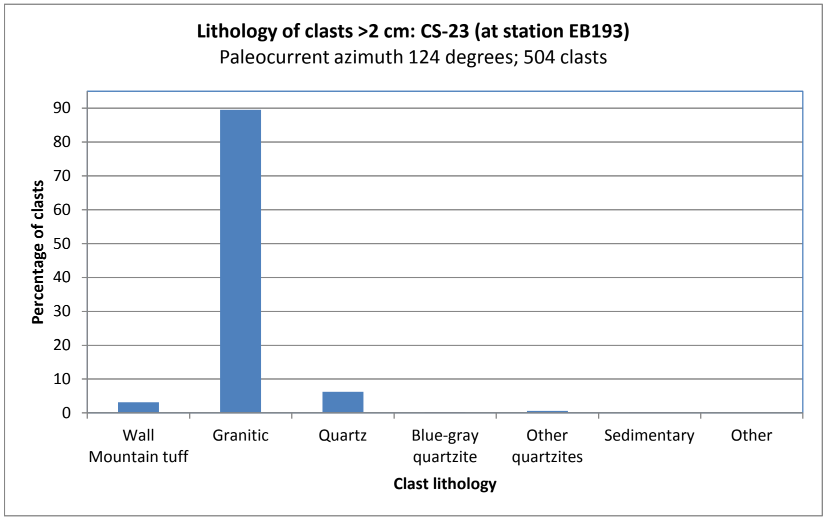


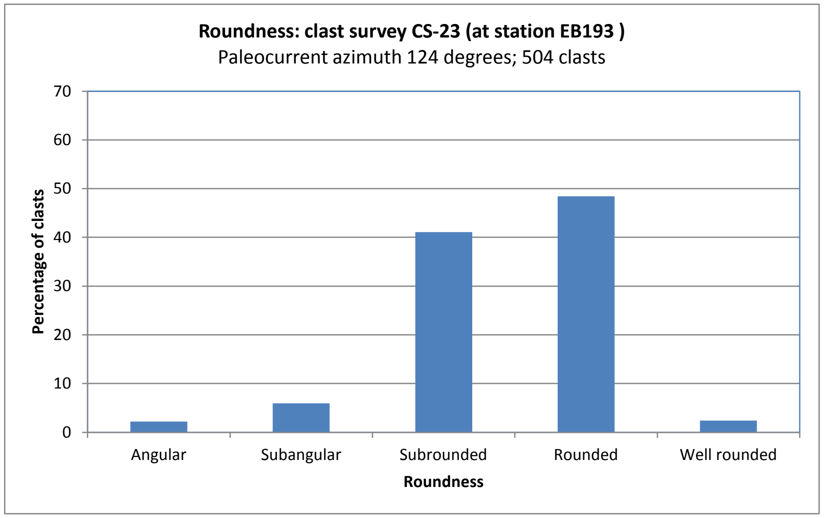
Weighted average clast size = 4.8 centimeters

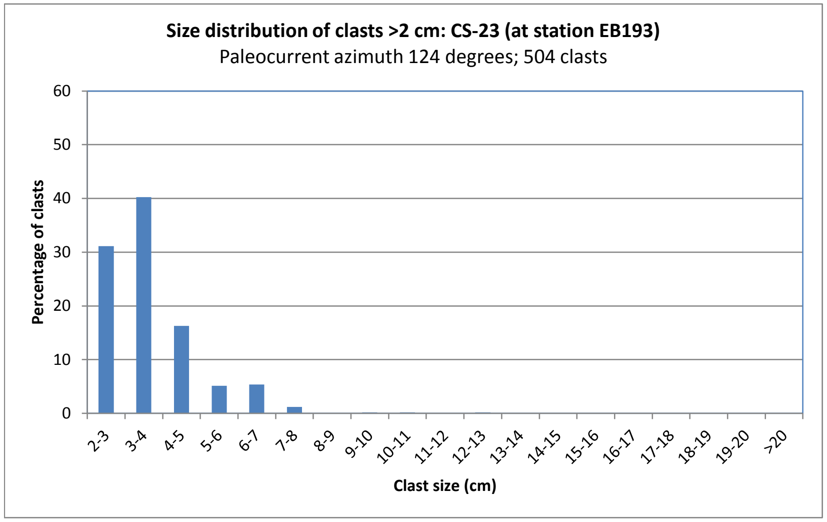
Rounding index = 3.3 (subrounded)

Clast population = 10.3 clasts per square meter

CS-23: LITHOLOGY, CLAST SIZE, AND ROUNDING





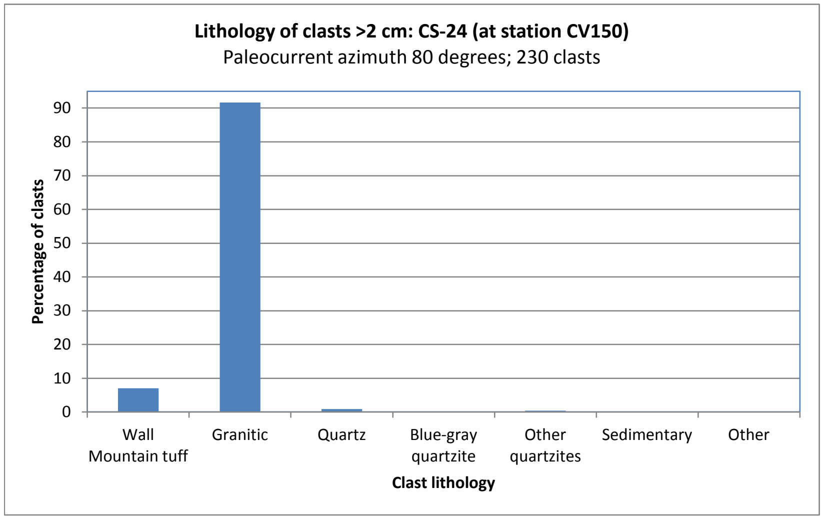


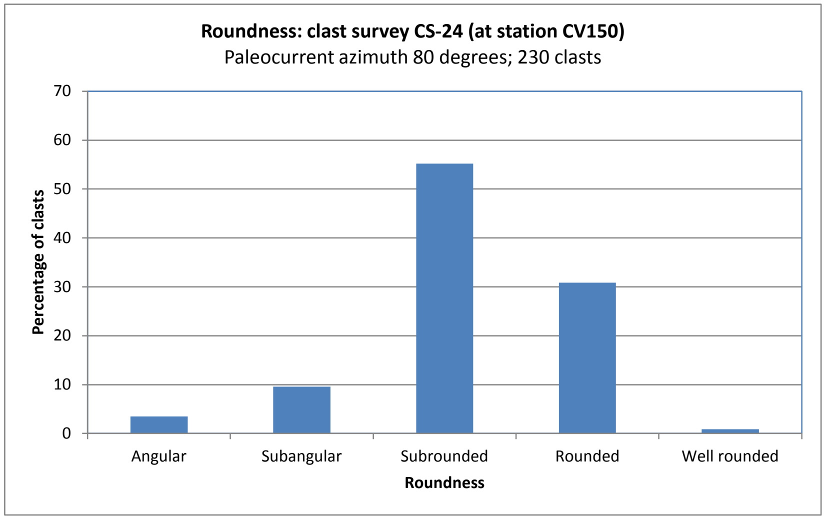
Weighted average clast size = 3.7 centimeters

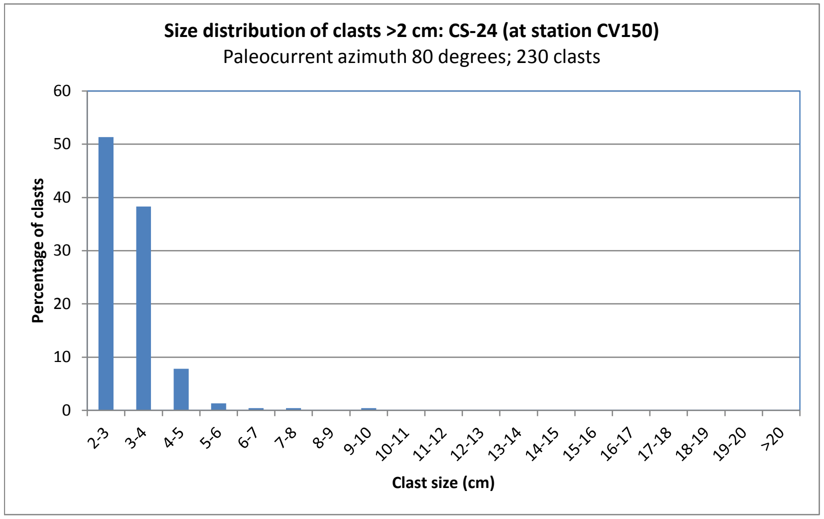
Rounding index = 3.4 (subrounded)

Clast population = 6.5 clasts per square meter

CS-24: LITHOLOGY, CLAST SIZE, AND ROUNDING







Weighted average clast size = 3.1 centimeters

Rounding index = 3.2 (subrounded)

Clast population = 5.0 clasts per square meter