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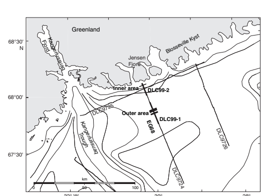
4. Transect EG68 Results[1]

Scientific Party[2]

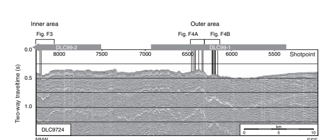
SCIENTIFIC OBJECTIVES

The principal objective of drilling on Transect EG68 was to recover lavas from the East Greenland shelf immediately offshore of the subaerial Paleogene flood province. Such drilling would allow the onshore Paleogene lava stratigraphy to be extended into the zone of seaward-dipping reflectors interpreted as mature ocean crust. Drilling targets were initially selected from two areas along the north-northeast–trending seismic Line DLC9724 (Fig. **F1**). The first target (inner area) was located in the region of smooth ground close to the coast and within the feather edge of the seaward-dipping reflector sequence (Fig. **F2**). Based on extrapolated lava flow orientations, we predicted that basalts recovered from this region would overlap with the highest stratigraphic levels of the subaerially exposed succession (i.e., Skrænterne Formation). The second target area (outer area) was located southeast along the DLC9724 seismic profile immediately landward of the clearly resolved consolidated sediment wedge onlapping the seaward-dipping lavas (Fig. **F2**). Lavas of the latest magnetic Chrons C24r–C23r (i.e., 53–51 Ma) could possibly be exposed in this area, but the magnetic zones and the detailed plate kinematics are poorly constrained (cf. Fig. **F6**). Drilling in this area was intended to sample the stratigraphically youngest lavas of the main seaward-dipping sequence not covered by the thick sediments on the outer shelf.

F1. Transect EG68 area, p. 16.



F2. MCS Line DLC9724, p. 17.



PRINCIPAL RESULTS

A total of 18 sites were drilled on Transect EG68. The two sites drilled in the inner area failed to recover basement because of unexpectedly thick glaciomarine sediment cover. Drilling in the outer area was more successful. Sixteen sites were drilled with a spacing between 50 and 600

[1]Examples of how to reference the whole or part of this volume.
[2]Scientific Party addresses.

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m on two basement highs ~5 km from the consolidated sediment wedge (Fig. F2). Drill sites were usually located on gentle south-southeast–sloping (4°–6°) surfaces immediately seaward of steep north-northwest escarpments recognizable in the sparker profile and interpreted as glacial erosional surfaces controlled by flow morphology and flow orientation.

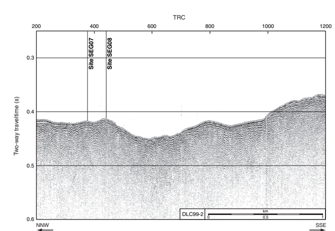
Drilling recovered glaciomarine sediments from most holes. The most common types of sediments are (1) pebble-sized clasts in a matrix of debris mud, (2) sandy diamicton, and (3) bioturbated glaciomarine mud. The original structure and composition of these sediments, however, cannot always be determined because of disturbances caused by the rotary action of the drill and pressure flushing to clear the bit. Basaltic basement was recovered from seven holes. A total of 3.46 m of core was recovered with the longest cores from Holes SEG05B and SEG10B (1.04 and 1.02 m, respectively). All igneous units represent basaltic flows with blocky, fractured, and weathered glacial eroded surfaces.

The individual flows are massive with occasional flow banding, defined by variations in the abundance of vesicles and mesostasis and parallel alignment of plagioclase phenocrysts. The lavas are fine grained and dominantly plagioclase ($An_{73–83}$) glomerophyric with minor amounts of phenocrystic clinopyroxene (Mg number = 0.78–0.81, where Mg number = Mg/[Mg + Fe_{total}] ratio) and olivine. The lavas are evolved olivine basalts with Mg numbers between 0.57 and 0.44 and TiO_2 contents between 1.9 and 2.5 wt%. These basalts are compositionally similar to lavas recovered from Deep Sea Drilling Project Leg 49 (Hole 407), and Ocean Drilling Program Legs 152 (Hole 917A, lower series), and 163 (Hole 988A) (Luyendyk, Cann, et al., 1979; Larsen, Saunders, Clift, et al., 1994; Duncan, Larsen, Allan, et al., 1996). The basalts are also similar in composition to the plateau lavas of East Greenland (Larsen et al., 1989; Tegner et al., 1998). All cores interpreted as in situ basement samples yield reversed magnetic polarity. A single preliminary ^{40}Ar-^{39}Ar age for basalt from Section 163X-SEG10B-1-1 gives an isochron age of 48.4 ± 0.7 Ma (C. Tegner, unpubl. data). Both the paleomagnetic and isochron support a postbreak-up age distinctly younger than expected for the lavas recovered from the outer area.

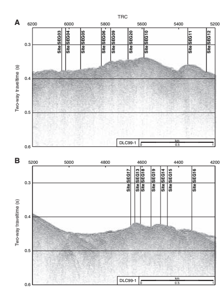
GEOPHYSICS AND SITE SELECTION

Preliminary drill sites were selected from air gun seismic Line DLC9724 (Fig. F2) acquired by the *Dana* cruise (Hopper et al., 1997). Final site selection was made after examination of shipboard sparker profiles following the DLC9724 navigational track. The apparent dip of imaged seaward-dipping reflectors along the proximal portion of DLC9724 is between 15° and 26°, whereas at the seaward end of the line, where the volcanic basement dips below the sediment wedge, the apparent dip decreases to between 10° and 15° (Figs. F3, F4). We interpret the trend of seaward-decreasing dip as reflecting a deeper erosional level within the inner part of seismic Line DLC9724 and a shallower erosional level along the outer part of the line, consistent with the crustal accretion model of Pálmason (1980). Assuming an average dip of 18° for the lavas exposed along the ~30-km-long DLC9724 seismic line implies that as much as 10 km of volcanic stratigraphy may be accessible at the seabed between the coast and the outer sediment wedge. Normal faulting may result in stratigraphic repetition, but large offset faults are not recognized in the seismic data. Nielsen (1978) noted from field

F3. Sparker Line DLC99-2, p. 18.



F4. Sparker Line DLC99-1, p. 19.



mapping that although major normal faults cutting the onshore lava succession were absent, closely spaced small-offset normal faults were recognized in the flexure zone along the coast leading to accentuated dips and, likewise, stratigraphic thickness. Therefore, we consider our estimate of stratigraphic thickness exposed at the seabed as an upper limit, with the additional caveat that if the Pálmason (1980) model applies, the shingled structure of the seaward-dipping reflectors precludes the lava pile from ever reaching a vertical thickness equal to the stratigraphic thickness.

Inner Area

Air gun seismic Line DLC9724 (Fig. **F2**) and sparker seismic Line DLC99-2 (Fig. **F3**) show potential drilling sites close to the coast. Two sites selected from the inner area were drilled (Sites SEG07 and SEG08). Both sites failed to recover basement. Onboard processing of the sparker seismic data improved the resolution at these sites, and it was concluded that the inner shelf had a considerable cover of glaciomarine sediments, possibly between 5 and 10 m thick in places. Based on our re-evaluation of the seismic data, we concluded that further drilling in the inner area would be futile using British Geological Society's Rockdrill fitted with a 3-m drill string.

Outer Area

The location of the outer area along the DLC99-1 sparker seismic line is shown in Figure **F4.** A series of topographic highs, presumably of basement, were selected as targets for drilling. The highs typically have gentle slopes dipping south-southeast and more steeply north-northwest–dipping escarpments facing the opposite direction toward the coast. The latter slopes often cause strong diffraction hyperbolae in the seismic data, which hide the true reflection from the north-northwest–facing steep slopes and suggest that they are made up of acoustically competent material. Some sediment infill, probably glaciomarine, is seen between the highs. This is visible on the DLC9724 air gun line and in particular on the DLC99-1 sparker line (Fig. **F4**). On the sparker line, the maximum thickness of the sediment is ~40 m, although it is generally much less. Clear reflections are rarely seen between the glaciomarine cover and the underlying basalt. The sediments, therefore, are primarily recognized because of the shape and internal seismic structure of the fills. In practice, we were only able to resolve sediment covers that exceeded 3 m from the sparker seismic data. This permitted us to eliminate many target areas that had excessively thick glaciomarine covers, but it did not guarantee sediment-free conditions at a site judged most promising based on the sparker data.

The more gently south-southeast–dipping slopes of the basement highs dip at 4° to 6° and are interpreted as representing more or less stratigraphically controlled erosional surfaces. These most likely are flow boundaries along which glacial erosion has carved out the less competent flow tops and thin interbedded sediments or soil horizons. Similarly, the north-northwest–facing escarpments are interpreted as "trap" morphology with steep erosional surfaces following original subvertical fractures. The sparker seismic data also show that at least some of the steep landward escarpments are blanketed with glaciomarine sediment, as are the flat terraces showing strong seismic diffractions.

A large number of possible drill sites on basement highs were selected on the sparker seismic Line DLC99-1 within a ~10-km-wide region ~40 km from the coast. Of these, 16 sites were drilled within a 5-km-wide zone (Fig. **F4**). Two marked basement highs of the type described above with long, gentle south-southeast–dipping slopes and steep escarpments to the north-northwest are centrally located within the drilling region.

OPERATIONS

The Shipboard Scientific Party boarded the *Aranda* in the port of Leith, Scotland, on 17 August 1999. After three days of mobilization, all equipment was loaded and installed. Following minor modifications, launching and recovery of the drill rig was tested successfully. We established the core cutting facility, thin section preparation laboratory, computer network, and digital photography studio prior to departing for the East Greenland coastal region on 20 August. The 5 days of transit from Leith to East Greenland were used to finalize installation, test equipment, and develop working schedules. A summary of the geographic locations of the drilled sites is given in Table **T1.**

T1. Core summaries, p. 22.

We arrived in the Transect EG68 area around midday on 25 August and immediately began collecting the first 22-km-long sparker seismic line, DLC99-1, using the BGS sparker and single-channel streamer. The first drill site (SEG03) was occupied in the late afternoon, and drilling commenced once it had been confirmed that the ship's dynamic positioning system was able to hold station using the Global Positioning System (GPS) with differential corrections from shore-based radio transmitters. During the night, four largely unsuccessful coring attempts were made, with only minor recovery of mud from one hole and more mud recovered on the drill rig frame. A calculation error in the navigational correction that resulted in an offset between the target and actual drill position of ~30 m was discovered and corrected.

We moved to Site SEG04 on the morning of 26 August, where we cored the first lava. An electrical fault in the drill rig transformer forced a pause in drilling. This fault was temporarily corrected with an auxiliary cable that subsequently caused an increase in the time needed to deploy and recover the rig. Drilling operations were resumed at Site SEG04 and continued at Sites SEG05 and SEG06 before unstable weather with gale force wind in the late afternoon necessitated a halt to all operations. Shelter was found in the entrance of J.A.D. Jensen Fjord, allowing repair of the drill rig transformer and cables and reestablishing full functionality of the drill rig.

The wind decreased sufficiently by the morning of 28 August to continue operations. The 10-km-long sparker Line DLC99-2 was collected before drilling started in the afternoon. Fine weather allowed drilling at Sites SEG07–SEG20 and redrilling of the successful Site SEG05. Sites SEG13 and SEG16 were terminated because the ship lost position. A total of 32 km of sparker seismic lines were collected and 18 sites drilled on this first transect.

Because of increasing wind and sea state in the late evening of 30 August, we stopped operations and sailed for Ammassalik, South Greenland, where we docked on the morning of 1 September after rough sailing in a storm with wind speeds up to 28 m/s. The port call in Ammassalik was additionally demanded by the necessary installation of a receiver to obtain GPS differential corrections from satellite instead of relying on shore-based radio beacons, which in future transect areas would be too distal to give a reliable signal. Installation and trials were finalized on the morning of 2 September, after which we left Ammassalik, sailing toward Transect EG65.

SITE SUMMARIES

Brief descriptions of cores recovered from 36 holes drilled at 18 different sites along Transect EG68 are provided in the following sections. A summary of the drilled sites and their recoveries is given in Table **T1**. Basement drilling on this transect was hampered by a cover of glaciomarine sediment of variable thickness containing a high proportion of gravel- to boulder-sized clasts. Drilling in seven of the 36 attempted holes failed to recover any material. Drilling in eight holes recovered only unconsolidated sediment, whereas drilling in the remaining holes successfully recovered either basement lithologies or basalt fragments from the base of the holes. Some of these basalt fragments are interpreted to be derived from the local volcanic basement.

In this presentation we follow the unit classification scheme discussed in the **"Explanatory Notes"** chapter. The overburden of unconsolidated sediment is classified as mud, diamicton, diamicton clasts, or basaltic gravel. All of these sediments are logged using the unit prefix "S." The term "diamicton" is used exclusively to describe core "consisting of sand and/or larger particles dispersed through a muddy matrix" (Flint et al., 1960). Most often the muddy matrix and sand particles were washed from the hole, leaving only a concentration of pebble- to cobble-sized clasts. When these clasts represent different rock lithologies or are nonbasaltic in nature, we classify the material as diamicton clasts. If the clasts are solely basaltic and are petrographically identical based on hand sample examination, we classify the material as basaltic gravel. Basaltic gravel may be derived from mechanical weathering of the local basement or may be of unknown origin. We limit our usage of the term "scree" in the following site summaries for those cases when (1) the basaltic gravel is found directly overlying cored basement with the same lithologic character or (2) holes at the same site recovered lithologically identical basaltic gravel.

As explained in the **"Explanatory Notes"** chapter, the unit prefix "C" is used for logging fragments of basalt that are large enough to be cored and recovered from the bottom of the core barrel or from the core catcher. From features of the core or from the drillers' log such units cannot be regarded as in situ basement. If we recovered indistinguishable material from adjacent holes at the same site, we infer that this cored material represents the local basement lithology.

Site SEG03

Holes SEG03A (Unit S-1), SEG03B (no recovery), SEG03C (no recovery), and SEG03D (no recovery)

Drilling in Hole SEG03A penetrated 1.03 m of glaciomarine sediments and recovered 40 cm of mud (Unit S-1) composed of moderately well sorted, grayish brown sediment ranging in grain size from clay to sand with the silty fraction dominating. The sandy fraction contains a high proportion of subangular basalt fragments and minor amounts of quartz. The sediment is largely structureless, except for subtle gray bands at 20 and 39 cm from the top of the unit and 0.5- to 1-cm-diameter vertical gray burrows near the base of the unit. The volcanic basement was not sampled at Site SEG03.

Site SEG04

Holes SEG04A (Units C-1, S-1, and I-1) and SEG04B (Units S-1 and I-1)

Drilling in both holes at this site sampled lithologically similar units. Drilling in Hole SEG04A began coring at 1.70 meters below seafloor (mbsf) and terminated at 2.24 mbsf. Unit C-1 is a ~4-cm-long cored fragment of sparsely clinopyroxene phyric basalt similar to the aphyric basalt described as Unit I-1. Unit S-1 is an interval of lithologically similar pieces of basaltic gravel, and together Units C-1 and S-1 are interpreted as scree from basement rock. Unit I-1 is a highly fractured, fine-grained, aphyric basalt. Small subspherical vesicles are filled with calcite and bluish green clay. Millimeter-wide fractures are filled dominantly by calcite. Drilling in Hole SEG04B started coring at 1.35 mbsf and ended at 1.60 mbsf. Unit S-1 is a diamicton composed of moderately well sorted sediment ranging in grain size from clay to pebble. The gravel- to pebble-sized clasts are subangular, sparsely clinopyroxene phyric basalt. The clasts are concentrated toward the base of the unit where a weak normal grading is apparent. Basaltic clasts in Unit S-1 are lithologically identical to Unit I-1 in this hole and are interpreted as scree similar to Unit S-1 of Hole SEG04A. Unit I-1 is described in thin section as a highly fractured, fine-grained, amygdaloidal, sparsely clinopyroxene phyric basalt indistinguishable from Unit I-1 in Hole SEG04A. We conclude that the volcanic basement was sampled at Site SEG04.

Site SEG05

Holes SEG05A (Unit S-1), SEG05B (Unit I-1), SEG05C (Unit S-1), and SEG05D (Units S-1 and C-1)

Four holes were drilled at Site SEG05. The drillers' logs for Holes SEG05A and SEG05C report penetration of 0.20 and 0.58 m of overburden, respectively, before coring began. These holes were cored to final depths of 1.20 and 1.10 mbsf, respectively. Diamicton composed of poorly sorted clay- to pebble-sized particles was recovered in both holes. Unit S-1 of Hole SEG05A contains subangular basaltic pebbles suspended in a mud matrix of clay to silt that displays a change in color from brown in the upper 15 cm to grayish brown in the lower 15 cm of the unit. Unit S-1 of Hole SEG05C is a poorly sorted, dark gray diamicton containing subangular to rounded basalt clasts. Pebble-sized clasts are concentrated at the top and bottom of the cored interval, grading to a granule-sized fraction in the central part of the cored unit. Hole SEG05B was cored from 1.00 mbsf and was terminated at 1.91 mbsf. A single igneous unit (Unit I-1) was recovered, consisting of moderately altered, highly plagioclase-olivine-clinopyroxene phyric basalt with abundant large (2–8 mm long) plagioclase (± olivine and clinopyroxene) glomerocrysts. Based on the visually estimated mode, the phenocryst assemblage is 15% plagioclase, 5% olivine, and trace amounts (<1%) of clinopyroxene. Drilling in Holes SEG05C and SEG05D was undertaken to confirm the recovery of basement in Hole SEG05B. As discussed above, Hole SEG05C did not reach basement. Drilling in Hole

SEG05D began coring at 0.56 mbsf and terminated at 1.90 mbsf. Two units were recovered. Unit S-1 is a poorly sorted, grayish brown diamicton similar to the sediments recovered in the other holes at Site SEG05. The bottom portion of core from Hole SEG05D consists of cored fragments of highly plagioclase-clinopyroxene-olivine phyric basalt (Unit C-1), lithologically indistinguishable from Unit I-1 in Hole SEG05B. Based on this recovery it was concluded that the volcanic basement was sampled at Site SEG05.

Site SEG06

Hole SEG06A (Units S-1 and C-1)

Coring in Hole SEG06A began at 1.00 mbsf and terminated at 2.46 mbsf. Two units were recovered. Unit S-1 is 0.56 m of poorly sorted dark gray diamicton composed of clay- to cobble-sized particles. Large (<1–5 cm in diameter) subangular clasts of basalt are concentrated toward the bottom of the unit. Unit C-1 is 9 cm and composed of cored fragments of sparsely plagioclase-clinopyroxene phyric basalt, lithologically similar to clasts found near the base of Unit S-1. This hole was abandoned because of severe weather conditions. The drillers' log for this hole indicates that solid ground was being cored; however, we were unable to confirm recovery of the volcanic basement by drilling a second hole at Site SEG06.

Site SEG07

Hole SEG07A (Units S-1 and C-1)

Coring in Hole SEG07A began at 1.80 mbsf and terminated at 3.00 mbsf. Unit S-1 is composed of small angular fragments of sparsely plagioclase phyric basaltic gravel. Unit C-1 is a 13-cm-long core of sparsely plagioclase phyric basalt. According to the drillers' log, soft ground was encountered below 1.92 mbsf. This observation suggests that Unit C-1 is a glacial boulder and that the volcanic basement was not sampled at Site SEG07.

Site SEG08

Hole SEG08A (Unit C-1)

Coring in Hole SEG08A began at 1.68 mbsf and terminated at 3.03 mbsf. Unit C-1 is composed of several cored fragments totaling 19 cm of fine-grained aphyric basalt. Some clasts are well-rounded, possibly from abrasion during coring; however, the bottom piece was not cored entirely and its base was rounded. These latter features suggest that material in Unit C-1 is either scree lying above the basement or it is parts of a glacial boulder. While the fractured nature of the recovered core might suggest that the former is more likely, drilling penetrated to the maximum depth of 3 m, with faster penetration below 2.2 m, which is more consistent with the latter origin. It was concluded that direct sampling of volcanic basement would not be possible and, therefore, Site SEG08 was abandoned.

Site SEG09

Holes SEG09A (Units S-1 and C-1) and SEG09B (Unit C-1)

Two holes were drilled at this site. Coring in Hole SEG09A began at 0.85 mbsf and terminated at 1.93 mbsf. Two units were recovered from Hole SEG09A. Unit S-1 is composed of highly weathered fragments of basalt and is classified as basaltic gravel. Unit C-1 is an assortment of large cored fragments of sparsely plagioclase phyric basalt. Coring in Hole SEG09B began 0.55 mbsf and terminated at 1.60 mbsf. Unit C-1 recovered from this hole is composed of cored fragments of highly plagioclase-clinopyroxene phyric basalt similar to Unit I-1 recovered from Hole SEG05B and to clasts from Unit S-1 in Hole SEG20B. The similarities between basaltic rocks recovered at this site and neighboring sites (Sites SEG05 and SEG20) suggest that plagioclase (± clinopyroxene) phyric basalt is a fairly extensive basement lithology in this region and that the volcanic basement was sampled at Site SEG09.

Site SEG10

Holes SEG10A (Units S-1 and C-1) and SEG10B (Units S-1 and I-1)

Two holes were drilled at this site. Coring in Hole SEG10A began at 0.54 mbsf and terminated at 1.22 mbsf. Unit S-1 is composed of pebble-sized, subangular, aphyric basalt clasts and is classified as basaltic gravel. One clast was found with live corals attached. Unit C-1 is a large cored clast of aphyric basalt, lithologically identical to the fragments in Unit S-1. Coring began in Hole SEG10B at 0.58 mbsf and terminated at 1.92 mbsf. Unit S-1 is composed of aphyric basaltic gravel, lithologically identical to the underlying Unit I-1. Unit I-1 is 1.02 m of fine-grained aphyric basalt with distinctive banding defined by variations in the abundance of mesostasis and flattened vesicles. Groundmass plagioclase laths display trachytic texture subparallel to the banding. Based on the similarities of the volcanic rocks, it was concluded that volcanic basement was sampled in both holes at Site SEG10.

Site SEG11

Holes SEG11A (Units S-1 and I-1), SEG11B (no recovery), SEG11C (Units S-1 and C-1), and SEG11D (no recovery)

Four holes were drilled at this site, but material was recovered only from Holes SEG11A and SEG11C. Coring in Hole SEG11A began at 0.68 mbsf and terminated at 0.83 mbsf. Unit S-1 is a basaltic gravel lithologically identical to Unit I-1. Unit I-1 is a 13-cm-long core of slightly altered, highly plagioclase-clinopyroxene phyric basalt containing 15% plagioclase and 2% clinopyroxene phenocrysts based on the visually estimated mode. Plagioclase glomerocrysts are abundant. Coring in Hole SEG11C began at 0.93 mbsf and terminated at 1.20 mbsf. Unit S-1 is 0.12 m of diamicton composed of mud with angular fragments of weathered basalt. Unit C-1 is composed of large cored fragments of slightly altered, moderately plagioclase-clinopyroxene phyric basalt, lithologically identical to Unit I-1 in Hole SEG11A. Based on the similarities of rocks recovered from these holes it was concluded that the volcanic basement was sampled at Site SEG11.

Site SEG12

Hole SEG12A (Unit I-1)

Coring began in Hole SEG12A at 0.35 mbsf and terminated at 0.87 mbsf. A total of 0.59 m composed of slightly altered, moderately plagioclase-clinopyroxene phyric basalt (Unit I-1) was recovered from this hole. This igneous unit was interpreted to be the volcanic basement.

Site SEG13

Hole SEG13A (Unit C-1), SEG13B (no recovery), and SEG13C (Units C-1 and I-1)

Three holes were drilled at Site SEG13. Material was recovered only from Holes SEG13A and SEG13C. Coring in Hole SEG13A began at 0.40 mbsf and terminated at 0.68 mbsf. Unit C-1 is composed of cored clasts of aphyric basalt. Coring in Hole SEG13C commenced at 0.57 mbsf and ended at 0.93 mbsf. Unit C-1 from Hole SEG13C is composed of several cored fragments of sparsely plagioclase-clinopyroxene-olivine phyric basalt resembling Unit I-1 from this hole, but with a slightly lower proportion of phenocrysts. Unit I-1 is a fine-grained, moderately plagioclase-clinopyroxene-olivine phyric basalt containing 1- to 2-mm-long plagioclase laths forming glomerocrysts with clinopyroxene. This igneous unit was interpreted as the volcanic basement.

Site SEG14

Hole SEG14A (Units S-1 and C-1)

Coring began in this hole at 0.55 mbsf and terminated at 2.22 mbsf. Unit S-1 is a very poorly sorted diamicton with variations in grain size from clay to pebble with the granule fraction dominating. The pebble-sized clasts are subangular basalt fragments. Unit C-1 is 7 cm of sparsely olivine phyric basalt. A fresh broken surface is found at the base of Unit C-1. This unit was interpreted as representing the volcanic basement.

Site SEG15

Hole SEG15A (Unit S-1)

Coring in this hole began at 0.83 mbsf and terminated at 3.08 mbsf. Unit S-1 is 0.35 cm of diamicton composed of moderately well sorted mud ranging in grain size from clay to coarse sand, with the major part of the mud in the silt fraction. The sandy fraction contains subangular basaltic clasts. The color of Unit S-1 grades from brown to gray downward to 22 cm. Below 22 cm, the unit contains a poorly sorted diamicton with pebble-sized, subangular to subrounded basaltic clasts. Basement was not directly sampled at this site because of the thick sediment cover.

Site SEG16

Holes SEG16A (Units S-1 and C-1) and SEG16B (Unit S-1)

Coring in Hole SEG16A began at 1.29 mbsf and terminated at 1.36 mbsf. Unit S-1 is a diamicton composed of poorly sorted, grayish brown silty mud with pebble-sized, subangular basaltic clasts. Unit C-1 sampled an 11-cm-long clast of amygdaloidal, moderately clinopyroxene-plagioclase phyric basalt with a mottled appearance and faint "flow" banding similar to that seen in Unit I-1 of Hole SEG10B. Coring in Hole SEG16B began at 0.80 mbsf and ended at 2.89 mbsf. Only 10 cm of diamicton, composed of small amounts of mud- and pebble-sized basalt clasts, was recovered (Unit S-1). Because of the limited recovery in this hole we were unable to confirm that the volcanic basement was sampled at this site; however, the similarities between Unit C-1 from Hole SEG16A and basement material recovered at Site SEG10 are noteworthy.

Site SEG17

Holes SEG17A (Unit S-1) and SEG17B (Subunits S-1A and S-1B)

Coring in Hole SEG17A began at 0.94 mbsf and terminated at 0.99 mbsf. The sediment recovered (Unit S-1) is composed of 15 cm of subangular fragments of aphyric basalt and classified as basaltic gravel. It is unknown at what point drilling began in Hole SEG17B, but it terminated at 2.00 mbsf. Two subunits are identified in this core. Subunit S-1A is 0.51 m of diamicton composed of pebble- to gravel-sized clasts in a matrix of mud. Subunit S-1B is composed of rounded to angular aphyric basalt clasts, also classified as basaltic gravel. It was concluded from the limited and uncertain nature of the basaltic material collected at these holes that the volcanic basement was not sampled at Site SEG17.

Site SEG18

Hole SEG18A (Units S-1 and C-1)

Coring in this hole began at an unknown depth and terminated at 3.00 mbsf. Unit S-1 is a diamicton composed of subangular fragments of basalt in a mud matrix. Unit C-1 is composed of 5 cm of large cored clasts of aphyric basalt. It was concluded that the volcanic basement was not sampled at Site SEG18.

Site SEG19

Holes SEG19A (Units S-1 and C-1) and SEG19B (Units S-1 and C-1)

Coring in Hole SEG19A began at an unknown depth and terminated at 0.66 mbsf. Unit S-1 is composed of pebble-sized fragments of medium-grained granite and weathered basalt. This unit was classified as diamicton clasts. Unit C-1 is an 8-cm-long cored fragment of fine-grained, glomerocrystic, sparsely plagioclase-clinopyroxene phyric basalt. In Hole SEG19B a similar interval between 0.68 and 0.74 mbsf was cored and similar lithologic units were recovered. In particular, Unit C-1 has a moderately clinopyroxene-plagioclase phyric basalt lithologically similar to Unit C-1 in Hole SEG19A, suggesting that the lava present at this site is a sparsely plagioclase-clinopyroxene phyric basalt and that the volcanic basement was cored at Site SEG19.

Site SEG20

Holes SEG20A (no recovery) and SEG20B (Unit S-1)

No material was recovered from Hole SEG20A. Hole SEG20B began coring at 1.58 mbsf and terminated at 2.50 mbsf. Unit S-1 is an assortment of gravel- to pebble-sized clasts and cored fragments of plagioclase phyric basalt classified as basaltic gravel. It was concluded that the volcanic basement was not sampled at Site SEG20.

SEDIMENTARY PETROLOGY

Unconsolidated sedimentary units were collected from most of the Transect EG68 holes. Intact, moderately sorted mud with evidence of bioturbation was only occasionally recovered (e.g., Hole SEG03A), but mud often adhered to the drill frame. This type of glaciomarine sediment is structureless mud and ranges in grain size from clay to coarse sand but with the modal grain size dominantly in the silt fraction. The sandy fraction contains subangular fragments of basaltic origin and often a minor content of quartz grains.

Massive sandy diamicton is by far the most common sediment type recovered (Holes SEG04B, SEG05A, SEG05C, SEG05D, SEG06A, SEG11C, SEG14A, SEG15A, SEG16A, SEG17B, and SEG18A). The diamicton is an unconsolidated, poorly to moderately sorted sediment that often occurs with large “floating” and pebble-sized subangular to rounded fragments (e.g., Holes SEG04B and SEG05A). The grain sizes range from clay to pebble with the modal grain size in the silt to sand fractions. The larger pebble-sized clasts are subangular to subrounded with occasional striations and weathered surfaces. The fragments are mostly basaltic, but gneissic and sandstone fragments also occur. There often seems to be a normal gradational contact toward the underlying basaltic basement, both in the grain size and in the content of fragments (Holes SEG04B and SEG06A). However, often the fine mud fraction was washed out by the drilling, leaving a residue of pebble to cobble-sized fragments.

The diamicton units are interpreted to be till. The most common till in the glaciomarine environment is a submarine lodgment till, but it is not possible, on the basis of the sparse amount of sediment cored, to conclude whether the sediment is a submarine lodgment till, a basal till, or a melt-out till. Alternatively, the sediment may have been remolded at a later stage by large icebergs scouring the soft sediment of the ocean floor and creating an ice keel turbate. Because the Transect EG68 area was below sea level during the Quaternary, most of the cored sediments were probably deposited at a time when the inland ice extended over the shelf of the East Greenland margin.

Many sedimentary units of uncertain origin are described as gravel. They are composed of pebble-sized clasts with subangular to subrounded shapes (Holes SEG10A, SEG10B, SEG11A, SEG13C, SEG17A, SEG18A, and SEG20B). The clast size varies from pebble to cobble. Interstitial debris mud may be present between the clasts or as coatings and in voids on clast surfaces. Live corals were found attached to a clast from Hole SEG10A. The clasts are mostly basaltic, but gneiss, sandstone, and mudstone clasts occur. Granitic fragments were found in clast accumulations in Hole SEG19A. Larger clasts may show sign of striations and have weathered surfaces that are consistent with glacial transport.

Sometimes the clasts are interpreted as representing basaltic scree locally derived and overlying basaltic basement (Holes SEG04A, SEG04B, SEG05B, and SEG08A). Singular large clasts were drilled at some sites (Hole SEG07A, SEG11C, SEG14A, SEG16A, and SEG19B) that may either represent glacial boulders or scree deposits.

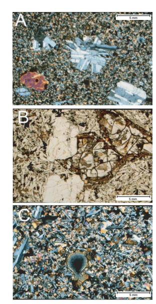
IGNEOUS PETROLOGY

Igneous units were recovered from seven holes representing a total of 3.46 m of core. The longest units were recovered from Holes SEG10B (1.02 m) and SEG05B (1.04 m). The following synthesis is based on the observations from the igneous units ("I" units), with additional information drawn from basaltic clast units ("C" units) judged to represent basement. Information obtained from inspection of five thin sections prepared from these igneous units is also incorporated.

The contact between the sediment cover and the underlying basaltic basement is not preserved in any of the holes drilled from Transect EG68. The igneous units have irregular, blocky, fractured, and weathered surfaces and massive flow morphologies with few internal structural features. In most cores, vesicles are irregularly distributed or concentrated in patches. Unit I-1 in Hole SEG10B was the only core displaying flow banding (perpendicular to the core axis) defined by variations in the proportion of mesostasis, elongated vesicles, and planar orientation of groundmass plagioclase laths.

Igneous units from Transect EG68 range from aphyric basalt (Holes SEG04A and SEG10B) to moderately to highly plagioclase-olivine-clinopyroxene phyric basalts (Holes SEG05B and SEG12A), sparsely to highly plagioclase-clinopyroxene phyric basalts (Holes SEG4B and SEG11A), and moderately plagioclase-clinopyroxene-olivine phyric basalt (Hole SEG13C). Plagioclase typically occurs in a glomerocrystic intergrowth with or without clinopyroxene (Fig. **F5A**). Euhedral olivine with inclusions of chromian spinel occur in some samples (Fig. **F5B**).

F5. Lava mineralogy and textures, p. 20.



In general, the lavas are fine grained, and seriate textures are most common (Fig. **F5C**). In one sample (Unit I-1, Hole SEG10B), a trachytic texture is evident. The groundmass is typically intergranular to intersertal (Fig. **F5C**) and composed of an assemblage of plagioclase, clinopyroxene, oxides, mesostasis (altered to palagonite), and rarely olivine. Thin section examination usually confirmed the visual core description. A common exception was the recognition of small amounts of olivine in thin section (Fig. **F5B**); however, this was not reported during the visual core descriptions.

Cored basalt clasts were recovered from a number of holes. The petrography of these clasts varies widely from aphyric (Holes SEG08A, SEG10A, SEG13A, and SEG18A) to sparsely olivine phyric (Hole SEG14A), sparsely plagioclase phyric (Holes SEG07A and SEG09B), sparsely clinopyroxene phyric (Hole SEG04A), moderately clinopyroxene-plagioclase phyric (Holes SEG16A and SEG19B), sparsely to highly plagioclase-clinopyroxene phyric (Holes SEG06A, SEG09B, SEG11C, and SEG19A), and sparsely to highly plagioclase-clinopyroxene-olivine phyric (Holes SEG05D and SEG13C). Such a large variation in phenocryst assemblages is difficult to reconcile with the more restricted assemblage reported for in situ basement (plagioclase-clinopyroxene and plagioclase-clinopyroxene-olivine basalt) from the outer area of Transect EG68. This suggests that most of the cored clasts probably are not samples of local basement. There are, however, two noteworthy exceptions: (1) clasts from Hole SEG05D (Unit C-1) that closely resemble the highly plagioclase-olivine-clinopyroxene phyric basalt of Unit I-1 in Hole SEG05B and (2) clasts of sparsely plagioclase-clinopyroxene-olivine phyric basalt recovered initially from Hole SEG13C that are practically indistinguishable from the moderately plagioclase-clinopyroxene-olivine phyric basalt core from the basement of the same hole.

Vesicles are unfilled or partially to completely filled by secondary minerals, including gray, green, and blue-gray clays, quartz, carbonate, and zeolite. Zoning in the vesicle fillings is commonly observed (Fig. F5C). Fractures are typically lined or filled by clay and carbonate. The phenocryst assemblages are variably altered to clay; however, often the groundmass appears relatively unaltered (Fig. F5A, F5C).

COMPOSITION OF IGNEOUS UNITS

Five igneous units were analyzed by shore-based X-ray fluorescence procedures. The results are summarized in Table T2. All units are hypersthene normative (Hy = 7.8–10.8 wt%) with SiO_2 contents between 47 and 49 wt%, MgO contents between 5 and 8 wt%, and TiO_2 contents between 1.9 and 2.5 wt%. Unit I-1 in Hole SEG05B has an anomalously high Al_2O_3 content (17.9 wt%, compared to 13.9–15.0 wt%) consistent with the high proportion of plagioclase glomerocrysts present in this unit. Mg numbers (Mg/[Mg + Fe_{total}] ratio) are between 0.57 and 0.44 and inversely correlate with TiO_2 content. As noted earlier, alteration is moderate with volatile contents from 1.0 to 2.8 wt% and Fe_2O_3/FeO ratios between 0.31 and 0.88. Overall, the major element data show that the basalts from the outer area of Transect EG68 are evolved, showing compositional variation consistent with low-pressure fractionation of plagioclase, augite, and olivine. In detail, the Mg number of the whole rocks systematically decreases stratigraphically seaward from old to young (i.e., Sites SEG04 to SEG12) (Fig. F2; Table T2).

T2. XRF data, p. 23.

PHENOCRYST COMPOSITIONS

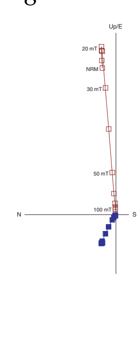
The phenocryst compositions were determined for representative samples from the six igneous units defined from Transect EG68. Microprobe results for coexisting plagioclase and clinopyroxene phenocrysts are presented in "Appendix B," p. 13, of the "Explanatory Notes" chapter and summarized in Table T3. Olivine suitable for microprobe analysis was not present in thin section (cf. Fig. F5B). Plagioclase compositions range from An_{73} to An_{83}, whereas clinopyroxene is augitic with Mg numbers from 0.78 to 0.81. Whole-rock and clinopyroxene Mg numbers are positively correlated.

T3. Phenocryst summary, p. 24.

PALEOMAGNETIC RESULTS

Paleomagnetic studies were performed on 18 core intervals from 14 sites along Transect EG68. The aim of these studies was to define the magnetic polarity and to judge whether the retrieved volcanic samples originated from in situ basement or from loose and rotated clasts. Figure F6 shows a Zijderveld diagram of demagnetization. After removal of small secondary components related to viscous and/or drill-induced magnetization, the direction of the characteristic magnetic remanence

F6. AF demagnetization, p. 21.



is defined using standard principal component analysis (Kirschvink, 1980). As the azimuth of the drill cores is unknown, only the characteristic inclination is meaningful. Only one interval did not yield a reliable estimate of the characteristic inclination because of scattered demagnetization results (Hole SEG09B). The demagnetization results are listed in Table **T4,** giving the characteristic inclination, intensity of the natural remanent magnetization, magnetic susceptibility, and Königsberger ratio. Also given is the interpreted polarity together with comments. The polarity for all samples from Transect EG68 is reversed with a mean characteristic inclination of –67.4° (N = 6, k = 51, α_{95} = 10.4°) (McFadden and Reid, 1982).

T4. Paleomagnetic results, p. 25.

In some cases the shipboard study suggested that the retrieved core was loose clasts, either based on the drillers' observations of a sudden increase in drill speed reflecting a transition from hard rock to soft sediment or from visual inspection showing weathering on the bottom of a clast. All these cases are also recognized by highly diverse characteristic inclinations between individual holes at the same site (Holes SEG06A, SEG07A, SEG08A, and SEG19A) (Table **T4**). For other sites, the in situ nature of the core was questioned during the shipboard inspection, although no conclusive indication was available (Holes SEG04A, SEG04B, SEG11A, SEG11C, SEG14A, and SEG16A). It was expected that by drilling multiple holes in the same unit at such sites, the paleomagnetic results would provide an indication of whether the obtained core was in situ or not. The results show that for some of these multiple hole sites, the retrieved basalts were not in situ. This is suggested by significant differences in the paleomagnetic results between individual holes (Holes SEG04A, SEG04B, SEG11A, and SEG11C) (Table **T4**) and/or by characteristic inclinations with intermediate directions (Holes SEG14A, SEG16A, and SEG20B) (Table **T4**).

CORE AND THIN SECTION DESCRIPTIONS

Brief lithologic descriptions of all recovered cores and thin section descriptions from sites drilled along Transect EG68, as well as digital core photographs taken onboard, are included on summary sheets in **Supplementary Material.** The same information can also be obtained from the ODIN database (see **"ODIN Database,"** p. 9, in the "Explanatory Notes" chapter).

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Figure F1. Transect EG68 area. Location of H/S *Dana* reflection seismic lines shown as thin lines (Hopper et al., 1997). Sparker Lines DLC99-1 (Fig. **F3,** p. 18) and DLC99-2 (Fig. **F4,** p. 19) on the landward portions of multichannel seismic Line DLC9724 (Fig. **F2,** p. 17) are marked by thick lines. Intersections of short cross lines and sparker lines mark drill sites.

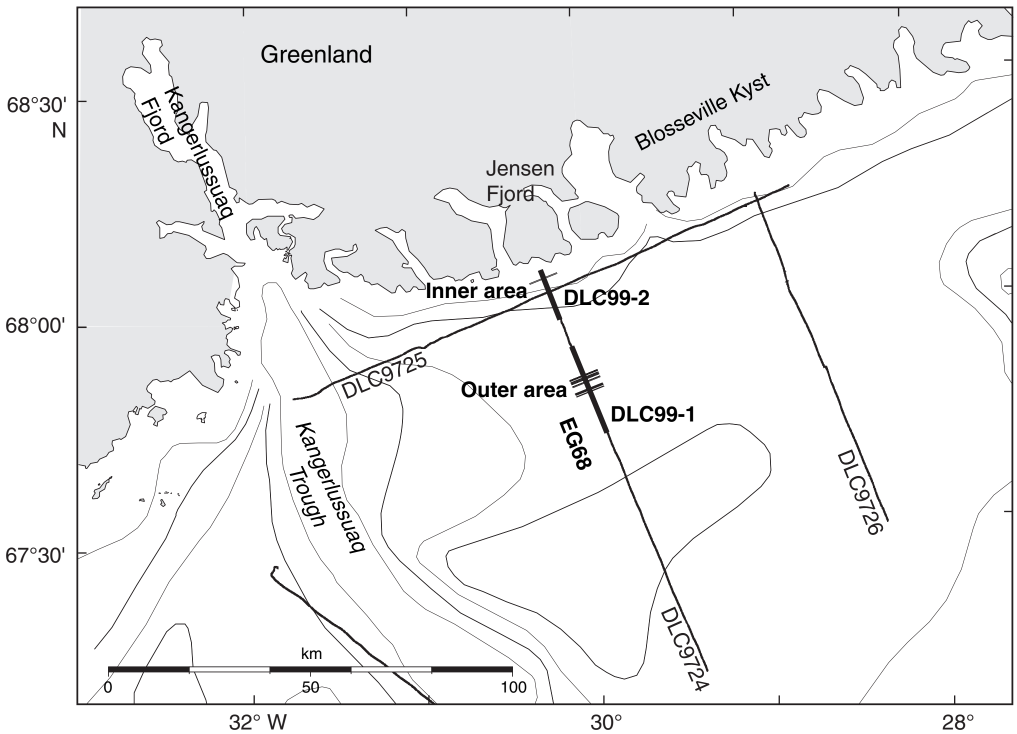

Figure F2. Multichannel seismic (MCS) Line DLC9724 (Hopper et al., 1997). Inner and outer areas and extent of corresponding sparker seismic lines are marked at top. Sparker Line DLC99-2 extends beyond the north-northwest end of MCS LineDLC9724. Thin vertical lines = positions of drill sites. First three multiple reflections are lowest in the section.

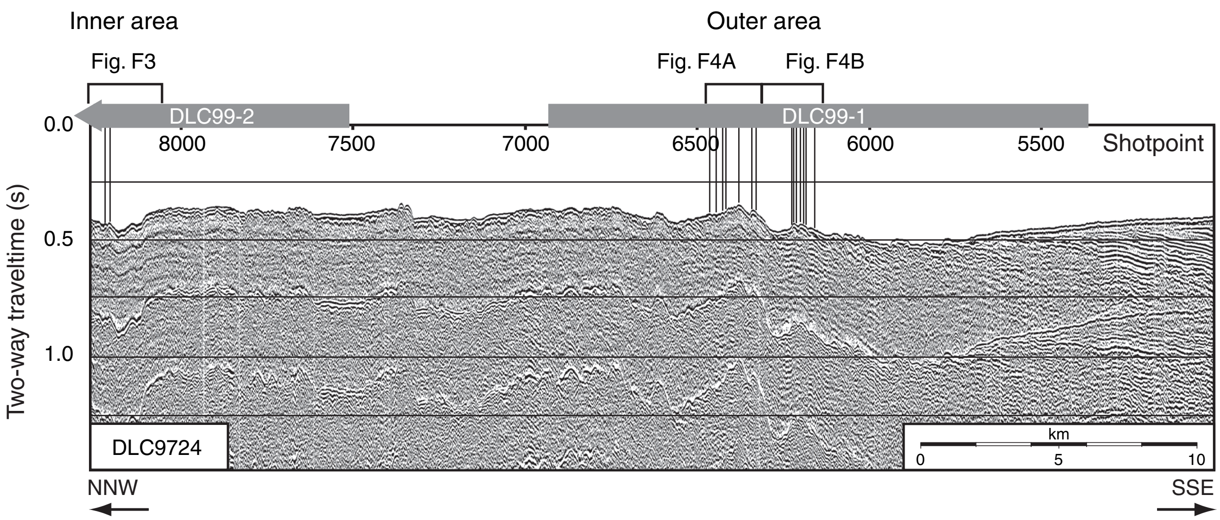

Figure F3. Single-channel sparker Line DLC99-2 of the inner area of Transect EG68 with locations of drill sites. Line collected between 67°55.4247′N, 30°04.7599′W and 68°05.380′N, 30°14.413′W. Length of line is 10 km, only part of which is shown. TRC = trace sequence number from 0 (beginning of line) to 4000 (Table T1, p. 22). 1 km = 400 TRC.

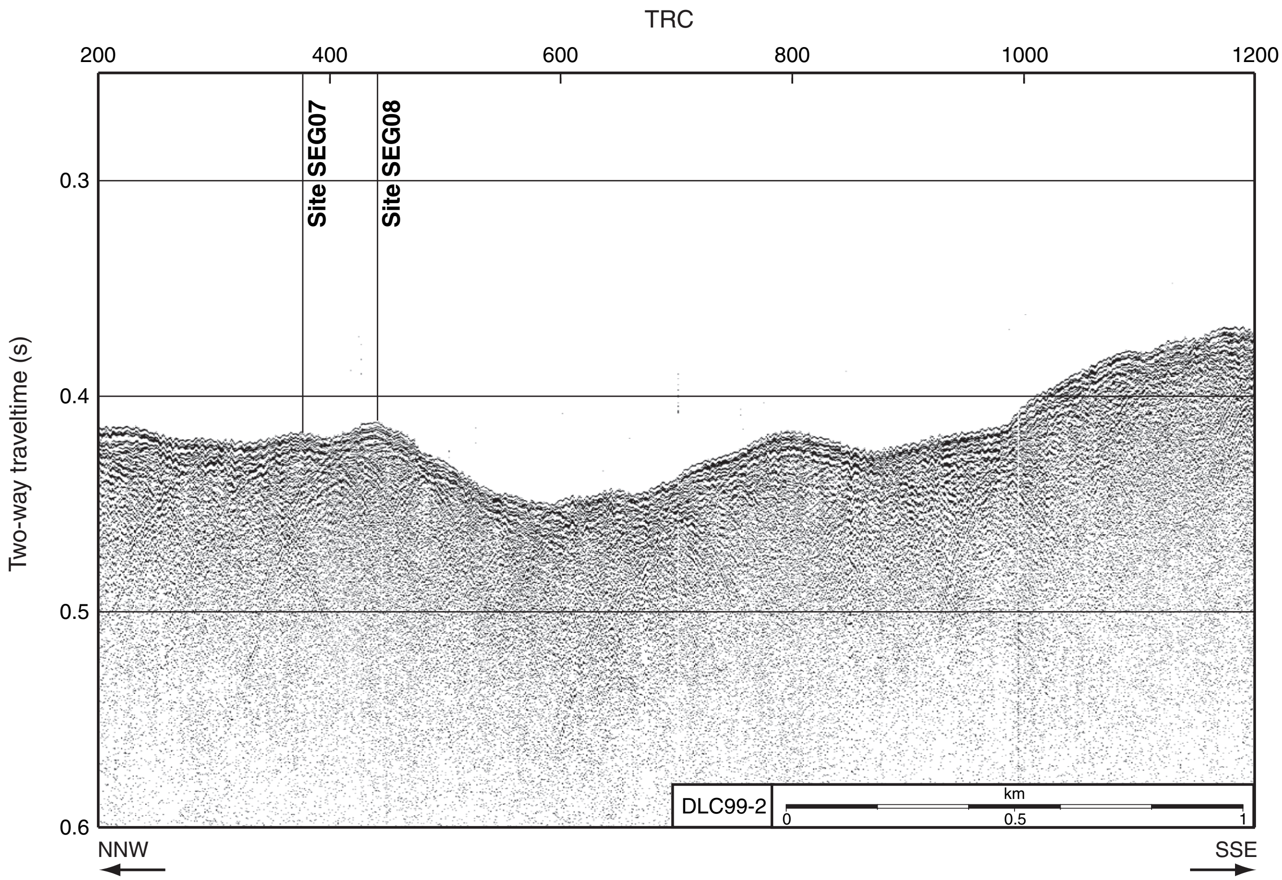

Figure F4. Single-channel sparker Line DLC99-1 covering the outer area of Transect EG68. **A.** Sites SEG03–SEG06, SEG09–SEG12, and SEG20. **B.** Sites SEG13–SEG19. Line collected between 67°43.3099′N, 29°53.2805′W and 67°55.4367′N, 30°04.77537′W. Length of line is 22 km, only part of which is shown. TRC = trace sequence number from 0 (beginning of line) to 8000 (Table T1, p. 22). 1 km = 400 TRC.

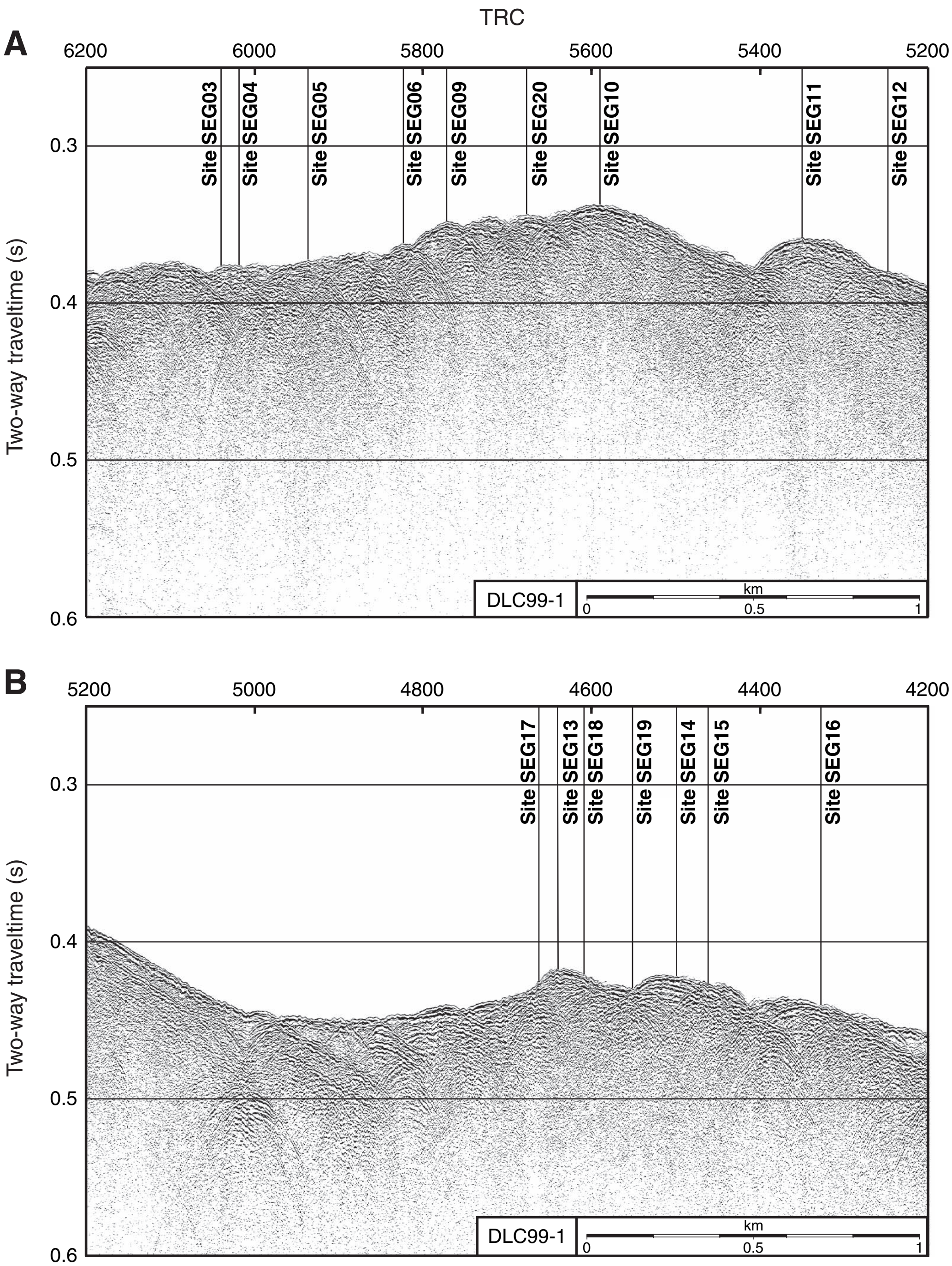

Figure F5. Typical mineralogy and textures of Transect EG68 lavas. **A.** Highly plagioclase-clinopyroxene phyric basalt with glomerocrysts of plagioclase and phenocrysts of clinopyroxene in a relatively fresh, fine-grained groundmass of plagioclase, clinopyroxene, Fe-Ti oxides, and mesostasis (Sample 163X-SEG05B-1-1, 41–45 cm). **B.** Plagioclase-olivine phyric basalt with a fine-grained groundmass of plagioclase, clinopyroxene, and Fe-Ti oxides. Euhedral olivine phenocrysts are completely replaced by iddingsite. Chromian spinel occurs as <0.1-mm-sized inclusions in the olivine (Sample 163X-SEG12A-1-1, 0–4 cm). **C.** Fine-grained, highly plagioclase-clinopyroxene phyric to glomerophyric and seriate basalt. Groundmass composed of fresh plagioclase, clinopyroxene, Fe-Ti oxides, and trace amounts of mesostasis. Tear drop–shaped vesicle filled by yellow to gray clay (Sample 163X-SEG11A-1-1, 11–15 cm).

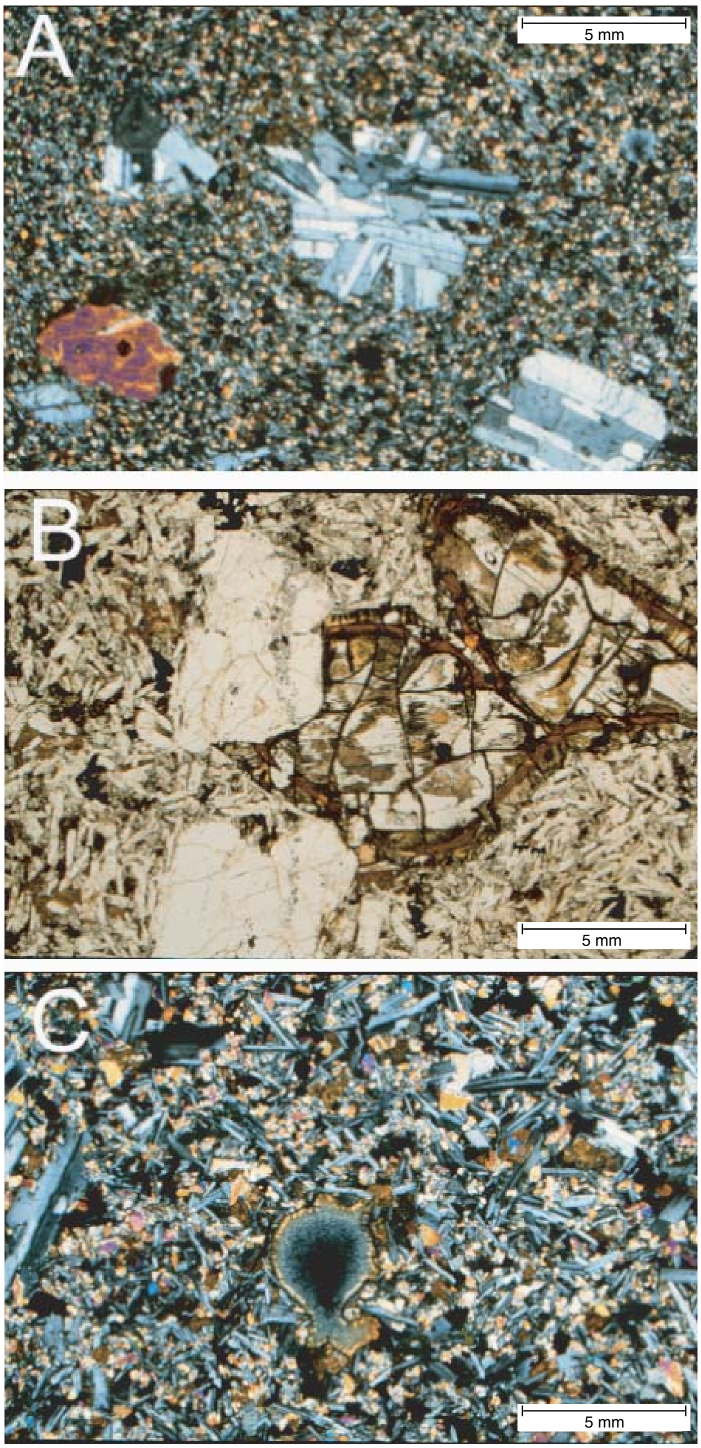

Figure F6. Response of Sample 163X-SEG12A1-1 (Piece 1B, 10–13 cm) to alternating-field demagnetization. Solid symbols = points on horizontal plane, open symbols = points on vertical plane. NRM = natural remanent magnetization.

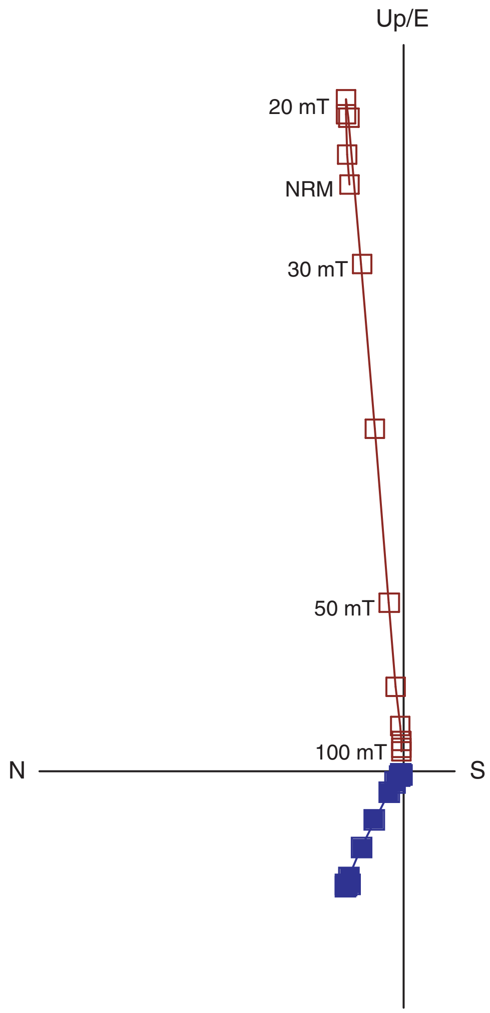

Table T1. Transect EG68 core summaries.

Core	UTC Date (Aug 1999)	UTC Time	Position Latitude	Position Longitude	Sparker line TRC	Air gun line shotpoint	Water depth (m)	Rock coring intervals (mbsf) Top	Rock coring intervals (mbsf) Bottom	Core recovery (m)
163X-										
SEG03A-1	25	21:22	67°52.025′N	30°1.514′W	6048	6450	272.60	0.00	1.03	0.40
SEG04A-1	26	03:29	67°52.003′N	30°1.507′W	6026	6447	272.66	1.70	2.24	0.53
SEG04B-1	26	07:02	67°52.006′N	30°1.498′W	6026	6447	272.86	1.35	1.60	0.70
SEG05A-1	26	11:03	67°51.893′N	30°1.413′W	5931	6433	270.87	0.20	1.20	0.38
SEG05B-1	26	12:27	67°51.893′N	30°1.415′W	5931	6433	271.51	1.00	1.91	1.04
SEG05C-1	30	18:36	67°51.896′N	30°1.408′W	5931	6433	273.90	0.58	1.10	0.36
SEG05D-1	30	20:28	67°51.896′N	30°1.401′W	5931	6433	273.70	0.56	1.90	0.59
SEG06A-1	26	17:06	67°51.728′N	30°1.240′W	5818	6411	264.58	1.00	2.46	0.65
SEG07A-1	28	13:54	68°5.178′N	30°14.242′W	380	8221	301.25	1.80	3.00	0.16
SEG08A-1	28	16:10	68°5.094′N	30°14.085′W	440	8208	300.90	1.68	3.03	0.19
SEG09A-1	28	20:28	67°51.663′N	30°1.171′W	5772	6403	253.30	0.85	1.93	0.11
SEG09B-1	28	22:06	67°51.662′N	30°1.177′W	5772	6403	251.30	0.55	1.60	0.13
SEG10A-1	29	00:46	67°51.433′N	30°0.961′W	5591	6372	248.10	0.54	1.22	0.13
SEG10B-1	29	02:10	67°51.440′N	30°0.963′W	5591	6372	246.60	0.58	1.92	1.28
SEG11A-1	29	07:50	67°51.121′N	30°0.697′W	5341	6328	266.80	0.68	0.83	0.19
SEG11B-1	29	09:15	67°51.122′N	30°0.680′W	5341	6328	266.30	0.51	0.63	0.00
SEG11C-1	29	10:06	67°51.119′N	30°0.684′W	5341	6328	266.30	0.93	1.20	0.28
SEG11D-1	29	11:38	67°51.119′N	30°0.679′W	5341	6328	265.60	0.90	1.42	0.00
SEG12A-1	29	13:38	67°51.012′N	30°0.570′W	5256	6315	280.60	0.35	0.87	0.59
SEG13A-1	29	15:57	67°50.205′N	29°59.870′W	4647	6217	304.35	0.40	0.68	0.07
SEG13B-1	29	17:25	67°50.211′N	29°59.880′W	4647	6217	304.90	0.83	0.88	0.00
SEG13C-1	29	19:16	67°50.212′N	29°59.878′W	4647	6217	308.59	0.57	0.93	0.19
SEG14A-1	29	21:28	67°50.04′N	29°59.655′W	4505	6194	311.72	0.55	2.22	0.37
SEG15A-1	29	23:36	67°50.005′N	29°59.580′W	4474	6189	311.85	0.83	3.08	0.35
SEG16A-1	30	01:57	67°49.779′N	29°59.411′W	4319	6157	323.73	1.29	1.36	0.65
SEG16B-1	30	03:32	67°49.777′N	29°59.409′W	4319	6157	323.32	0.80	2.89	0.10
SEG17A-1	30	05:59	67°50.232′N	29°59.882′W	4660	6221	303.62	0.94	0.99	0.15
SEG17B-1	30	07:23	67°50.231′N	29°59.884′W	4660	6221	304.85	0.00*	2.00	0.63
SEG18A-1	30	09:18	67°50.160′N	29°59.841′W	4608	6211	312.97	0.00*	3.00	0.27
SEG19A-1	30	10:24	67°50.091′N	29°59.746′W	4551	6201	306.98	0.00*	0.66	0.11
SEG19B-1	30	11:45	67°50.091′N	2°959.752′W	4551	6201	305.30	0.68	0.74	0.31
SEG20A-1	30	13:39	67°51.549′N	30°1.062′W	5673	6387	247.65	1.23	1.32	0.00
SEG20B-1	30	12:04	67°51.544′N	30°1.050′W	5673	6387	247.76	1.58	2.50	0.36

Notes: Sparker Line DLC99-1, air gun Line DLC9724. UTC = Universal Time Coordinated. TRC = trace sequence number along line (see Fig. F3, p. 18). * = drillers' log did not give a start coring depth for this core.

Table T2. Representative X-ray fluorescence element data, Transect EG68.

Core, section, interval (cm)	Major element oxides (wt%)												Iron oxide (wt%)		Mg#	CIPW Hy (wt%)	Trace elements (ppm)						
	SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total	Fe_2O_3	FeO			V	Cr	Ni	Cu	Zn	Sr	Zr
163X-																							
SEG04B-1-1 (Piece 6, 60–68)	47.30	1.92	14.85	10.82	0.21	8.02	11.28	2.37	0.18	0.18	2.86	99.43	5.26	5.96	0.569	7.8	367	311	68	118	67	162	139
SEG05B-1-1 (Piece 3B, 39–47)	47.76	1.96	17.89	9.83	0.19	5.63	12.19	2.61	0.38	0.22	1.33	99.66	4.53	5.68	0.504	1.8	291	91	32	84	62	338	135
SEG10B-1-1 (Piece 2G, 94–103)	48.87	2.22	13.90	12.14	0.20	6.00	10.99	2.80	0.33	0.24	2.32	99.40	3.91	8.49	0.468	10.8	377	62	27	217	85	198	158
SEG11A-1-1 (Piece 2, 11–19)	48.94	2.10	14.97	12.04	0.21	5.89	11.51	2.71	0.30	0.24	1.08	99.59	2.95	9.30	0.465	9.1	356	81	35	193	78	234	171
SEG12A-1-1 (Piece 1A, 0–7)	48.69	2.46	14.47	12.12	0.19	5.26	10.28	3.08	0.61	0.26	2.60	99.83	5.11	7.44	0.435	7.0	358	26	10	138	91	295	180

Notes: FeO* = all iron calculated as FeO. Fe_2O_3 and FeO = originally analyzed concentrations. Loss on ignition (LOI) corrected for iron oxidation. Major element oxides, including LOI, have been normalized to 100%. Total = sum of oxides as originally analyzed. Mg# = Mg/(Mg + Fe_{total}). CIPW Hy = Cross, Iddings, Pirsson, and Washington normative content (all iron calculated as FeO) for hypersthene.

Table T3. Summary of phenocryst composition, Transect EG68.

Core, section, interval (cm)	Plagioclase (An mol%)		Augite (Mg#)	
	Average	Range	Average	Range
163X-				
SEG04B-1-1 (Piece 6, 60–64)	—	—	0.81	0.79–0.83
SEG05B-1-1 (Piece 3B, 41–45)	0.8	0.74–0.82	0.8	0.80–0.81
SEG05B-1-1 (Piece 6, 98–102)	0.8	0.78–0.82	—	—
SEG10B-1-1 (Piece 2G, 94–98)	0.73	0.67–0.74	0.79	0.78–0.80
SEG11A-1-1 (Piece 2, 11–15)	0.82	0.81–0.83	0.78	0.75–0.81
SEG12A-1-1 (Piece 1A, 0–4)	0.83	0.80–0.84	—	—

Notes: See **"Appendix B,"** p. 13, in the "Explanatory Notes" chapter for details. An = anorthite, Mg# = Mg/(Mg + Fe) with all iron as Fe^{2+}. — = no data.

Table T4. Paleomagnetic results, Transect EG68.

Core, section, interval (cm)	NRM (nA/m)	χ (10^{-3} SI)	Q ratio	CI (°)	Polarity	Comments
163X-						
SEG04A-1-1 (Piece 6A, 40–43)	2060	35.00	1.47	24.1	N	Not in situ
SEG04B-1-1 (Piece 3, 42–45)	1018	9.34	2.72	–20.7	N	Not in situ
SEG05B-1-1 (Piece 3B, 34–37)	308	59.85	0.13	–70.8	R	
SEG06A-1-1 (Piece 3, 60–63)	2824	8.58	8.23	12.2	N	Clast
SEG07A-1-1 (Piece 2, 10–13)	4148	19.68	5.27	–6.9	N	Clast
SEG08A-1-1 (Piece 1D, 10–13)	1814	49.55	0.92	–5.3	N	Clast
SEG09B-1-1 (Piece 1, 3–5)	930	13.68	1.70	?	?	
SEG10B-1-1 (Piece 2C, 25–28)	1083	21.82	1.24	–65.9	R	
SEG10B-1-1 (Piece 2J, 13–16)	851	23.70	0.90	–63.5	R	
SEG11A-1-1 (Piece 2, 13–12)	4922	42.05	2.93	17.9	N	Not in situ
SEG11C-1-1 (Piece 3, 13–16)	1004	15.70	1.60	32.5	N	Not in situ
SEG12A-1-1 (Piece 1B, 10–13)	2360	18.54	3.18	–79.8	R	
SEG13C-1-1 (Piece 3, 13–16)	3993	19.70	5.07	–56.1	R	
SEG14A-1-1 (Piece 4A, 33–36)	4368	40.70	2.68	27.9	N	Not in situ
SEG16A-1-1 (Piece 2A, 56–59)	3945	21.38	4.61	–19.8	N	Not in situ
SEG19A-1-1 (Piece 2, 6–9)	3195	34.50	2.32	16.6	N	Clast
SEG19B-1-1 (Piece 2A, 23–26)	2863	17.84	4.01	–68.4	R	
SEG20B-1-1 (Piece 1C, 22–25)	1867	14.20	3.29	–8.9	N	Not in situ

Notes: NRM = natural remanent magnetization, χ = magnetic susceptibility, Q ratio = Königsberger ratio, CI = characteristic inclination, N = normal, R = reversed, ? = unknown.