ICE-GOUGED MICRORELIEF ON THE FLOOR OF THE EASTERN CHUKCHI SEA, ALASKA: A RECONNAISSANCE SURVEY

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ABSTRACT

Side-scan sonar and bathymetric records,obtained from 1,800 km of trackline from the eastern Chukchi Sea continental shelf, between water depths of 20 and 70 m,show the ubiquitous presence of furrow-like linear depressions produced by gouging of the sea bed by ice keels. These sea bed micro-features are regionally widespread but are not uniformly distributed. Furthermore, the microrelief, texture, and lithologic structure of sea bed sediments have been significantly modified by the disruptive processes associated with ice gouge formation.

An analysis of some 10,200 individual gouges shows that the density of ice gouges increases with increasing latitude,increasing slope gradients, and decreasing water depth. Across the northern half of the shelf few trackline segments are free of ice gouges; in the southern portion numerous segments contain no ice gouges. However, ice gouges extend at least as far south as Cape Prince of Wales Shoal. Densities of over 200 gouges per km of trackline are not uncommon in water depths less than 30 m ,but no values higher than 50/km are encountered in water deeper than 50 m. No ice gouges have been observed in water depths exceeding 58 m. Saturation ice gouge densities (greater than 300/km) occur along the eastern side of Barrow Sea Valley and the northeast flank of Hanna Shoal.

Maximum gouge incision depths per km of trackline are greatest in water 36 to 50 m deep . A maximum incision depth of 4.5 m occurs in the 35-40 m water depth interval. Individual ice gouge events wider than 100 m, most produced by multi-keeled ice fragments, are found between 31 and 45 m depths.The dominant azimuth of gouge furrows shows no preferred orientation

on the Chukchi Sea shelf; only locally does bathmetric control of the trend of gouges appear.

The occurrence of current-produced bedforms within individual ice gouges suggests an interaction between slow-moving grounded or gouging ice keels and swift currents. In other cases, current-produced bedforms, interpreted as being in equilibrium with existing flow regimes, lie adjacent to ice gouges, suggesting contemporary ice gouging to water depths of at least 43 m.

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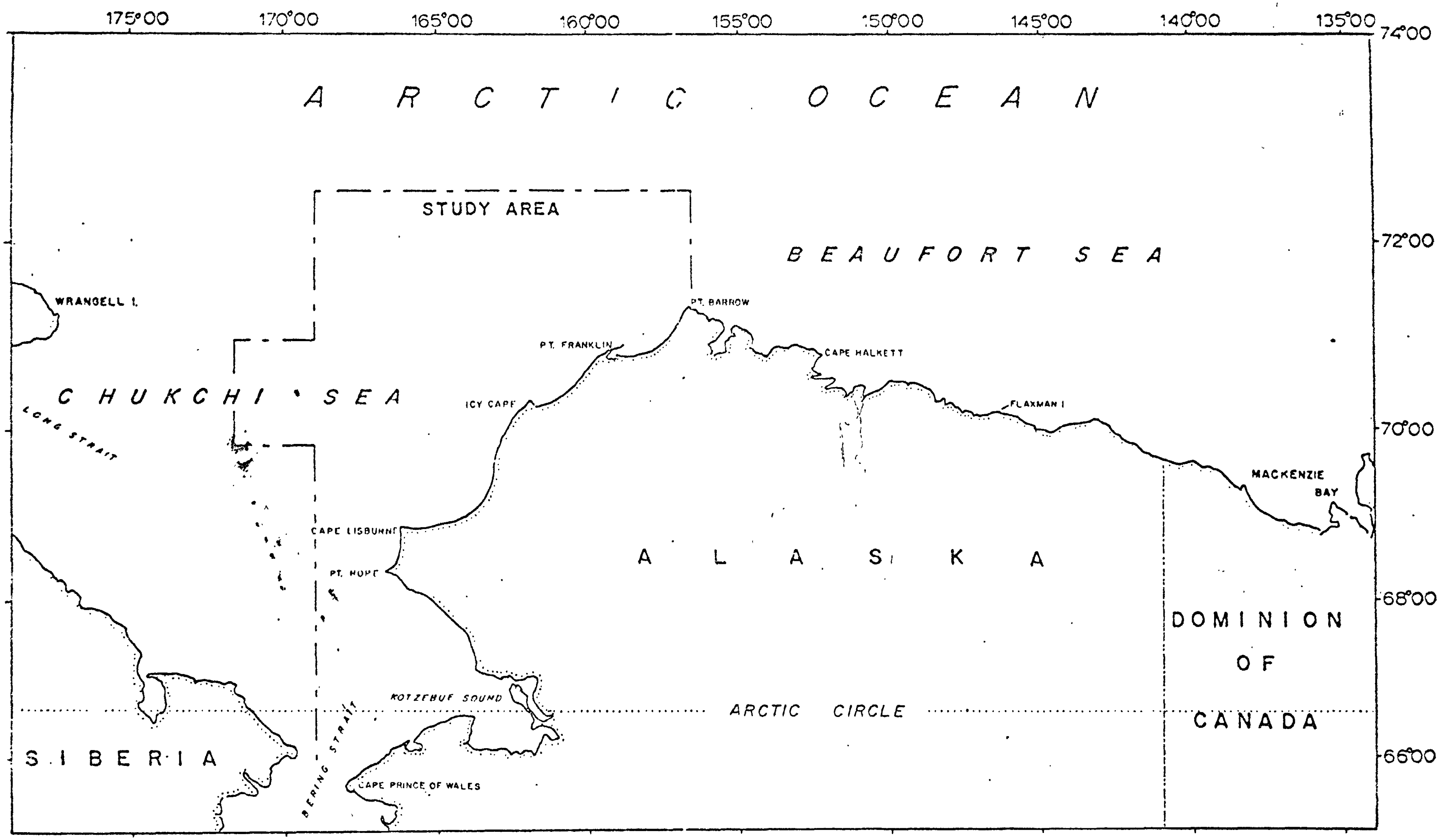
INTRODUCTION

During summer 1974 side-scan sonar studies of the eastern Chukchi Sea covered an area of approximatly 250,000 km^2 (Fig.1). These studies were conducted to test the hypothesis put forward by Grantz (oral commun.,1974) that hyperbolic echo traces in earlier seismic reflection profiles (Fig.2) of the shelf resulted from the furrow-like ,linear depressions produced by gouging of the sea bed by ice keels (Pelletier and Shearer,1972;Reimnitz and others,1973). Hyperbolic echo traces can be expected from such features when they lie at an angle to a towed hydrophone array or to a hull-mounted transducer (Hollister and others,1974),so that sequential reflection points move along the feature and coincide with the sea bed return signal when the feature is crossed.

Nature and Scope of Study

Previous sedimentologic studies of the Chukchi Sea continental shelf have dealt mainly with the nature and textural distribution of sea bed deposits (Creager and McManus,1967). Processes associated with the disruptive actions of ice keels moving through sea bed materials have been largely ignored (McManus and others,1969). Such processes include re-suspension,winnowing,and mixing of sea bed sediments, the disruption of lithologic structures and of benthic communities, and deformation of the sea bed (Reimnitz and Barnes,1974). The widespread occurrence of ice gouged micro-features has important implications for modern depositional and sediment transport mechanisms operating on Arctic shelves.

Figure 1. Location map showing regional geographic features of the northwestern Alaska coast and limits of study area.


175°00
170°00
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150°00
145°00
140°00
135°00
74°00
72°00
70°00
68°00
66°00
ARCTIC OCEAN
STUDY AREA
BEAUFORT SEA
WRANGELL I.
CHUKCHI SEA
LONG STRAIT
PT. BARROW
PT. FRANKLIN
CAPE HALKETT
FLAXMAN I
ICY CAPE
MACKENZIE BAY
CAPE LISBURNE
PT. HOPE
ALASKA
DOMINION OF CANADA
KOTZEBUE SOUND
ARCTIC CIRCLE
SIBERIA
BERING STRAIT
CAPE PRINCE OF WALES

Figure 1.

Figure 2. Seismic reflection profile obtained in the eastern Chukchi Sea which shows the character of hyperbolic echo traces(marked by arrows).

The sonographs (side-scan sonar records) and bathymetric records obtained during 1974 field operations were recorded along 1,800 km of survey tracklines in water depths between 20 and 70 m. These records provide a reconnaissance data base from which the signficance and general character of ice-gouged microrelief of the eastern Chukchi Sea may be analyzed with respect to bathymetry and geographic location. This study involved the examination of some 10,200 individual ice-gouged micro-features for orientation,incision depth, width, and relative abundance over the shelf.

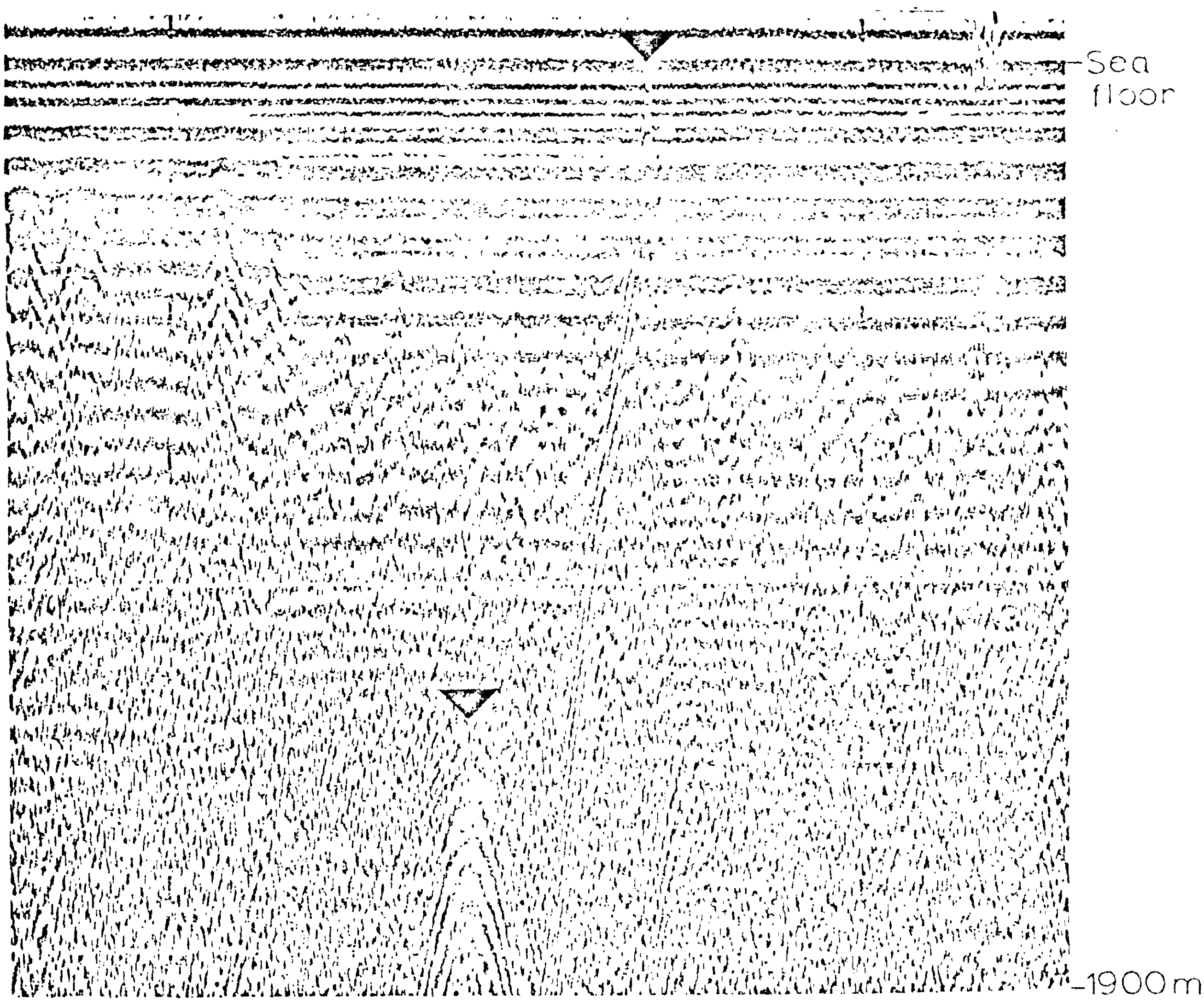


Figure 2.

Specific objectives of this study are: a) to provide a reconnaissance map showing the extent and areal distribution of ice-gouged microrelief; b) to determine the dominant azimuth of ice-gouged micro-features;c) to determine whether ice-gouge densities,maximum incision depths,and maximum gouge widths are related to water depth;and d) to compare the character of ice-gouged microfeatures in the Chukchi Sea with those found in the adjacent Beaufort Sea.

Fieldwork

The records used in this study were collected by members of the Office of Marine Geology of the U.S.Geological Survey in cooperation with the U.S.Coast Guard aboard the U.S.C.G.Cutter BURTON ISLAND. Bathymetric profiles were obtained with a 12 kHz,hull mounted transducer coupled to a power transceiver and 47 cm dry paper recorder.

Sonographs were obtained using a dual channel side-scan sonar system consisting of a towed 105 kHz transducer assembly (tow fish) coupled to a double helix wet paper recorder-transceiver. The system transmited short bursts (0.1 millisecond) of sound across the sea bed in fan-shaped beams to both sides of the track surveyed. The return echos, when processed and graphically recorded, produce a continous acoustic "shadow" picture of the sea bed. The records allow the detailed study of distribution patterns in sea bed morphology not delineated by vertical echo sounding techniques. Details of the systems theory of operation have been described by Belderson and others (1972).

During the field survey operations the tow fish was operated 10 to 20 m above the sea bed at speeds of 4 to 7 knots. Slant range (the horizontal distance surveyed to each side of the survey track) was generally set at 125 m.

Ice conditions during the survey allowed freedom of ship movement over all but the northeast sector of the study area (Fig.1). The location of side-scan sonar Trackline Segments (Fig.3) was determined by satellite navigation fixes taken by the BURTON ISLAND, and are considered to be accurate within about 0.5 km.

Sea bed sediments were collected at 183 locations to assess the possible correlation between the character of ice-gouged micorfeatures seen in sonographs and the texture of sea bed sediments. Of the total,110 were collected using a modified Van Veen type grab sampler. The remaining sediment samples were collected by the selective side-scan sonar-based sampling technique of Newton and others (1972). Surficial sediments were collected by lowering a sampler at points along the survey tracklines where sonographs indicated the presence of sediment facies boundaries. Such boundaries commonly could be inferred by the presence or absence of hydraulic bedforms,by changes in the acoustic character of the sea bed, and by changes in the character of individual ice-gouged microfeatures.

Previous Studies

Since the application of side-scan sonar to detailed morphologic studies of high latitude continental margins ,numerous authors have presented sonographs to illustrate microfeatures, ascribed to ice keels gouging the sea bed, identical to the features under discussion here. The variety of terms applied to these features has been pointed out by Lewis (1977); these include "ice scours" (Pelletier and Shearer,1973), "ice scores" (Kovacs,1972)

Figure 3. Location of side-scan sonar tracklines as determined by satellite navigation. Individual line segments have been categorized numerically and keyed to the data presented in appendix 1 and 2. The location of numerals shown corresponds to the initial position fix of each segment.

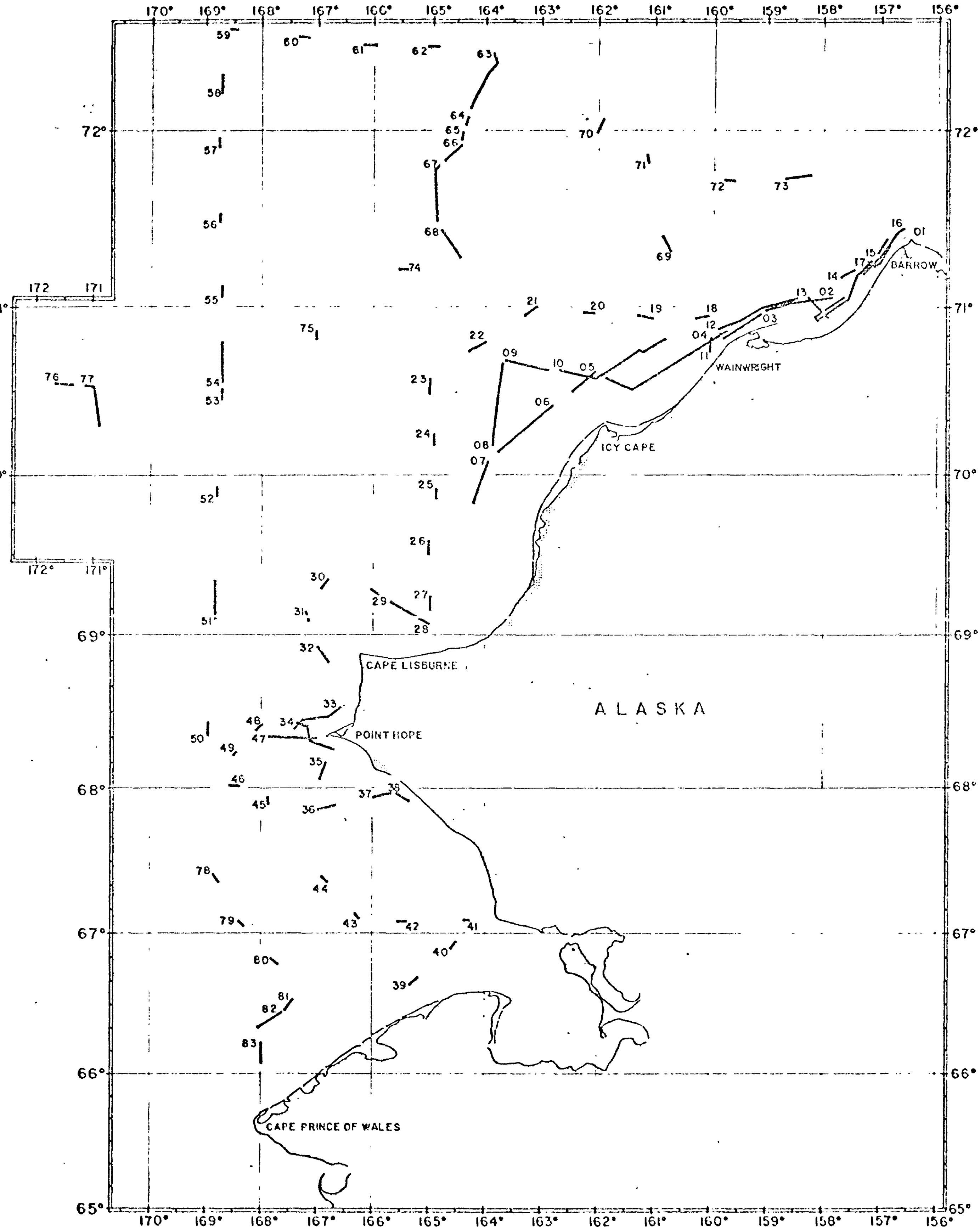

ALASKA
BARROW
WAINWRIGHT
ICY CAPE
CAPE LISBURNE
POINT HOPE
CAPE PRINCE OF WALES

Figure 3

"plough marks" (Harris,1974),and "furrow marks" (Harris and Jollymore,1974). In this paper the term " ice gouge" used by Wright and Priestley (1922) and Reimnitz and others (1972,1973) has been used to describe the feature created by an ice keel that has ploughed through the sea bed. The term "ice gouging" has been applied to the interaction of one or more ice keels with the sea bed.

Typically, ice gouges consist of linear or curnilinear depressions having flanking ridges of displaced sea bed materials. They occur as solitary features on an otherwise unmarked sea bed or in groups where sequential ice gouges may be superimposed. Individual ice gouges may be several kilometers long. They are commonly incised 0.5 to 2.0 m below the undisturbed level of the sea bed and are tens of meters wide.

According to Reimnitz and Barnes (1974), the appearance of an ice gouge may be related to a) the underwater shape of ice;b) the nature of the materials exposed at the sea bed;c)the type of force driving the ice through the sea bed;and d) the relative age of the feature. Broad, flat ,and shallow ice gouges are attributed to ice gouging by ice island fragments (i.e. tabular icebergs of glacial origin). The presence of numerous parallel ice gouges is usually the result of gouging bu multi-keeled pressure ridges (a line or wall of broken ice forced up and down by pressure) raking the sea bed. Ice gouges formed in cohesive sediments appear rough and irregular on sonographs and are thought to be not easily modified by waves or bottom currents or by slumping of flanking ridges. Ice gouges in soft, unconsolidated materials generally appear smooth on sonographs. Solitary ,unstable pieces of ice may wobble or change direction sharply during gouging, producing lines of equally spaced,closed depressions on the sea bed or ice gouges with paths having acute changes in orientation (Reimnitz and others ,1972;Reimnitz and Barnes,1974).

Repeated ice gouging of the sea bed by ice keels can rotate blocks of sediment,effectively destory any lateral continuity of sediment beds,and homogenize sea bed materials (Barnes and Reimnitz,1974). In addition, relatively soft sea bed deposits (30 to 200 kg/m^2 shear strengths) may become compressed (350 to 700 kg/m^2 shear strengths) when subjected to ice gouging (Lewis and others,1977; Reimnitz and Toimil,1977a).

An idealized ice gouge is shown in Figure 4. The cross-section has been modified after Reimnitz and others (1977b) to illustrate terms applied to ice-gouge morphology. Observed gouge depressions are probably narrower and shallower than their initial incision width due to slumping of ridge flanks and reworking by sea bed processes,and the extent of disruption of the sea bed by ice gouging reaches beyond the original incision width of an gouge.

Studies of the character of ice-gouged microrelief on the floor of the southern Beaufort Sea adjacent to the study area have been summarized by Reimnitz and Barnes (1974), who include the complementary studies of Carsola (1954), Skinner (1971),Pelletier and Shearer (1972) ,Kovacs (1972), and Brooks (1973). These studies are of particular interest here because of their proximity to the study area and because they lie updrift in the stream of drifting ice. Much of the deep draft ice carrried westward within the Pacific Gyre and entering the study area probably originates on,or first passes along the southern Beaufort Sea shelf, leaving a record of its under water character in the form of ice gouges.

Figure 4. Physiographic drawing of typical ice gouge being cut by an ice keel. The idealized cross-section shown has been drawn to express terms applied to ice morphology and also slumping of gouge flanks after ice keel has passed (modified after Reimnitz and others,1977b)

In the southern Beaufort Sea contemporary ice gouging is occurring in water depths between 6 and 30 m (Pelletier and Shearer, 1972; Kovacs, 1972;Reimnitz and Bannes,1974;Lewis,1977). While ice gouging shoreward of the 6 m isobath is probably frequent, the resulting microrelief is likely to be smoothed over rapidly by wave and current action. Side-scan sonar test lines established off northern Alaska and resurveyed between the years 1973, 1975,and 1976 show that in the depth range of 6 to 14 m about two percent

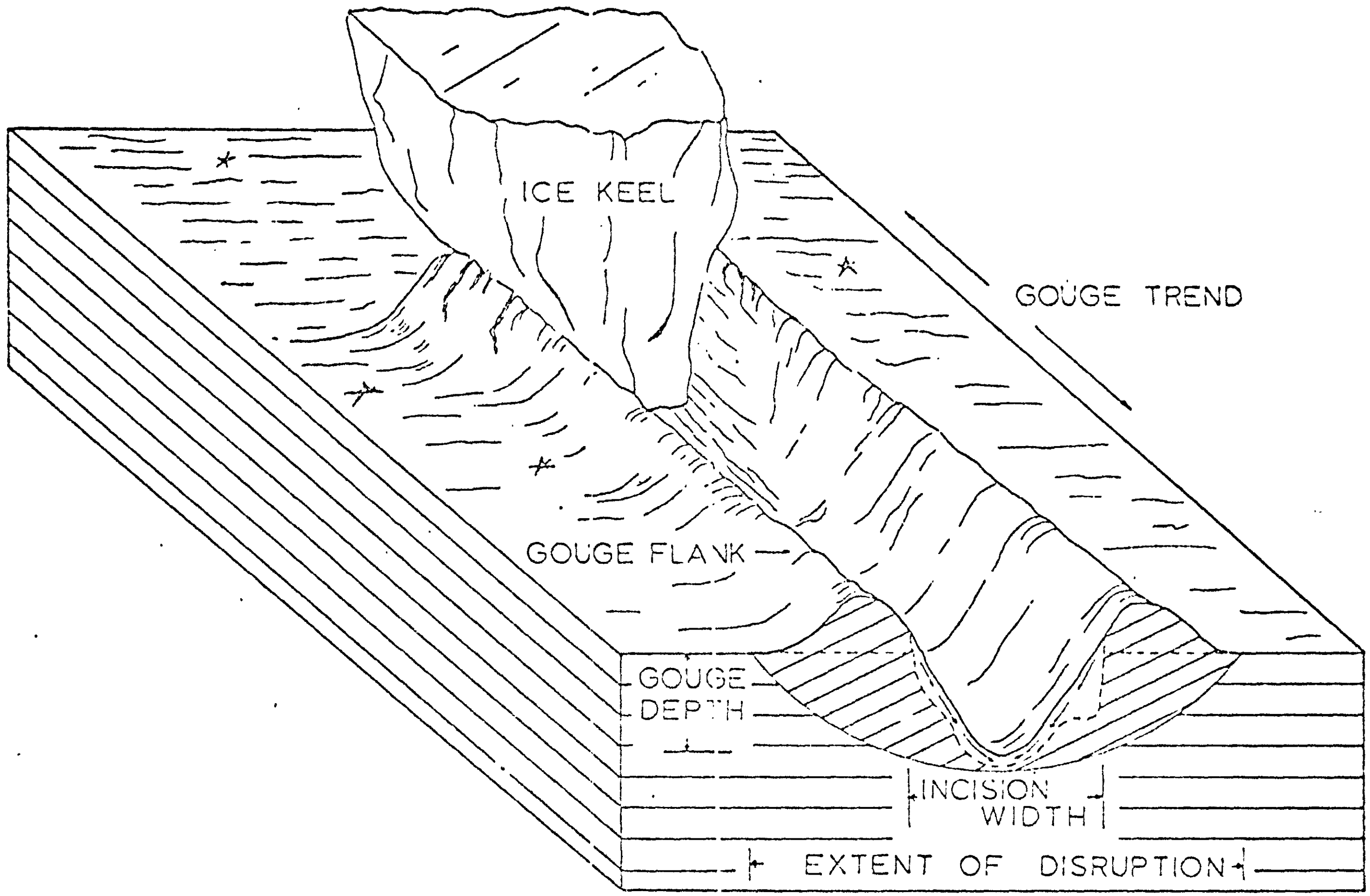

ICE KEEL
GOUGE TREND
GOUGE FLANK
GOUGE DEPTH
INCISION WIDTH
EXTENT OF DISRUPTION

Figure 4

of the sea bed is annually reworked to a depth of 20 cm by ice gouging (reimnitz and others,1977c;Barnes and others,1977).. This suggests an ice gouge recurrence interval for a given point on the sea bed of about 50 years. Off northern Canada, in water 15 to 20 m deep, average ice gouge recurrence intervals are reported from 50 to 500 years (Lewis and others,1976).

Estimates on the mean age of ice gouges observed on the outer Beaufort Sea shelf range from a few tens of years to thousands of years (Pelletier and Shearer,1972;Kovacs,1972; Kovacs and Mellor,1974; Reimnitz and Barnes,1974;Lewis and others,1976; Hnatiuk and Brown,1977;Reimnitz and others,1977). Many of the ice gouges observed in water depths of 30 to 45 m are considered to be relict (over 3,000 years old), i.e. formed at a time of lower sea level (Pelletier and Shearer,1972). Lewis (1977) places the seaward limit of contemporary ice gouging at the 50 m isobath. Reimnitz and Barnes (1974) and Løken (1974) believe that high age estimates for ice gouges observed on the outer shelf underrate the importance of contemporary ice gouging at depth. They question the validity of applying regional, average sedimentation rates to sediment infilling of individual ice gouges and limited deep-ocean da-a on the distribution of ice keel depths to shelf areas- Reimnitz and Barnes (1974) consider ice gouges observed at the shelf break to be older than those on the inner and central shelf,but,do not rule out the possibility that some of the ice gouges,even at water depths of 100 m are modern. Reimnitz and others (1977) point out that the microrelief and configuration of gouges in water depths of 100 m within their study area are not strikingly dissimilar to those observed on the central shelf.

Additionally, they point out that although bottom current pulses recorded along the shelf edge are sufficient (up to 55 cm/sec) to erode and transport muddy sand sediments of the region, ice gouges are present that have not been markedly eroded or infilled.

Until recently only Carsola (1954) and Rex (1955) had published studies dealing directly with microrelief of the Chukchi Sea continental shelf. Carsola (1954) found micro-relief features almost everywhere on the upper continental slope of the shelf in water depths between 60 and 400 m, and along the northwest flank of the Barrow Sea Valley. He characteristized the relief as a "pit" and "mound" topography having maximum relief to 18 m, but, usually only 2 to 10 m over distances of 150 to 300 m. Carsola (1954) attributed this topography to mass movement of sea bed sediments on low gradients;after considering several alternatives, including glacial depositional, sea ice melt deposits.relict surface permafrost features,and the grounding of sea ice and icebergs. In examining the latter possibility he points out that, while grounding of sea ice is a common accurrence in all arctic coastal waters, ice of the thickness necessary to ground in 60 to 400 m of water is not known to exist under present conditions within the region. Also, at a lower stand of sea level during the Pleistocene, conditions may have permitted ice grounding to such depths, but post-glacial sedimentation or submarine reworking should have removed traces of these features.

Rex (1955) described bottom irregularities delineated in echograms recorded along the inner shelf near Point Barrow;these have relief of 1 to 3 m over distances of 10 to 30 m, which he attributed directly to ice gouging, primarily by the keels of pressure ridges. Rex (1955) noted that the ice-gouged relief is best developed between the 6 and 30 m isobaths; above and below these depths it is much subdued. He recognized an almost exact coincidence between the distribution of ice gorges and the areal distribution of sea ice pressure ridges that annually form adjacent to the coast; this suggests that the microrelief is contemporary.

Evidence for contemporary ice gouging of sediments of the inner shelf is also provided by United States Coast Pilot(1969) in which changes in water depths over regions of the inner shelf due to ice gouging are noted to extend south of Icy Cape (Fig.1).

Indirect evidence that sea bed sediments of the shelf have been influenced by ice gouging on a regional basis is provided by Barnes and Reimnitz (1974). These authors state:"In our initial studies in the

> eastern Chukchi Sea, we thought the chaotic lithologic character of sediments was caused by intense bioturbation ,possibly including reworking by walrus tusks (Barnes,1972). We would now interpret such disturbed structures as resulting from ice-bottom interactions, which would suggest that many of the Chukchi Sea sediments are influenced by the ice-related processes we have observed in the Beaufort Sea".

Direct evidence for the widespread occurrence of ice-gouged micro-relief is revealed in the sonographs obtained during the 1974 field operations. A portion of these data has been presented in a report concerning the origin of a recurrent,grounded icefield near the crest of Hanna Shoal (a regional topographic high of the northeast shelf 180 km northwest of Point Barrow) and its influence on the adjacent sea bed (Toimil and Grantz,1976).

Sonographs and bathymetric profiles in a narrow lead along the southwest-northeast-trending western margin of the grounded icefield show extensive modification of the sea bed sediments by both currents and ice gouging. Water depths along the track varied between 27 and 33 m. Distinct facies changes,defined by sand ripple fields and contrasts in acoustic reflectivity show the influence of bottom currents and imply a general coarsening of sediments toward the grounded iceflield's northern end. Here, disruption of the sea bed by ice gouging was found to be most intense. The ice gouges characteristic of those produced by multi-keeled pressure ridges were more numerous (densities of over 300 per km), wider,and deeper than those observed along the southern portion of the track. Some more than 100 m wide and cut as deep as 1.5 m into the sea bed. Variations in the type of ice gouging along the survey track are attributed to the character and relative age of the adjacent grounded icefield and reworking of the sea bed by bottom currents. Regions in the lee of older ,more stable portions of the iceield are considered to have considerable but not total protection from ice gouging that extensively churns the sea bed elsewhere, allowing bottom processes longer periods in which to erode and infill existing gouges. Toimil and Grantz (1976) consider ice gouges observed at the shoal to be modern.

REGIONAL SETTING

The study area, here called the eastern Chukchi Sea shelf includes the region between the Alaskan coast seaward of the 20 m isobath and the 169° meridian from Cape Prince of Wales to the Arctic Ocean (about 73° N. parallel). Also included are the northern flanks of Herald Shoal (Fig.5).

Bathymetry

Detailed bathmetric data are not available for most of the study area. Bathymetric data from the shelf are plotted on 1:700,000 scale , National Ocean Survey chart number 9402. Using this chart and supplementary data from bathymetric measurements made by the U.S.Coast Guard Cutter BURTON ISLAND in 1972 and 1974, together with reconnaissance bathymetric data complied by Holmes (1975) a bathymetric map of the study area was prepared (Fig.5). The bathymetric contours in Figure 5 depict the major topographic features of the shelf but do not reflect the complexity of the existing bathymetry (Carsola,1954;Dietz and others,1964).

The shelf in general is characterized by extremely subtle topographic relief. Amoung the more conspicuous features of the shelf are Hope Sea Valley and Barrow Sea Valley which provide pathways along which relatively deep draft ice from the Arctic Basin may reach southern portions of the shelf. Barrow Sea Valley cuts the shelf parallel to the coast and underlies the Alaskan Coastal Current near Point Barrow. A detailed bathymetric survey conducted by Lepley (1962) reveals that immediately west of Point Barrow the valley floor is flat over distances of 8 to 20 km, and along this axis depths exceeding 57 m may continue southward to 159^{o} W. Hope Sea Valley cuts across the southern portion of the study area in a broad s-shaped course trending north-northwest offshore of Cape Thompson (Fig.5). Along its axis water depths may exceed 60 m.

Forming the principal barriers to drifting ice on the open shelf are Herald Shoal , Hanna Shoal,and a broad regional topographic north-south trending high extending southward from the western end of Hanna Shoal.

Figure 5. Reconnaissance bathymetric map of eastern Chukchi Sea from NOS chart 9402,bathymetric data complied by Holmes (1975) ,and U.S. Geological Survey data.

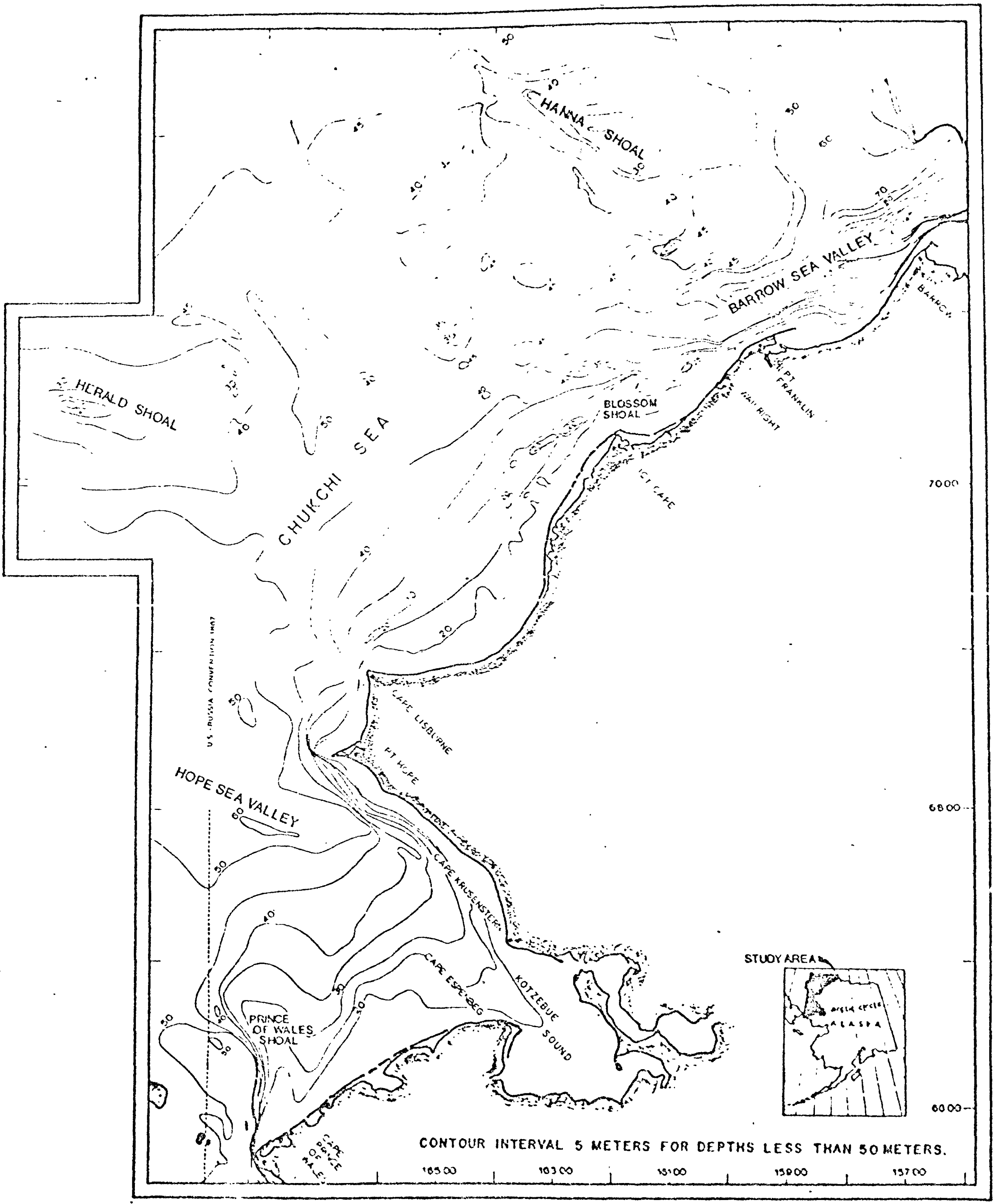

HANNA SHOAL
BARROW SEA VALLEY
BARROW
HERALD SHOAL
CHUKCHI SEA
BLOSSOM SHOAL
PT FRANKLIN
WAINWRIGHT
ICY CAPE
CAPE LISBURNE
PT HOPE
HOPE SEA VALLEY
CAPE KRUSENSTERN
CAPE ESPENBERG
KOTZEBUE SOUND
PRINCE OF WALES SHOAL
CAPE PRINCE OF WALES
STUDY AREA
ALASKA
CONTOUR INTERVAL 5 METERS FOR DEPTHS LESS THAN 50 METERS.

Figure 5

Herald Shoal occupies approximately 17,000 km^2. It's maximum relief is about 32 m; rising to within at least 20 m of sea level at the crest,with slope gradients ranging from 0.5 to 4m/km. The crestal ridge is about 25 km in length, trending generally east-west and is marked by irregular relief (holmes,1975). The shoal appears to be a surface expression of a northwest southeast stratigraphic and structural trend that extends northward from Cape Lisburne. Grounded ice formations large enought to be detected on satellite images of the region over the shoals crest have been reported by Kovacs and others (1975).

Hanna Shoal repeatedly serves to capture and hold deep draft ice masses (Toimil and Grantz ,1976). It extends 250 km west from Point Barrow and is isolated from the coast by the Barrow Sea Valley. The shoal overlies the seaward extension of the Barrow Arch of northern Alaska (Grantz and others,1975), a regional geologic structure that bring hard, mildly metamorphosed,earily Paleozoic strata to within 1 km of the sea bed beneath parts of the Chukchi Sea. Toimil and Grantz (1976) have suggested that northeast-striking isobaths near the east flank of the shoal crest may be the physiographic expression of a subsidiary, northeast-striking anticline of the Barrow Arch. The shoal rises to within 17 m of sea level near 72°00.5 N, 161°55.0 W (Grantz,oral commun.).

Nearshore bathymetry north of Cape Lisburne is irregular due to the presence of numerous isolated shoals (Fig.5),most common between the 20 and 30 m isobaths. Seaward of Kasegaluk Lagoon and Wainwright these appear as elongate features striking roughly northeast,paralleling the coast,for distances of 10 to 20 km.

Page 19 is not available.

where it merges with westward and northward-flowing waters of the Pacific Gyre and Transpolar Drift System of the Arctic Ocean. Predominant winds in the Chukchi Sea are from the northwest and may effectively slow the normal northeast flow of waters along the coast. Occasional winds from the south or southwest increase northward flow along the coast northwest of Cape Lisburne.

Sea Bed Sediments

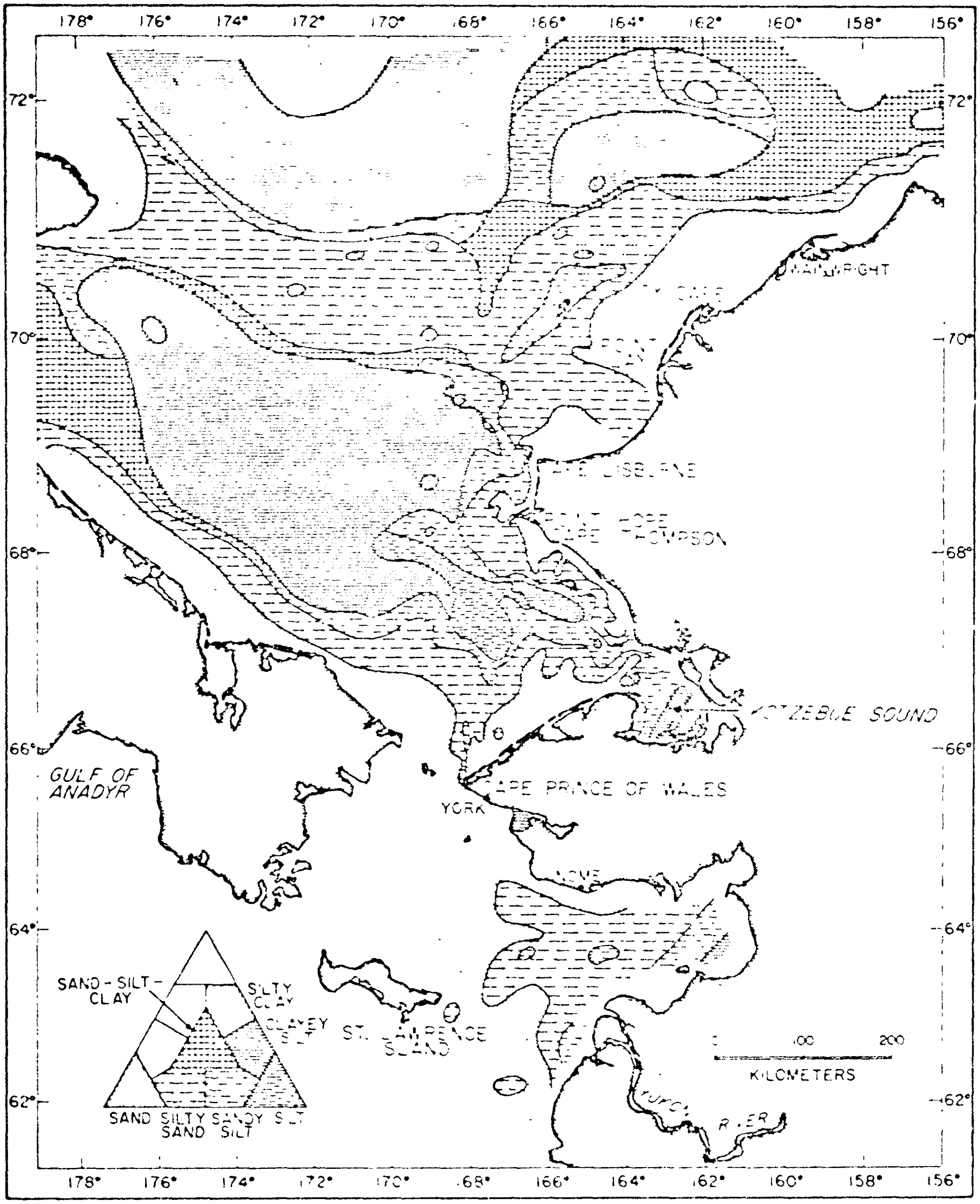
Sea bed sediments collected within the study area consist of palimpsest silts,sands,and gravels (in decreasing order of abudance). Clay particles are generally absent or are found in small amounts. The textural distribution of these deposits has been illustrated by Creager and McManus (1966) using Shepard's three end-member classification (Fig.6). The distribution represents a relatively thin blanket of surficial materials,which tend to thicken and mask subsurface topographic irregularities. Sediment thickness rarely exceeds 10 m and is more often 3 to 5 m thick (Moore,1964). In water depths greater than 30 m bedrock is frequently exposed.

The distribution pattern seen in Figure 6 indicates that movement of sediments over the shelf is largely controlled by the predominant northward flow of coastal and offshore waters. Deposition is believed to be localized in depressions and beneath current eddies in the lee of spits and headlands (Holmes,1975).

The main sediment source for the southern portion of the study area is the northward flow of waters through Bering Strait (Creager and McManus, 1966). During the Holocene (last 12,000 years), one-third to one-half of the sediment load of the Yukon River ($96.8X10^{6}$ tons/yr at present) has bypassed

Figure 6. Textural distribution of sea bed sediments expressed in terms of three end-member relationship of Shepard (1954). From Creager and McManus (1967).

the northern Bering Sea and has been deposited in the southern Chukchi Sea (Nelson and Creager,1977). During the past 18,000 years, sediment has been deposited in the southern Chukchi Sea at an estimated average rate of



178°
176°
174°
172°
170°
168°
166°
164°
162°
160°
158°
156°
72°
70°
68°
66°
64°
62°
KOTZEBUE SOUND
GULF OF ANADYR
YORK
SAND - SILT - CLAY
SILTY CLAY
CLAYEY SILT
SAND
SILTY SAND
SANDY SILT
SILT
KILOMETERS

Figure 6

78-693

70 mg/cm^2/yr (62 cm/1000 years) (Holmes and others,1968;McManus and others 1969).

Secondary sources of sediments introduced into the study area are the cliffs forming the Cape Thompson-Cape Lisburne headland, which provide gravel in significant amounts to be dispersed by wave action. Other rivers along the coast usually flow into coastal lagoon complexes walled off from the shelf by barrier beaches with a few narrow openings. Materials introduced by ice-rafting are considered to be relatively insignificant,but, the importance of this mechanism may increase in the northern portion of the study area where sediment distribution is diverse (Creager and McManus,1967) and where ice islands or ice-island fragments become grounded,as at Hanna Shoal. The relatively long residence time on such shoals of grounded ice islands,which are of glacial origin and contain erratics, may produce a significant local increase in the proportion of coarse-grained detritus in the sea bed sediments.

Radiographs of box-core samples collected on the central shelf reveal sedimentary structures indicating that the sea bed is heavily utilized and reworked by benthic fauna (Barnes,1972) and subjected to ice gouging (Barnes and Reimnitz,1974).

Sea Ice Regime

For between 7 and 9 months of the year, the entire eastern Chukchi Sea is ice covered. The inner shelf, out to about the 20 m isobath, is covered by floating fast ice that is attached to the coast and reaches a thickness of 1.3 to 2 m by winters end. Prevaling winter winds cause an overall southward migration of the polar pack ice, aganist the general northward flowing currents, from its August-September position northwest of Point Barrow to the northern Bering Sea through Bering Strait. By Novermber the polar pack ice has moved south to Icy Cape and by mid-January the entire Chukchi Sea is closed by the polar pack ice. At no time is the sea a solid sheet of ice. Rather, the polar pack ice is contiusely undergoing compaction and rarefaction under the influence of winds and currents.

Within the polar pack ice canopy two types of ice have sufficient draft (greater than 20 m) to ground within the study area, sea ice ridges, the more abundent type and ice island fragments calved from the floating ice shelves of northern Ellesmere Island and brought westward by the Pacific Gyre. More than 400 such fragments were observed along the Alaskan Beaufort Sea coast during a reconnaissance flight in spring of 1972 (Hnatiuk and Johnston,1972), and 27 were found by William S. Dehn in the grounded icefield at Hanna Shoal in 1972 (Kovacs and others,1975). Ice Island T-3 which grounded on Hanna Shoal in 1960 was about 50 m thick (crary,1954) and its keel was about 44 m below sea level.

Many sea-ice ridges, which are numerous in the polar pack ice, have keels of draft exceeding 20 m. Sonar measurements of such keels along 165 km of track in the Chukchi and Beaufort Seas (Weeks and others,1971) showed that 4 percent were more than 23 m deep and that one was more than 30 m deep. A 47 m keel depth has been reported by Waldo Lyon (in Weeks and others ,1971).

Sea-ice ridges form by compression ,or by shear with a component of compression, throughout the polar pack ice canopy. The deformation is most intense in the Stamukhi Z-ne (after Reimnitz and others,1977c) ,a zone of highly deformed first-year ice that lies between the drifting polar pack ice and the stationary floating-fast ice that develops along both the Beaufort and Chukchi Sea coast in winter and spring. Ridge heights and keel depths have been found to be 10 to 20 percent greater in the Stamukhi Zone than in the polar pack and ridges and keels are as much as 50 percent more frequent. Belts of heavily ridged ice in the Stamukhi Zone may extend parallel to the coast for tens of kilometers (Klimovich,1972; Hibler and others,1972;Kovacs and Mellor,1974).

METHODS

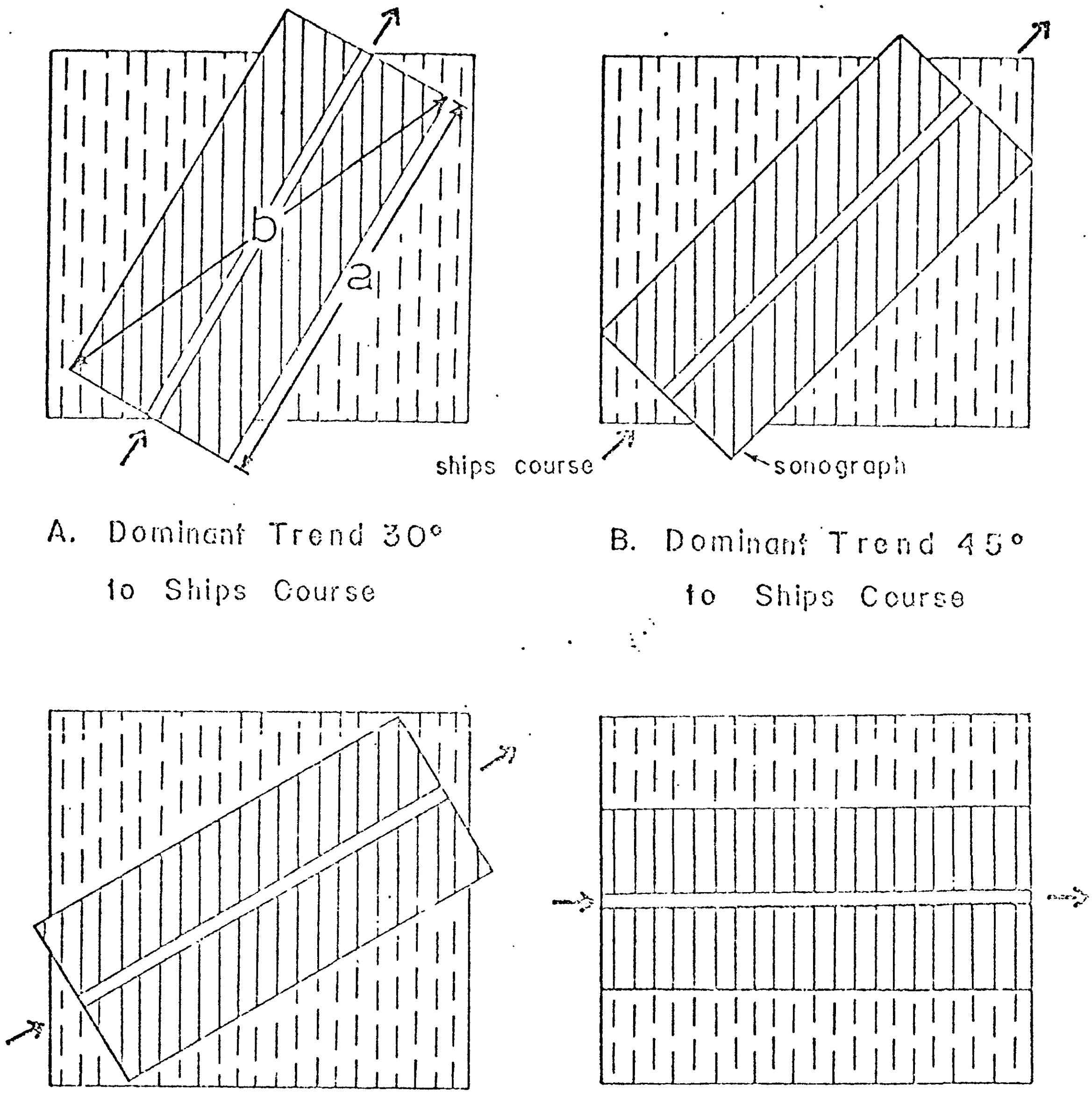
The dominant trend of ice gouges, their density, and maximum incision width were determined directly from sonographs over 1-km, linear segments of tracklines plotted in Figure 3. Corresponding maximum incision depths and water depths were measured directly from fathograms. The values (Appendix 1 and 2) were normalized to minimize variations due to differences in lateral distortions and trackline orientation relative to the dominant gouge trend of a given segment. The values were then classed according to these parameters and their relative frequency plotted with respect to discrete water depth intervals. Mean ice gouge densities and dominant ice gouge trends over complete trackline segments were also plotted and displayed geographically.

Most ice gouges are linear. The overall orientation (azimuth) along an ice gouge is the gouge trend (Fig.4). The dominant trend of ice gouges over trackline segments was determined visually and then measured with respect to the navigational heading of the trackline segment. Distortion in the sonographs caused by differences in ship speed versus paper speed was compensated for by using angular correction ellipses (Newton and others,1973) when measuring gouge trends. Dominant gouge trends could not be determined for all trackline segments because of the high variability of gouge orientation in some regions.

To determine ice gouge densities, all identifiable ice gouges were counted following the method of Reimnitz and Branes (1974). Every gouge produced by a multi-keeled ice fragment was included. Corrections were than applied to normalize the observed values to represent the number of gouges which would have been counted on a survey heading run normal to the dominant gouge trend. For a given seafloor segment more gouges will be counted on a survey heading normal to the dominant gouge trend than one run parallel to it. The correction factor used is expressed by $N=N_{obs}$ $(X/X\sin\emptyset + Y\cos\emptyset)$, where N is the corrected number of ice gouges per trackline segment, N_{obs} is the observed number of ice gouges per trackline segment, X is the length of trackline segment, Y is twice the slant range of the side-scan sonar, and $\emptyset$ is the angle between the dominant gouge trend over the trackline segment and the trackline azimuth. This correction factors recognizes that the number of observed ice gouges per trackline segment (X) is based on counts made over a rectangular area (in most cases 250 m wide and 1000 m long) whose diagonal length is greater than the length of the trackline segment (Fig.7).

The maximum incision width (Fig.4) produced by a single ice gouge event over each trackline segment was measured, again using a correction ellipse to compensate for lateral distortion. In general, ice gouges with incision widths less than 2 m could not be resolved on sonographs. The widest ice gouge event over a particular trackline segment did not always

Figure 7. For a given trackline segment (a) more ice gouges will be observed on a survey heading running normal to the dominant ice gouge trend than one running parallel to it. In normalizing ice gouge counts with respect to survey heading vs dominant trends consideration was given to the fact that over the rectangular area covered by sonographs the diegional length (b) is greater than the trackline segment.



A. Dominant Trend 30° to Ships Course

B. Dominant Trend 45° to Ships Course

C. Dominant Trend 60° to Ships Course

D. Dominant Trend 90° to Ships Course

Figure 7.

cross the axis of the survey trackline and therefore was not always recorded on corresponding bathymetric profiles.

The maximum gouge incision depth (Fig.4) over each trackline segment was measured directly from bathymetric profiles with a resolution of about 0.5 m. The values obtained are conservative, since only gouges directly beneath the ship could be measured and ture depth could be measured only for gouges that were wide relative to the fathometer sound cone.

RESULTS

Side-scan sonar surveys of the eastern Chukchi Sea shelf which were obtained along earlier (1972) seismic reflection tracklines that showed hyperbolic echo traces, confirmed the presence of ice gouges cut into the sea bed. A positive correlation between the occurrence of hyperbolic echo traces and the presence of ice gouges was found, but an inverse relationship was not.

The areal distribution of maximum ice gouge densities over complete trackline segments (Fig.8) shows that within the study area, ice gouges are regionally widespread but not uniformly distributed. South of Cape Lisburne ice gouge dens-ties are generally low, numerous trackline segments are devoid of ice gouges, and in most cases individual gouges appear subdued on sonographs. Along the western flank and more northernportions of Cape Prince of Wales Shoal, maximum ice gouge densities range between 11/km and 16/km. Ice gouge densities exceeding these values are rare south of Cape Lisburne, but occur along the north flank of the shoal extending from Point Hope (trackline segment 33, Fig.8) and between the 24 and 26 m isobaths south-east of Cape Thonpson (trackline segment 38,Fig.8). In these regions maximum

Figure 8. Maximum ice gouge density values over complete trackline segments plotted according to their aeral distribution.

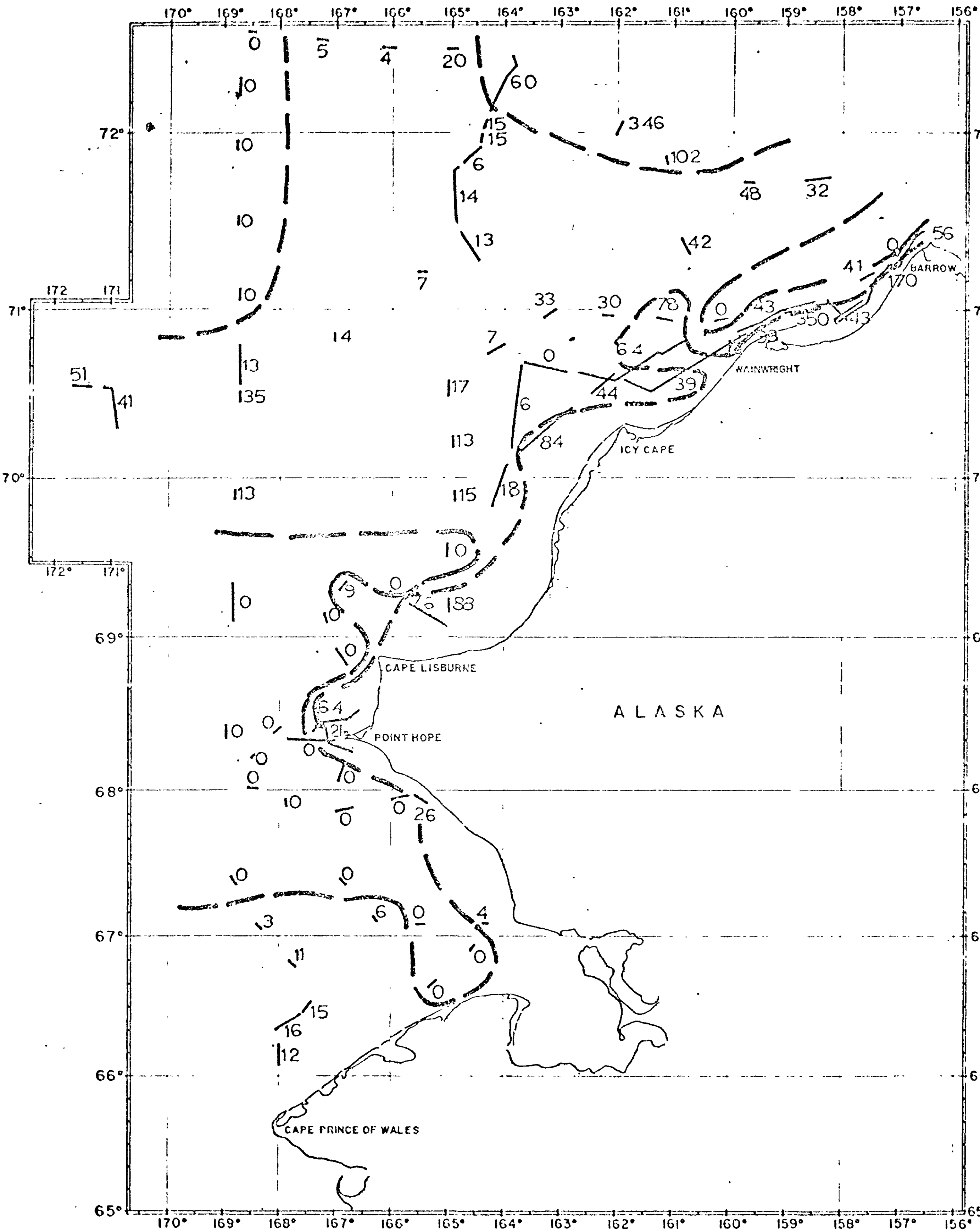

ALASKA
BARROW
WAINWRIGHT
ICY CAPE
CAPE LISBURNE
POINT HOPE
CAPE PRINCE OF WALES

Figure 8

densities of 64/km and 26/km, respectively are present.

North of Cape Lisburne, few trackline segments have no ice gouges and the character of individual gouges are larger than south of the cape. Ice gouge densities exceeding 50/km are common along the coast between the 20 and 35 m isobaths, along the north and northeast flanks of offshore topographic highs, and in regions having relatively steep bottom slopes, including the eastern flank of Barrow Sea Vally.

Over broad, flat regions of the open shelf, few trackline segments reveal densities exceeding 20/km; and none have values exceeding 50/km. Individual gouges in these regions are typically exceptionally long, solitary features.

Figure 8 summarizes ice gouge densities over large areas of the sea bed. Therefore, the patchiness in the areal distribution of gouges seen in the original data (Appendix 2) is not well represented. It should be noted that zones of high gouge densities (100/km) are often found adjacent to zones of low densities (20/km) without intermediate zones. This can sometimes be related to changes in water depth (e.g. trackline segment 2). Major changes in gouge densities for adjacent zones may also occur without notable changes in water depth (trackline segments 3,4,13, and 52). The variability of ice gouge densities over 1-m water depth intervals together with corresponding mean density values (Fig.9) reflects a wide scatter in ice gouge densities over similar bathymetric settings. In general the standard deviation of densities over each interval is found to exceed mean values.

Figure 9. Normalized maximum ice gouge density values (black dots) and mean ice gouge density values plotted over one meter water depth intervals.

Ice gouge densities, maximum incision depths, and maximum gouge widths over 1-km long segments have been summarized in the form of graphs to illustrate the relative frequency of occurrence of gouge parameters over various water

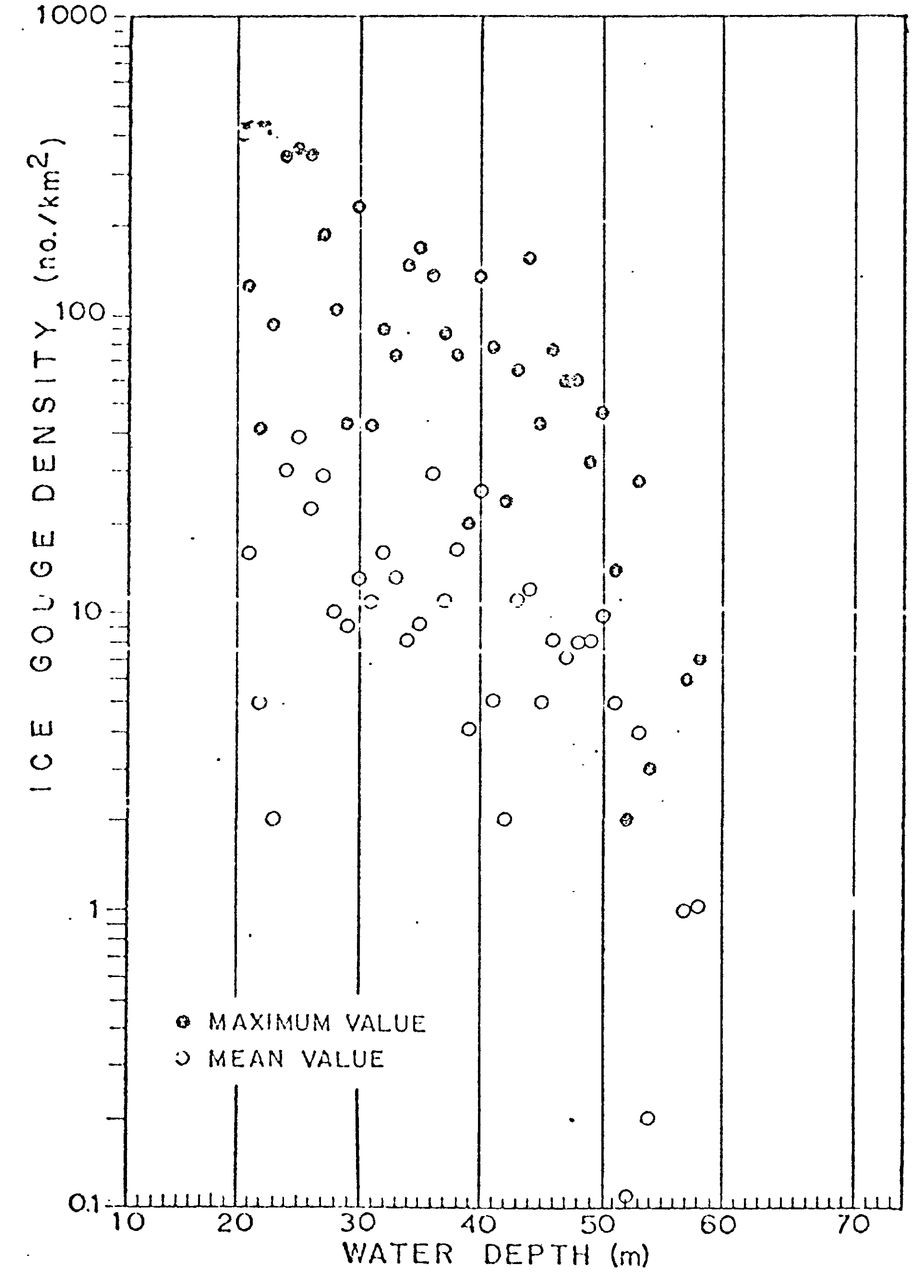

1000
100
10
1
0.1
ICE GOUGE DENSITY (no./km²)
MAXIMUM VALUE
MEAN VALUE
10
20
30
40
50
60
70
WATER DEPTH (m)

Figure 9

depth intervals. Ice gouge densities of over 200/km are found over about 5 percent of the total trackline coverage at water depths between 21 and 35 m. (Fig.10). Ice gouge densities decrease rapidly at depths greater than 50 m. No values higher than 10/km are found at depths over 56 m and no ice gouges are observed in water deeper than 58 m.

Figure 10. Summary of ice gouge density values plotted according to their frequency of occurrence within 5 meter water depth intervals.

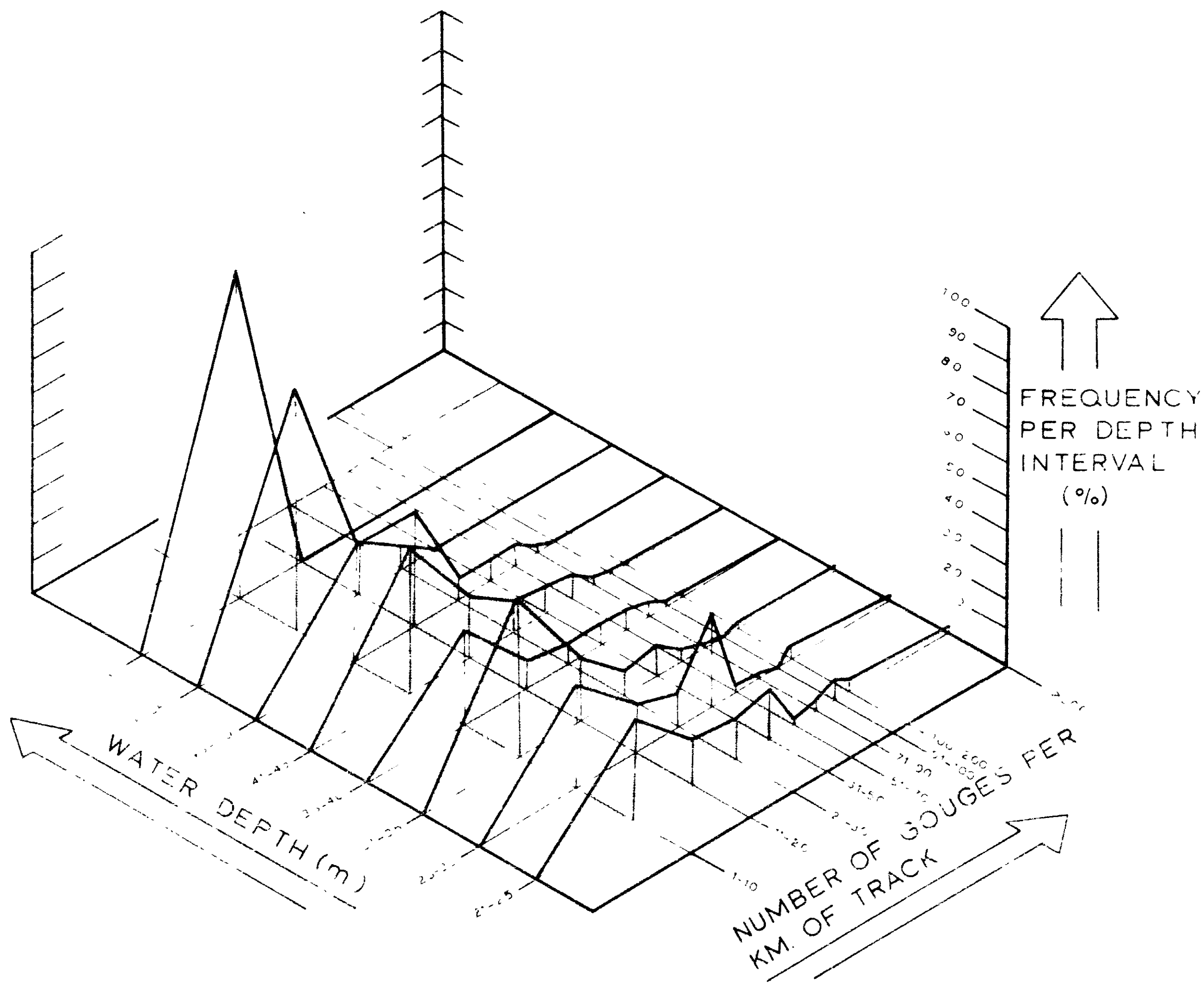

FREQUENCY
PER DEPTH
INTERVAL
(%)
WATER DEPTH (m)
NUMBER OF GOUGES PER
KM. OF TRACK

Figure 10.

Maximum gouge incision depths are highest in the 36 to 50 m water depth range (Fig.11). A maximum incision depth of 4.5 m was found in the 36 to 40 m depth interval. All of the ice gouges in the 21-25 m depth interval have incision depths less than 2.0 m; none of the gouges below 56 m have incision depths of more than one meter. Maximum gouge widths per trackline kilometer compared to water depth (Fig. 12) show an increase in the occurrence of wide gouges between water depths of 31 and 45 m. Gouges wider than 100 m occur within the 36-40 m depth interval. Most of the wide gouges appear to have been produced by multi-keeled ice fragments (Figs. 13 and 14). A wide flat gouge characteristic of that cut by an ice island fragment was observed along trackline segment 54 just east of the crest of Herald Shoal.

Figure 11. Summary of maximum ice gouge incision depth values plotted according to their frequency of occurrence within 5 meter water depth intervals.

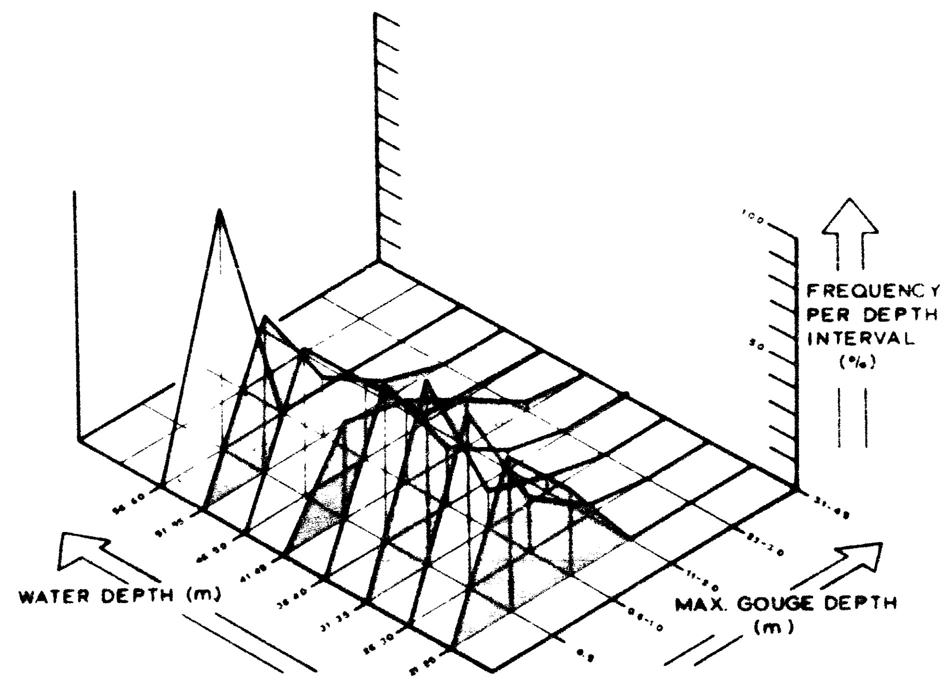
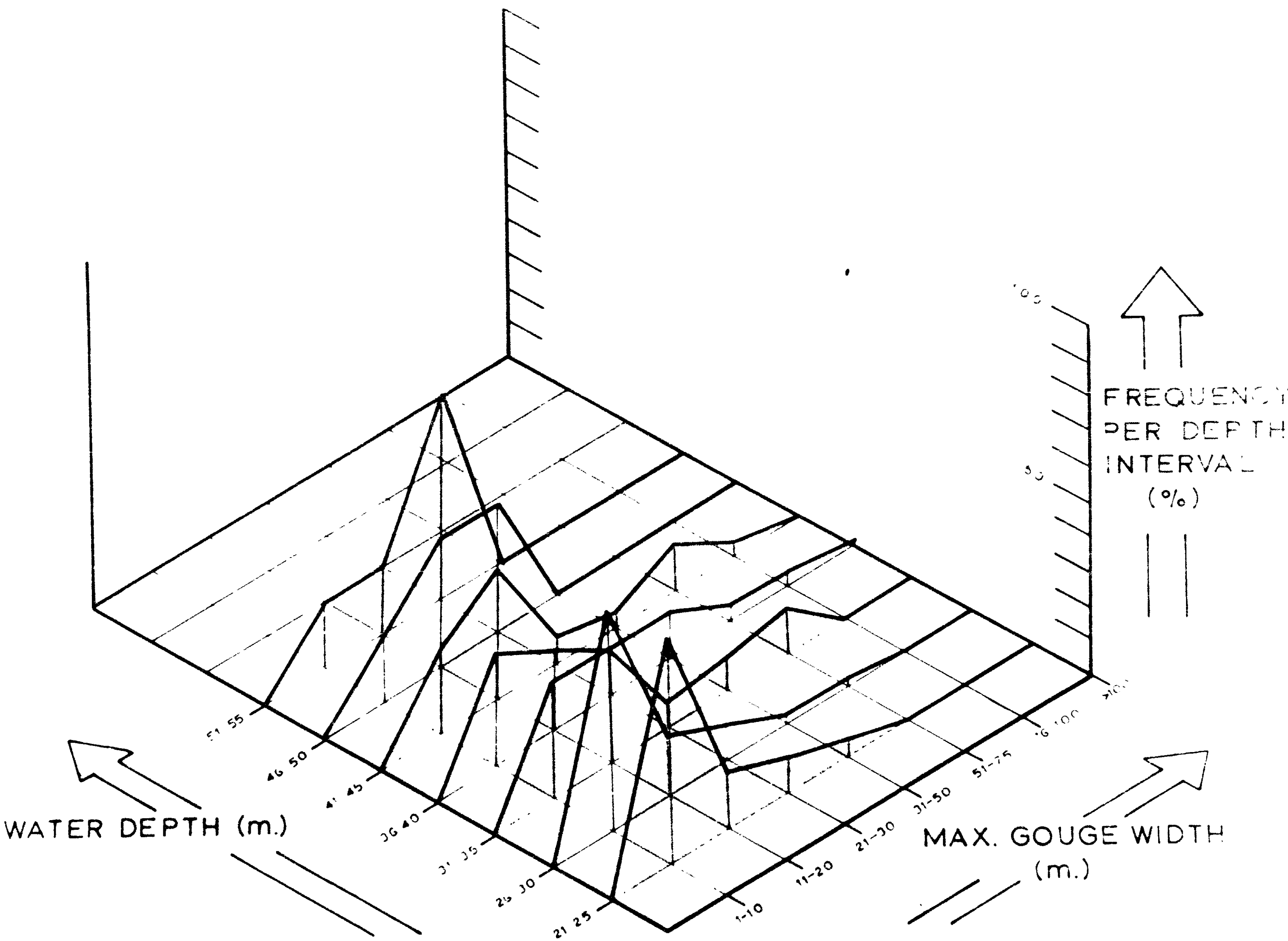

FREQUENCY
PER DEPTH
INTERVAL
(%)
WATER DEPTH (m)
MAX. GOUGE DEPTH
(m)

Figure 11

Figure 12. Summary of maximum ice gouge width values plotted according to their frequency of occurrence within 5 meter water depth intervals.

Figure 13. A maximum gouge incision depth of 4.5 m was measured from this gouge seen in the northern portion of the study area (trackline segment 64, Fig.3).



FREQUENCY
PER DEPTH
INTERVAL
(%)
WATER DEPTH (m.)
MAX. GOUGE WIDTH
(m.)
1-10
11-20
21-30
31-50
51-75

Figure 12

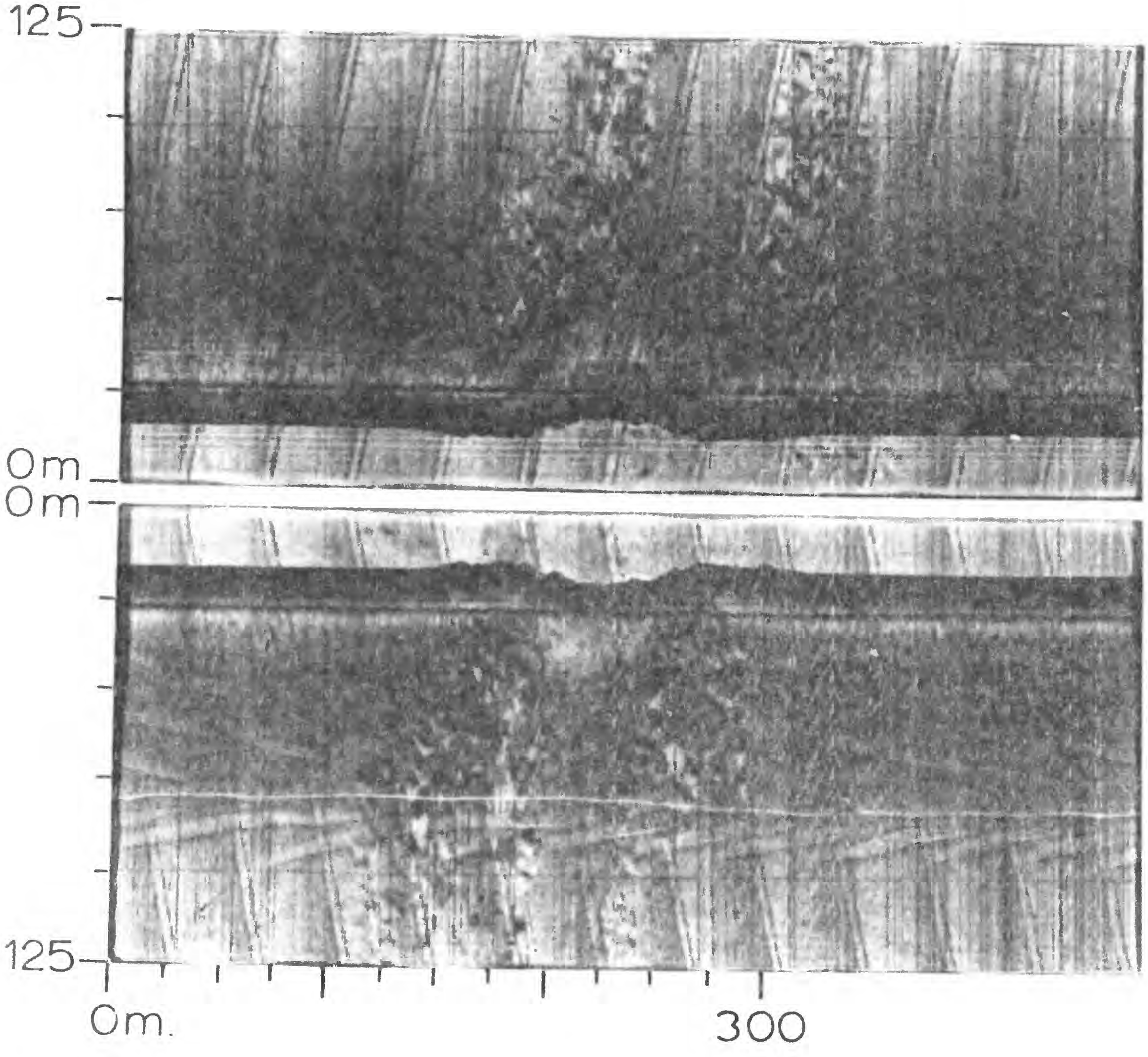


Fig 13.

Figure 14. Widest ice gouges were generally found formed by multi-keeled ice masses characteristic of pressure ridges, as demomatrated in this photo taken of a sonograph obtained in water 37 m deep.

The dominant azimuth of ice gouges taken from the data base and plotted for one kilometer segments (Fig.15) show a wide scatter of dominant trends within the study area. In most cases the dominant trend of gouges lies oblique to regional bathymetric cc.tours; only locally, where slope grandients are relatively steep, is bathymetric control of gouge trends apparent.

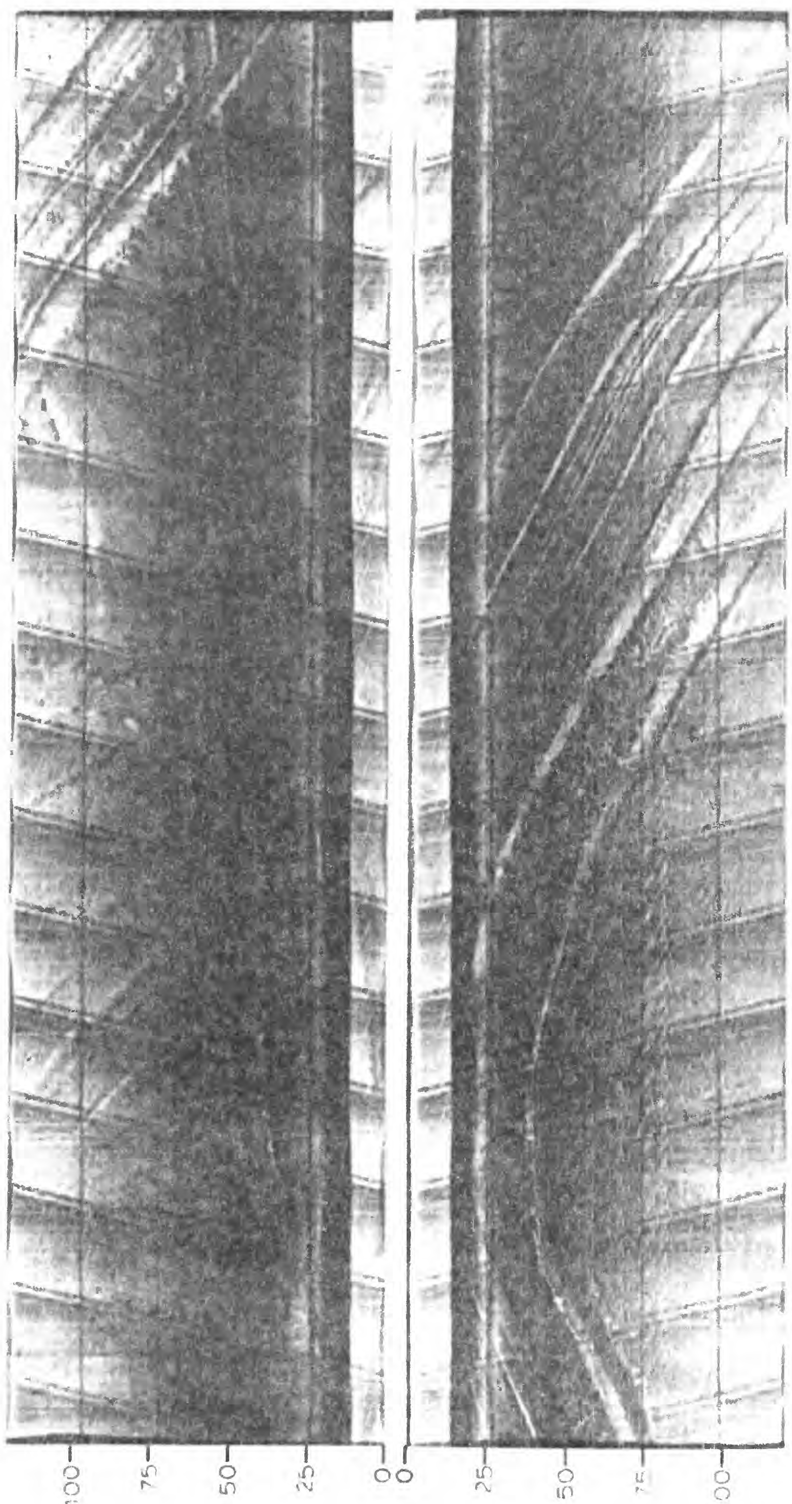
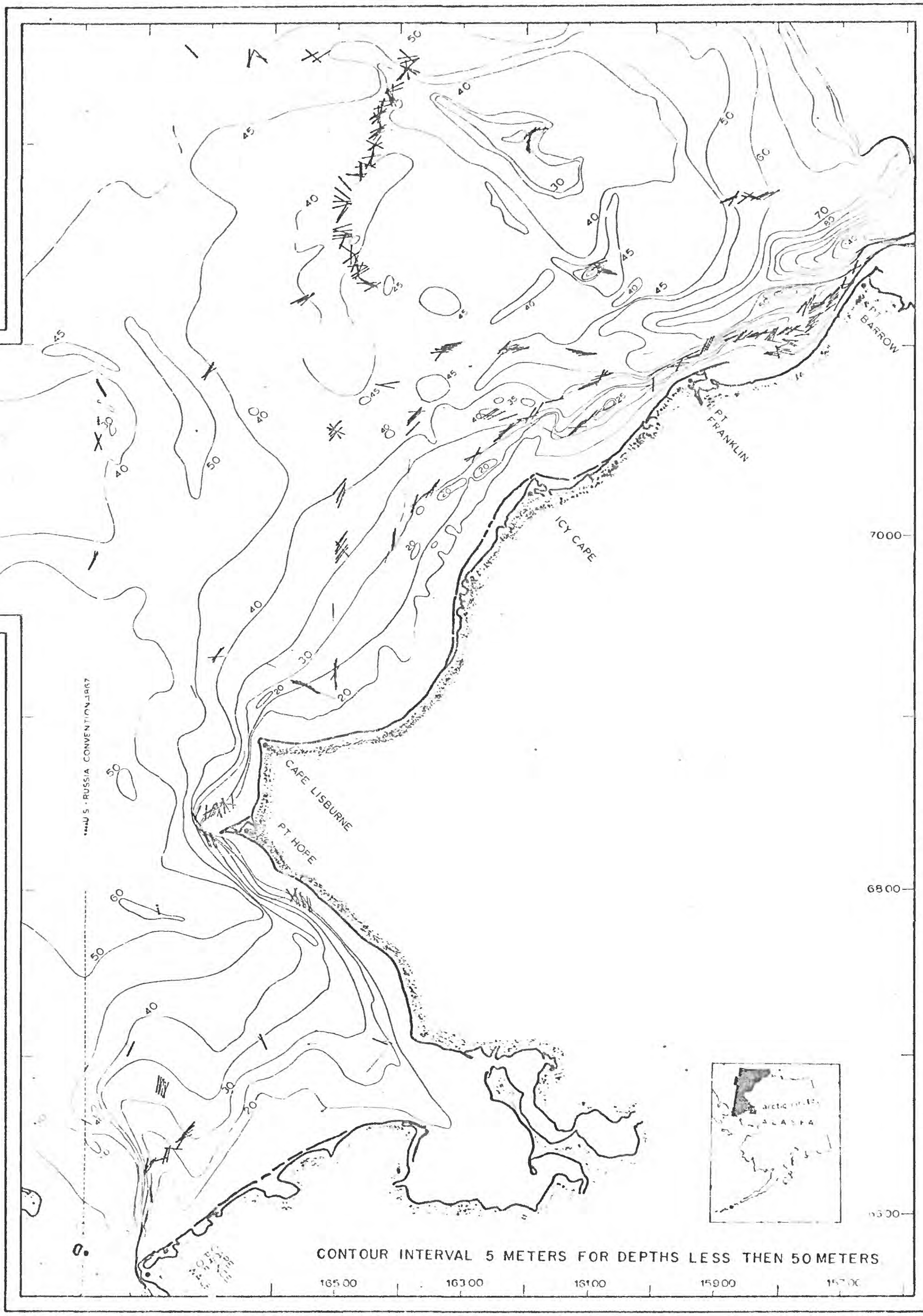


Figure 14

Figure 15. Plotted areal distribution of dominant ice gouge trends over one kilometer long segments of side-scan sonar tracklines (Fig.3).



BARROW
PT. FRANKLIN
ICY CAPE
CAPE LISBURNE
PT. HOPE
U.S.-RUSSIA CONVENTION 1867
7000
6800
CONTOUR INTERVAL 5 METERS FOR DEPTHS LESS THEN 50 METERS
165 00
163 00
161 00
159 00
ALASKA

Figure 15

DISCUSSION

The distribution of ice gouges observed in this study indicates that the entire eastern Chukchi Sea has been and is subject to ice reworking and thatthe morphologic character and density of existing gouges is highly variable. Two types of ice gouges, each characteristic of particular bathymetric settings,are present. Ice gouges in water depths less than 35 m have narrow incision widths,shallow incision depths, high density, and no well developed linear trends (Fig. 16). Gouges in water deeper than 35 m are wider and deeper , occur in lower densities, and are linear over long distances (Figs. 13 and 14). Marked increases in ice gouge densities are found with decreasing water depth, with increasing latitude,and with increased slope gradient.Highest densities occur along the northeast flanks of topographic highs and areas of steep slope grandients. Lowest values occur offshore, over areas of low slope gradients, and along the south flanks of topographic highs.

Figure 16. Sonograph obtained at 25 to 30 m water depth interval. The high density and poorly defined dominant trend of the ice gouges and their narrow,shallow character is typical for gouges observed in water depths less than 35 m.

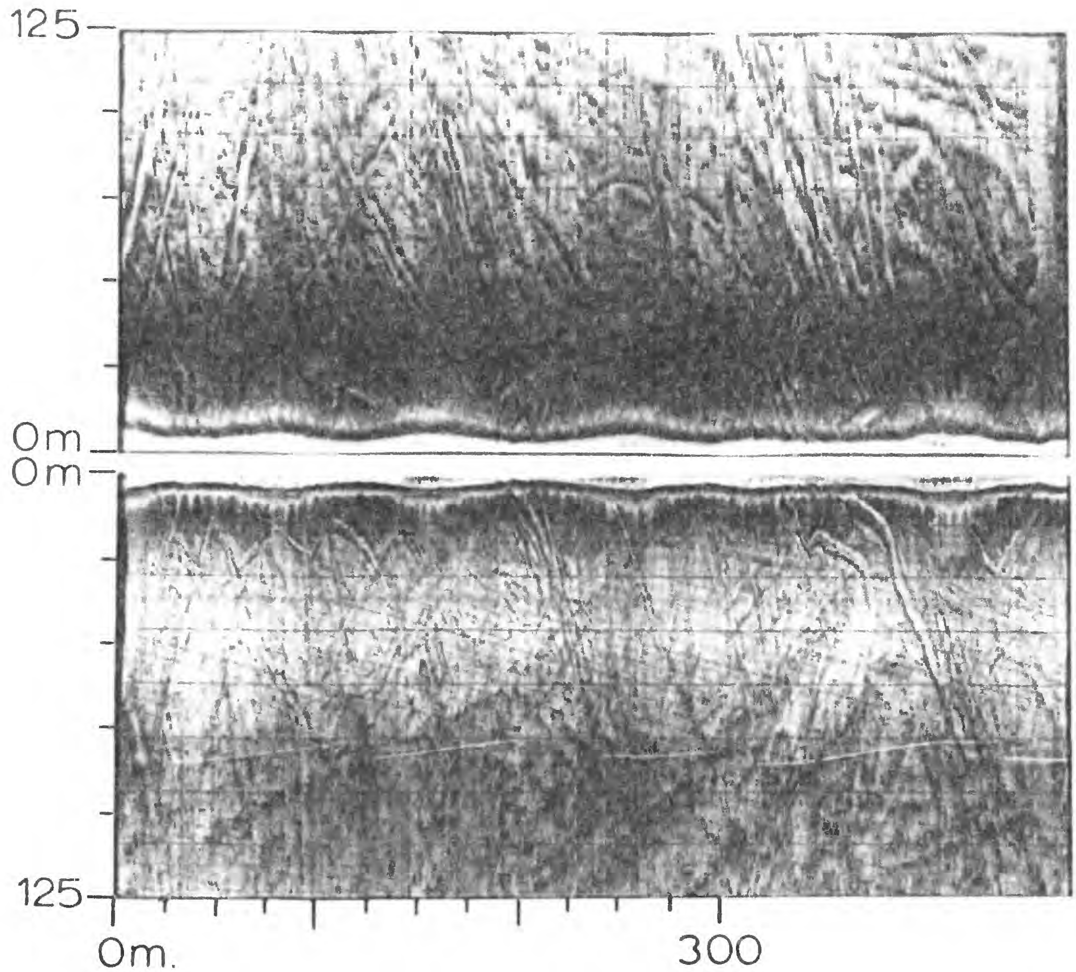


Figure 16

In the southern Beaufort Sea off northern Alaska Reimnitz and Barnes (1974) report ice gouges to dominant small-scale morphology of the shelf seaward of the 8 to 10 m isobaths to water depths of at least 75 m, with ice gouges present in water depths in excess of 100 m. Ice gouge densities of over 100 /km are report for a number of regions across the Alaskan Beaufort Sea shelf. Lowest values occur in the shelter of barrier island chains,off major river deltas, and on the shoreward flanks of bathymetric highs of the central Beaufort Sea shelf. Highest values occur on the seaward side of bathymetric highs having steep slope gradients and within broad (5 to 15 km wide), roughly east-west trending zones parallel to the coast across the central shelf in water 10 to 50 m deep. Ice gouge densities appear relatively uniform over extensive areas of the shelf having similar ice and bathymetric environments.

Evidence suggesting a correlation between zones of the Alaskan Beaufort Sea shelf with high ice gouges densities, great incision depths (up to 5.5 m), and a high degree of disruption of internal sedimentary structures,and sea ice zonation patterns has recently been provided by Reimnitz and others (1977c). Along the boundary between relatively immoble,undeformed fast-ice of the inner shelf and the moble,polar pack ice, the seasonally recurring development of a zone of shear has long been recognized. Within this zone, sea ice is subjected to the highest compressional and shear stress (Kovacs and Mellor, 1974), resulting in the formation of pronouced,linear,pressure and shear ridges as well as hummock fields which are stabilized by grounding,generally between the 10 and 20 m isobaths.Subsequent slippage along the shear boundary is interpreted as occurring at or seaward of initially grounded ridge systems;

new grounded ridge systems thus form a widening zone ,the Stamukhi zone of Reimnitz and others (1977c), which by late winter may extend into water at least 40 m deep. Reimnitz and others (1977c) find a causal relattionship between the spatial distribution of major ice ridge systems of the Stamukhi zone and that of offshore shoals down drift of major coastal promontories. Such a relationship implies that ice gouging is not random over the southern Beaufort Sea shelf for given water depth intervals but may be intensified within certain geographic boundaries.

Such a relationship, in part, appears responsible for regional variations in ice gouge densities within the eastern Chukchi Sea. Correlation of sea ice zonation and well developed ice gouged sea bed morphology has been recognized by Rex (1955) and development of recurrent grounded icefields is well documented for the crest of major bathymetric highs and shoals of both the offshore and coastal regions of the shelf (Kovacs and Mellor,1974;Kovacs and others,1976;Toimil and Grantz,1976).

The distribution of dominant gouge trends reveals no regionally preferred orientations (Fig.15). Only locally are dominant gouge trends developed parallel to bathymetric contours. Such preferred trends occur with steep slope gradients,and along the seaward side of elongate,northeast-southwest striking shoals of the inner shelf. Scattering of trends increases with distance from the coast. This is fundamentally different from the well developed east-west trend of ice gouges parallel to the coast and the bathymetric contours observed in the Alaskan Beaufort Sea.

In the Mackenzie Bay region of the Beaufort Sea (Fig.1) Lewis and others (1976), have differentiated active and relict ice gouges according to water depth. They place the limit of active ice-gouging at the 50 m isobath. This limit is based on the premise that gouge incision depths increase with increasing water depth to some relative maximum. Beyond this maximum, incision depths decrease to a point where the deepest ice keels within the ice canopy just brush the sea bed and produce no gouges. The premise requires that gouges formed in deep water have incision depths limited only by keel draft and not by bottom resistance and for a given water depth zone that rates of ice-gouging and gouge infilling be uniform. Such uniformity is not suggested in the sonographs from the eastern Chukchi Sea.

The distribution of maximum ice gouge incision depths within the study area is patchy. Zones of deep gouge depressions are found adjacent to shallow gouges without intermidate zones and without noted changes in water depth or slope gradients. Maximum values are associated with low slope gradients. No correlation is apparent between high ice-gouge density and deep incision depths except that maximum values for both parameters are found north of Icy Cape. Surficial sea bed sediments throughout this region are thin, textural distribution is diversified and not related directly to water depth (compare Figs.5 and 6), and rock is exposed at or near the sea bed in water deeper than 30 m. It is suggested that these conditions probahly place limits on gouge incision depths unrelated to keel draft; this would explain the wide scatter locally in gouge incision depth values seen in Appendix 2.

Regional increases in ice gouge densities related to both latitude and slope gradient appear independent of water depth or sea ice zonation patterns. Gouge incision depth also show regional increases in maximum values with increasing latitude and decreased slope gradients. These regional increases contribut to the wide scatter in the value of gouge parameters over similar bathymetric settings and suggest pronounced regional differences in rates of both ice gouging and gouge infilling. In a number of areas rapid infilling and reworking of recently formed ice gouges is indicated by the presence of current-produced bedforms adjacent to or within individual ice gouges (Figs.17 and 18). In some cases,gouges appear to have been completely filled in and only narrow linear ribbons of rippled bedforms,absent on the surrounding sea bed, mark former gouge flanks. This condition (Fig.17) indicates an interaction between slow-moving,grounded of gouging ice and swift currents.

Figure 17. The influence of strong currents on ice gouging processes and rapid reworking of ice gouges is recorded in this sonograph by the association of sand ripples along the flanks and trough of individual ice gouges.

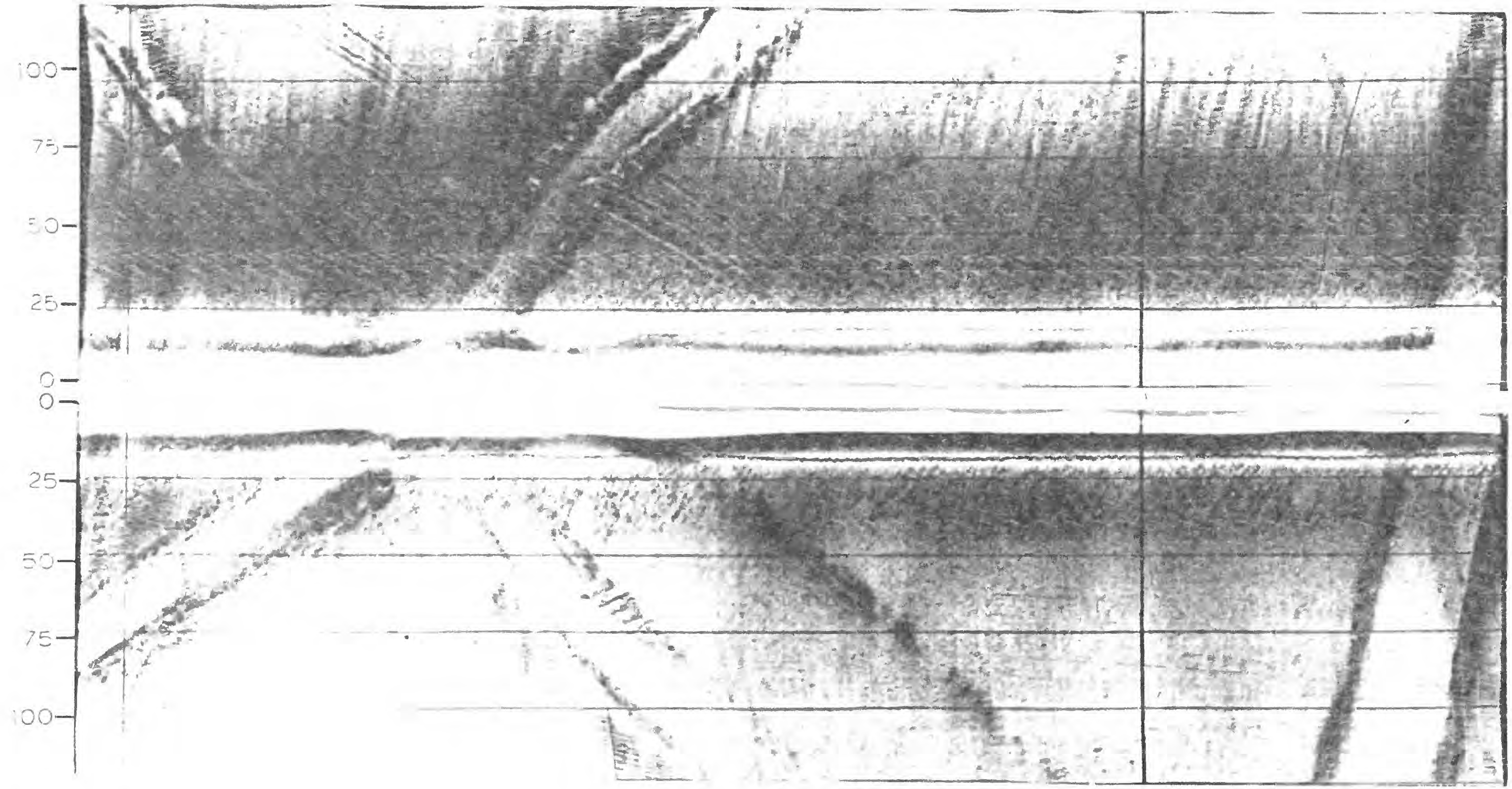


Figure 17

Rippled bedforms are most common in coastal regions south of Icy Cape where water depth is less than 30 m. But, bottom ripples also occur offshore in deeper waters. For example, rippled bedforms infilling ice gouges are found near the crest of Hanna Shoal, 180 km northwest of Point Barrow, in water 33 m deep (Toimil and Grantz, 1976). Along trackline segment 24 (Fig.3) several ice gouges cut across an extensive field of megacurrent ripples with undulating crests in water depths between 43 and 45 m (Fig.18).

Figure 18. Sonograph obtained along trackline segment 24 in water depths of 43 to 45 m in which an ice gouge is seen cutting across an sand ripple field interpreted to be active under present day current regimes.The gouges seen appear subdued and partially filled in.

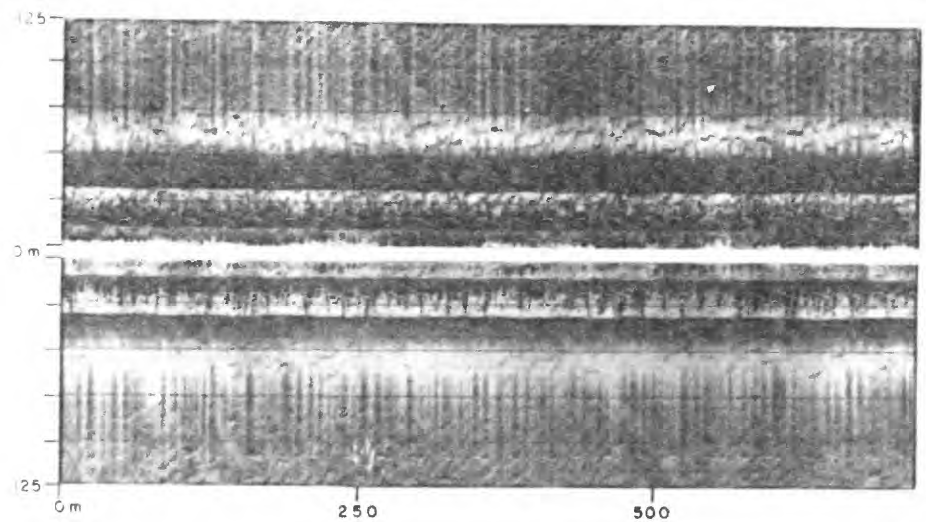


Figure 18

The sand ripples seen in Figure 18 have wave lengths of between 3 and 5 m and amplitudes below the 0.5 m resolution of the fathometer.Ripple crest strike 150°-330° T, perpendicular to the axis of the overlying Alaskan Coastal Current,and ripple slip faces are oriented toward the northeast. Surficial sediments in the area of trackline 24 have been described by Barnes _1972) as containing 50 percent sand with mean grain sizes from 0.62 mm to 2.0 mm. Average surface current speeds in the aera of trackline 25 have been reported to be from 25 cm/sec to 80 cm/sec (U.S. N.O. oceanographic Atlas of the Polar Seas-Part II, 1968). Current ripples, consisting of medium grain sands similar to those described, form at current speeds in excess of 65 cm/sec. These conditions suggest that the ripples seen in Figure 18 are active under present conditions and that the ice gouges observed are recent features. Based on this evidence modern ice-gouging is occurring in water depths of at least 43 m within the study area,and the draft of modern ice within the Chukchi Sea is up to 43 m.

The general decrease in the intensity of ice gouge parameters from north to south within the study area and the lack of gouges along the southern flanks of bathymetric highs on the open shelf indicates a perferred southward direction of ice gouging events.This condition presents à mechanisms were by sea bed materials and benthic communities from high Arctic sources ,picked up by the keels of gouging ice, may be transported southward,perhaps into the Bering Sea. This mechanisms has beenlargely ignored in previous sedimentologic study of the region. In the past, the period in which the eastern Chukchi Sea shelf is covered by an ice canopy has been considered a period of quiescence; when classical sea bed sediment transport processess lie dormant. In the

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Canadan Beaufort Sea Shearer and Blasco (1975) ,using a submersible, have attributed high-bottom water turbidity found in depth less than 60 m to resuspension of bottom sediments by ice action of to erosion by accelerated bottom currents constricted under an ice canopy. It appears likely that similar ice related processes influence the sedimentary environment of the ice covered Chukchi Sea shelf.

CONCLUSIONS

Comparison of ice-gouging in the Chukchi Sea with that of the Alaskan Beaufort Sea shows a number of major differences and some similarites. The Chukcki Sea differs from the Beaufort Sea in that a) ice-gouge density is more variable under otherwise uniform conditions,b) the maximum water depth to which ice gouges are observed is much shallower (58 m vs 100 m), c) rates of gouge infilling and ice gouging are not uniform over similar water depth intervals,d) regional orientations of gouge trends are not well developed,e) where gouge trends are developed they lie oblique to bathymetric contours,and f) the process of ice gouging is often associated with and modified by strong currents. The two areas are similar in max-mum values of ice gouge density, incision depth,and gouge width. In addition,it is clear that ice gouging is an important geologic agent in the sedimentary and morphologic environments of both the Chuckchi and Beaufort Seas.

The Chukchi Sea continental shelf has long been considered to have a potential for major oil and gas accumulations.The results of this study have direct implications to design and safety limitations of offshore exploration and engineering structures placed on the sea bed and subject to ice gouging.

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APPENDIX 1.

In this section the initial position of side-scan sonar trackline segments plotted in Figure 3 are given. The positions listed were determined by satellite navigation fixes taken by the U.S.Coast Guard Cutter BURTON ISLAND and can be considered accurate to within 0.5 km.

TRACKLINE SEGMENT	INITIAL POSITION	
	N. LATITUDE	W. LONGITUDE
01	71°21.2'	156°48.2'
02	71°03.8'	157°49.3'
03	70°58.0'	159°06.0'
04	70°51.6'	159°42.1'
05	70°38.0'	162°00.5'
06	70°25.4'	162°43.0'
07	70°06.2'	163°56.5'
08	70°11.4'	163°53.9'
09	70°42.3'	163°39.6'
10	70°38.8	162°41.0'
11	70°44.3	160°00.0'
12	70°52.3'	159°52.1'
13	71°03.2'	158°15.1'
14	71°10.0'	157°47.0'
15	71°12.7'	156°32.5'
16	71°27.6'	156°32.5'
17	71°15.5'	157°07.0'
18	70°57.3'	160°00.0'
19	70°56.5'	161°00.0'
20	70°58.0'	162°03.0'
21	71°00.0'	163°05.5'
22	70°48.2'	163°58.5'
23	70°36.0'	165°00.0'

TRACKLINE SEGMENT	INITIAL POSITION	
	N. LATITUDE	W. LONGITUDE
24	70°15.9'	164°54.2'
25	69°56.0'	165°53.6'
26	69°36.8'	165°02.0'
27	69°16.4'	165°00.0'
28	69°05.5'	169°59.0'
29	69°06.5'	165°53.5'
30	69°22.6'	166°47.0'
31	69°10.9'	167°13.2'
32	68°57.0'	166°59.8'
33	68°33.2'	166°34.1'
34	68°27.0'	167°20.1'
35	68°12.2'	166°49.2'
36	67°53.2'	166°57.5'
37	67°57.1'	166°03.0'
38	67°59.5'	165°37.6'
39	66°39.4'	165°22.5'
40	66°56.9'	164°37.0'
41	67°05.8'	164°14.0'
42	67°06.0'	165°23.5'
43	67°06.3'	166°13.5'
44	67°22.0'	166°13.0'
45	67°54.9'	167°50.0'
46	68°02.0'	168°22.3'

TRACKLINE SEGMENT	INITIAL POSITION	
	N. LATITUDE	W. LONGITUDE
47	68°22.0'	167°45.0'
48	68°26.1'	167°57.2'
49	68°15.6'	168°25.0'
50	68°22.1'	168°56.5'
51	69°07.3'	168°51.0'
52	69°53.2'	168°48.5'
53	70°28.9'	168°44.0'
54	70°34.4'	168°44.8'
55	70°04.2'	168°44.2'
56	71°30.0'	168°45.0'
57	71°55.2'	168°47.2'
58	72°12.9'	168°42.5'
59	72°35.5'	168°33.5'
60	72°32.8'	167°22.0'
61	72°30.0'	166°12.0'
62	72°28.9'	165°01.5'
63	72°26.8'	163°51.0'
64	72°05.5'	164°18.9'
65	72°00.5'	164°24.0'
66	71°55.8'	164°25.5'
67	71°49.1'	164°48.0'
68	71°27.9'	164°46.2'
69	71°19.8'	160°42.2'

TRACKLINE SEGMENT	INITIAL POSITION	
	N. LATITUDE	W. LONGITUDE
70	71°58.5'	162°01.5'
71	71°50.0'	161°04.0'
72	71°44.0'	159°49.5'
73	71°44.0'	158°39.0'
74	71°13.8'	165°23.5'
75	70°52.5'	167°01.5'
76	70°34.5'	171°40.0'
77	70°32.0'	171°10.0'
78	67°26.4'	168°50.5'
79	67°06.9'	168°23.2'
80	66°50.9'	167°50.5'
81	66°32.7'	167°26.2'
82	66°27.0'	167°37.2'
83	66°14.6'	168°00.5'

APPENDIX 2

In this section each trakline segment listed in Appendix 1 and plotted in Figure 3 has been broken down into linear 1 km long segments. Listed for each segment are the date and time side-scan sonar and bathymetric data were obtained along the segment and the average water depth traversed. Also listed are the speed and course of the ship over each recording period. Corresponding gouge parameters including the dominant gouge trend relative to the ship's heading measured for the sonographs, the corrected dominant azimuth of gouges over the segment,the observed number of ice gouges present, the correction factor used to norminalize gouge counts, the corrected number of gouges , the maximum gouge incision depth measured over the one kilometer long segment, and the maximum width of the widest gouge observed along the segment.

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
01	217	22:07	54.0	4	207	+25	242	002	1.6	003	0.5	---
		22:15	48.0			--	---	004	---	004	0.5	---
		22:23	46.0			+30	237	013	1.4	018	0.5	---
		22:31	44.0			+30	237	027	1.4	038	0.5	---
		22:38	43.0			+20	227	056	1.7	065	0.5	---
		22:46	44.0			+05	212	052	3.0	156	0.5	---
		23:15	44.0		226	+30	256	012	1.4	017	0.5	---
		23:24	44.0			--	---	---	---	---	---	---
		23:37	43.0	6	225	+20	245	017	1.7	029	0.5	---
		23:43	43.0			--	---	015	---	015	0.5	---
		23:49	44.0			--	---	003	---	003	0.5	---
		23:56	44.0			--	---	---	---	---	---	---
	218	00:08	44.0			--	---	---	---	---	---	---
		00:15	44.0			--	---	004	---	004	0.5	---
		00:21	44.0			--	---	---	---	---	---	---
02	218	03:20	36.0	5	263	+15	278	011	2.0	022	0.5	---
		03:26	36.0			+25	288	026	1.6	042	0.5	---
		03:32	36.0			+20	283	024	1.7	041	0.5	---
		03:39	36.0			-30	233	031	1.4	043	0.5	---
		03:45	36.0			-22	241	040	1.7	068	0.5	---
		03:53	36.0			-25	238	085	1.6	136	0.5	---
		04:01	36.0			+30	293	056	1.4	078	0.5	---
		04:08	36.0			+15	278	057	2.0	114	0.5	013
		04:14	36.0			+30	293	061	1.4	085	0.5	043
		04:21	36.0			+15	278	047	2.0	094	0.5	025
		04:27	36.5			-18	245	042	1.7	071	0.5	---
		04:34	36.5			-25	238	045	1.6	072	0.5	---
		04:38	36.5			-20	243	044	1.7	075	0.5	---
		04:46	36.5			-15	248	053	2.0	106	0.5	013
		04:53	36.0			+40	303	051	1.2	061	0.5	025
		04:59	36.0			+35	298	041	1.3	053	0.5	013
		05:05	36.0		236	-30	206	050	1.4	070	0.5	---
		05:12	35.0			-20	216	046	1.7	078	0.5	014
		05:18	35.0			-15	221	033	2.0	066	0.5	010
		05:25	35.0			+15	251	065	2.0	130	0.5	018
		05:31	34.0			-10	226	062	2.4	149	0.5	013
		05:37	34.0			+15	251	028	2.0	056	0.5	017

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
02	218	05:37	34.0	5	236	+15	251	028	2.0	056	0.5	017
		05:44	34.0		263	+15	278	029	2.0	058	0.5	008
		05:51	34.0			--	---	021	---	021	0.5	---
		05:58	34.0			--	---	016	---	016	0.5	---
		06:04	34.0			-05	258	009	3.0	027	0.5	005
		06:10	----			-20	243	008	1.7	014	---	---
		06:16	----			--	---	004	---	004	---	---
		06:30	31.0			--	---	000	---	000	---	---
		06:37	31.0			-10	253	008	2.4	019	0.5	014
		06:43	30.0			-10	253	009	2.4	022	0.5	013
		06:50	29.0			-10	253	007	2.4	017	0.5	013
		06:56	28.0			-15	248	009	2.0	018	0.5	003
		07:03	27.0			-25	238	037	1.6	059	0.5	005
		07:10	26.0			-35	228	032	1.3	042	0.5	005
		07:16	25.0			+08	271	078	2.4	187	0.5	005
		07:23	25.5			-25	238	072	1.6	115	0.5	008
		07:30	24.0			-10	253	145	2.4	348	0.5	008
		07:36	26.0			+25	288	220	1.6	352	0.5	015
		07:42	27.0			-15	248	094	2.0	188	0.5	008
		07:49	32.0			-10	253	007	2.4	017	0.5	006
		07:55	32.0			-10	253	096	2.4	230	0.5	003
		08:02	30.5			-15	248	014	2.0	028	0.5	005
		08:08	32.0			-25	238	033	1.6	053	0.5	005
		08:14	32.5			--	---	002	--	002	0.5	003
		08:20	33.0			-15	248	022	2.0	044	0.5	005
		08:27	33.0			-15	248	037	2.0	074	0.5	003
		08:34	33.0			--	---	010	---	010	0.5	---
		08:40	33.0			--	---	000	---	000	---	---
03	218	12:14	38.0	5	238	--	---	002	---	002	0.5	---
		12:20	37.5			--	---	003	---	003	0.5	---
		12:26	37.5			--	---	000	---	000	---	---
		12:33	37.5			--	---	000	---	000	---	---
		12:39	38.0			--	---	002	---	002	0.5	---
		12:45	38.0			--	---	000	---	000	---	---
		12:52	39.0			--	---	000	---	000	---	---
		12:58	38.0			--	---	000	---	000	---	---
		13:05	38.0			--	---	000	---	000	---	---
		13:11	38.0			+10	248	009	2.4	022	0.5	005

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM.^{2}	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
03	218	13:17	37.5	5	238	+20	258	011	1.7	019	0.5	003
		13:23	37.5			+20	258	007	1.7	012	0.5	---
		13:31	38.0			+10	248	016	2.4	038	0.5	010
		13:37	38.0			+10	248	023	2.4	055	0.5	010
		13:43	38.0			+10	248	008	2.4	019	0.5	---
		13:49	38.0			+15	253	012	2.0	024	0.5	010
		13:56	38.0			+05	243	031	3.0	093	0.5	005
		14:04	37.0			+05	243	021	3.0	063	0.5	003
		14:10	37.0			+05	243	028	3.0	084	0.5	003
		14:16	37.0			--	---	003	---	003	0.5	---
		14:22	37.0			--	---	005	---	005	0.5	008
		14:34	37.5			--	---	002	---	002	0.5	---
		14:40	38.0			--	---	004	---	004	0.5	---
		14:47	38.0			+30	268	006	1.4	008	0.5	---
		14:55	38.0			--	---	000	---	000	---	---
		15:02	37.0			+10	248	011	2.4	026	0.5	004
		15:09	36.5			+10	248	011	2.4	026	0.5	003
		15:15	36.5			-20	218	006	1.7	010	0.5	---
		15:21	36.5			+25	263	038	1.6	061	0.5	013
		15:27	36.5			+30	268	043	1.4	060	0.5	005
		15:34	36.5			--	---	011	---	011	0.5	---
		15:41	36.5	6		--	---	000	---	000	---	---
		15:46	36.5			--	---	000	---	000	---	---
		15:51	36.5			+05	243	016	3.0	048	0.5	010
		15:56	36.5			+05	243	032	3.0	096	0.5	005
		16:01	36.0			+05	243	019	3.0	057	0.5	003
		16:06	36.0			--	---	004	---	004	0.5	---
04	218	20:50	22.0	7	221	--	---	000	---	000	---	---
		20:55	22.0			--	---	000	---	000	---	---
		21:00	22.0			--	---	000	---	000	---	---
		21:05	22.0			--	---	000	---	000	---	---
		21:10	22.0		237	--	---	000	---	000	---	---
		21:15	22.0			--	---	000	---	000	---	---
		21:20	22.0			--	---	000	---	000	---	---
		21:25	22.0			--	---	000	---	000	---	---
		21:30	22.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
04	218	21:35	22.0	7	237	--	---	000	---	000	---	---
		21:40	22.0			--	---	000	---	000	---	---
		21:45	22.0			--	---	000	---	000	---	---
		21:50	22.0			--	---	000	---	000	---	---
		21:55	22.0			--	---	000	---	000	---	---
		22:00	22.0		242	-15	227	014	2.0	018	---	---
		22:05	22.0			-10	232	007	2.4	017	0.5	---
		22:10	22.0			-20	222	012	1.7	020	0.5	---
		22:15	22.0			--	---	008	---	008	0.5	---
		22:34	22.0			--	---	010	---	010	0.5	---
		22:39	22.0			--	---	005	---	005	0.5	---
		22:44	22.0			--	---	000	---	000	---	---
		22:49	22.0			-15	227	008	2.0	016	0.5	---
		22:54	22.0			--	---	000	---	000	---	---
		23:00	22.0			--	---	000	---	000	---	---
		23:05	22.0			--	---	000	---	000	---	---
		23:10	22.0			--	---	000	---	000	---	---
		23:15	22.0			+15	257	003	2.0	006	0.5	---
		23:20	22.0			--	---	000	---	000	---	---
		23:30	22.0			--	---	000	---	000	---	---
		23:35	22.0			--	---	000	---	000	---	---
		23:40	22.0			--	---	000	---	000	---	---
		23:50	22.0			--	---	000	---	000	---	---
		23:55	22.0			--	---	000	---	000	---	---
	219	00:00	22.0			--	---	000	---	000	---	---
		00:05	22.0			--	---	000	---	000	---	---
		00:10	22.0			--	---	000	---	000	---	---
		01:10	22.0			--	---	000	---	000	---	---
		01:15	22.0			--	---	000	---	000	---	---
		01:20	22.0			--	---	000	---	000	---	---
		01:25	22.0			--	---	000	---	000	---	---
		01:30	22.0			--	---	000	---	000	---	---
		01:35	22.0			--	---	000	---	000	---	---
		01:40	22.0			--	---	000	---	000	---	---
		01:45	22.0			--	---	000	---	000	---	---
		01:50	22.0			--	---	000	---	000	---	---
		01:55	22.0			--	---	000	---	000	---	---
		02:10	22.0			+05	247	008	3.0	024	0.5	003
		02:15	22.0			+10	252	016	2.4	039	0.5	013
		02:20	22.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY (/KM.²)	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
05	219	07:29	31.0	7	234	-10	224	016	2.4	038	0.5	010
		07:34	32.0			-15	219	010	2.0	020	0.5	---
		07:40	32.0			-10	224	004	2.4	010	0.5	---
		07:46	32.0			-10	224	011	2.4	026	0.5	---
		07:51	32.0			-15	219	021	2.0	042	0.5	005
		07:56	32.0			--	---	006	---	006	0.5	---
		08:02	32.0			--	---	002	---	002	0.5	---
06	219	10:50	27.0	7	231	-20	211	015	1.7	025	0.5	005
		10:55	27.0			--	---	003	---	003	0.5	---
		11:00	27.0			+15	246	015	2.0	030	0.5	010
		11:05	27.0			+10	241	014	2.4	033	0.5	008
		11:10	26.5			+05	236	013	3.0	039	0.5	---
		11:15	26.5			--	---	000	---	000	---	---
		11:20	26.5			--	---	000	---	000	---	---
		11:25	26.0			--	---	000	---	000	---	---
		11:30	25.0			--	---	000	---	000	---	---
		11:35	25.0			--	---	000	---	000	---	---
		11:40	25.0			--	---	000	---	000	---	---
		11:45	25.0			--	---	000	---	000	---	---
		11:50	25.0			--	---	000	---	000	---	---
		11:55	25.0			--	---	000	---	000	---	---
		12:00	24.5			--	---	000	---	000	---	---
		12:05	24.5			--	---	000	---	000	---	---
		12:10	24.5			--	---	000	---	000	---	---
		12:15	24.0			--	---	000	---	000	---	---
		12:20	24.0			--	---	000	---	000	---	---
		12:40	25.0			--	---	000	---	000	---	---
		12:45	25.0			--	---	000	---	000	---	---
		12:50	25.0			--	---	000	---	000	---	---
		13:00	25.5			--	---	000	---	000	---	---
		13:05	25.5			--	---	000	---	000	---	---
		13:10	26.0			--	---	000	---	000	---	---
		13:15	26.0			--	---	000	---	000	---	---
		13:25	24.5			-20	211	005	2.4	012	0.5	---
		13:30	24.5			--	---	003	---	003	0.5	---
		13:40	24.0			-15	216	028	2.0	056	0.5	005
		13:45	24.0			00	231	030	4.0	120	0.5	015

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
06	219	13:50	24.0	7	231	00	231	021	4.0	084	0.5	010
		13:55	24.0			00	231	018	4.0	072	0.5	---
		14:00	23.0			--	---	000	---	000	---	---
		14:05	23.0			--	---	000	---	000	---	---
		14:10	23.0			--	---	000	---	000	---	---
		14:15	23.0			--	---	000	---	000	---	---
		14:20	24.0			--	---	000	---	000	---	---
		14:25	24.0			--	---	000	---	000	---	---
		14:36	24.5			-30	201	002	1.4	003	0.5	---
		14:41	25.0			--	---	000	---	000	---	---
		14:46	25.0			--	---	000	---	000	---	---
		14:51	26.0			--	---	000	---	000	---	---
07	219	16:15	----	7	200	--	---	000	---	000	---	---
		16:20	----			--	---	000	---	000	---	---
		16:25	----			--	---	000	---	000	---	---
		16:30	----			--	---	000	---	000	---	---
		16:35	----			--	---	000	---	000	---	---
		16:40	----			--	---	000	---	000	---	---
		16:45	----			--	---	000	---	000	---	---
		16:50	----			--	---	000	---	000	---	---
		16:55	----			--	---	000	---	000	---	---
		17:00	----			--	---	000	---	000	---	---
		17:05	----			--	---	000	---	000	---	---
		17:10	----			--	---	000	---	000	---	---
		17:15	----			--	---	000	---	000	---	---
		17:20	----			--	---	000	---	000	---	---
		17:25	----			--	---	000	---	000	---	---
		17:30	----			--	---	006	---	006	0.5	---
		17:35	----			-15	185	009	2.0	018	0.5	005
		17:40	----			-15	185	007	2.0	014	0.5	005
		17:50	----			--	---	000	---	000	---	---
		17:55	----			--	---	000	---	000	---	---
		18:00	----			--	---	000	---	000	---	---
		18:05	----			--	---	000	---	000	---	---
		18:20	----			--	---	000	---	000	---	---
		18:25	----			--	---	000	---	000	---	---
		18:40	----			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.²	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M.)
08	219	22:20	27.0	7	005	--	---	000	---	000	---	---
		22:25	27.0			--	---	000	---	000	---	---
		22:35	27.0			--	---	000	---	000	---	---
		22:40	28.0			--	---	000	---	000	---	---
		22:45	28.0			--	---	000	---	000	---	---
		22:50	28.0			--	---	000	---	000	---	---
		22:55	29.0			--	---	000	---	000	---	---
		23:00	29.0			--	---	000	---	000	---	---
		23:05	29.0			--	---	000	---	000	---	---
		23:10	29.5			--	---	000	---	000	---	---
		23:15	30.0			--	---	000	---	000	---	---
		23:20	30.0			--	---	000	---	000	---	---
		23:25	30.0			--	---	000	---	000	---	---
		23:30	30.5			--	---	000	---	000	---	---
		23:35	30.5			--	---	000	---	000	---	---
		23:40	30.5			--	---	000	---	000	---	---
		23:45	30.5			--	---	000	---	000	---	---
	220	00:00	30.5			--	---	000	---	000	---	---
		00:05	30.5			--	---	000	---	000	---	---
		00:10	30.5			--	---	000	---	000	---	---
		00:15	31.0			--	---	000	---	000	---	---
		01:16	34.0			--	---	000	---	000	---	---
		01:21	34.0			--	---	000	---	000	---	---
		01:26	35.0			--	---	000	---	000	---	---
		01:40	36.5			--	---	008	---	008	0.5	---
		01:45	37.0			+40	045	005	1.1	006	0.5	---
		01:50	37.0			--	---	000	---	000	---	---
		02:10	38.0			--	---	001	---	001	0.5	---
		02:25	38.0			+40	045	001	1.1	001	0.5	---
		02:30	38.0			+40	045	002	1.1	002	0.5	---
		02:35	38.0			+40	045	005	1.1	006	0.5	---
		02:40	38.0			+80	085	001	1.0	001	0.5	---
		02:45	39.0			--	---	000	---	000	---	---
		02:50	39.0			--	---	000	---	000	---	---
		02:55	39.0			--	---	000	---	000	---	---
09	220	03:50	38.0	7	102	--	---	000	---	000	---	---
		03:55	38.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
09	220	04:00	38.0	7	102	--	---	000	---	000	---	---
		04:05	38.0			--	---	000	---	000	---	---
		04:10	38.0			--	---	000	---	000	---	---
		04:15	39.0			--	---	000	---	000	---	---
		04:20	39.0			--	---	000	---	000	---	---
		04:25	39.0			--	---	000	---	000	---	---
		04:30	39.5			--	---	000	---	000	---	---
		04:35	39.5			--	---	000	---	000	---	---
		04:40	39.5			--	---	000	---	000	---	---
		04:45	39.0			--	---	000	---	000	---	---
		04:50	39.0			--	---	000	---	000	---	---
		04:55	39.0			--	---	000	---	000	---	---
		05:00	39.0			--	---	000	---	000	---	---
		05:10	39.0			--	---	000	---	000	---	---
		05:23	37.0	5	098	--	---	000	---	000	---	---
		05:28	37.0			--	---	000	---	000	---	---
		05:33	37.0			--	---	000	---	000	---	---
		05:38	37.0			--	---	000	---	000	---	---
10	220	07:05	34.0	7	101	--	---	000	---	000	---	---
		07:10	34.0			--	---	000	---	000	---	---
		07:15	34.0			--	---	000	---	000	---	---
		07:20	35.0			--	---	000	---	000	---	---
		07:25	35.0			-40	061	005	1.2	006	0.5	---
		07:30	35.0			-40	061	007	1.2	008	0.5	---
		07:35	35.0			--	---	000	---	000	---	---
		07:40	35.0			--	---	000	---	000	---	---
		07:45	35.0			-35	066	006	1.3	008	0.5	---
		07:50	35.0			--	---	000	---	000	---	---
		07:55	35.0			--	---	006	---	006	---	---
		08:15	35.5			--	---	000	---	000	---	---
		08:20	35.5			-30	071	010	1.4	014	0.5	---
		08:35	34.0			--	---	000	---	000	---	---
		08:40	34.5			--	---	000	---	000	---	---
		08:50	34.0			--	---	000	---	000	---	---
		08:55	34.0			--	---	000	---	000	---	---
		09:18	34.0		056	+20	076	002	1.7	003	0.5	---
		09:23	34.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.²	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
10	220	09:28	33.5	7	056	-20	036	004	1.7	006	0.5	---
		09:45	34.0			--	---	000	---	000	---	---
		09:50	34.0			--	---	000	---	000	---	---
		09:55	34.5			-20	036	003	1.7	005	0.5	---
		10:00	34.5			--	---	000	---	000	---	---
		10:05	34.5			--	---	000	---	000	---	---
		10:10	34.5			--	---	000	---	000	---	---
		10:15	35.0			--	---	000	---	000	---	---
		10:20	35.0			--	---	000	---	000	---	---
		10:25	35.0			--	---	000	---	000	---	---
		10:30	35.0			--	---	000	---	000	---	---
		10:35	35.0			--	---	000	---	000	---	---
		10:40	35.0			--	---	000	---	000	---	---
		10:45	35.0			--	---	000	---	000	---	---
		10:50	35.0			--	---	000	---	000	---	---
		10:55	35.0			--	---	000	---	000	---	---
		11:00	35.0			+20	076	004	1.7	007	0.5	---
		11:05	35.0			--	---	000	---	000	---	---
		11:10	35.0			--	---	000	---	000	---	---
		11:15	35.0			--	---	000	---	000	---	---
		12:50	37.0		055	--	---	000	---	000	---	---
		12:55	37.0			+15	070	009	2.0	018	0.5	---
		13:00	38.0			--	---	000	---	000	---	---
		13:05	38.0			+15	070	004	2.0	008	0.5	---
		13:10	38.0			+15	070	008	2.0	016	0.5	---
		13:15	38.0		051	+10	061	028	2.3	064	0.5	010
		13:20	38.0			+05	056	005	3.0	015	0.5	---
		13:25	38.0	5		-20	031	022	1.7	037	1.0	025
		13:27	38.0			-05	046	022	3.0	066	1.0	010
		13:34	38.0			+20	071	016	1.7	027	1.0	030
		13:49	38.0			+20	071	028	1.7	048	1.0	030
		13:55	41.4			+25	076	017	1.5	026	1.5	032
		14:01	45.0			--	---	000	---	000	---	---
11	220	18:35	----	7	000	--	---	000	---	000	---	---
		18:40	----			--	---	000	---	000	---	---
		18:50	----			--	---	000	---	000	---	---
		18:55	----			--	---	000	---	000	---	---
		19:00	34.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
11	220	19:05	35.0	7	000	--	---	000	---	000	---	---
		19:10	37.0			--	---	000	---	000	---	---
		19:15	40.0			--	---	000	---	000	---	---
		19:20	45.0			--	---	000	---	000	---	---
12	220	20:10	50.0	7	060	--	---	000	---	000	---	---
		20:15	52.0			--	---	000	---	000	---	---
		20:20	50.0			--	---	000	---	000	---	---
		20:25	48.0			--	---	000	---	000	---	---
		20:30	50.0			--	---	000	---	000	---	---
		20:45	44.0			--	---	000	---	000	---	---
		20:50	44.0			--	---	000	---	000	---	---
		20:55	44.0			--	---	000	---	000	---	---
		21:00	45.0			--	---	000	---	000	---	---
		21:05	45.0			--	---	002	---	002	---	---
		21:10	46.0			--	---	000	---	000	---	---
		21:15	46.0			--	---	000	---	000	---	---
		21:20	46.0			--	---	000	---	000	---	---
		21:25	46.0			--	---	000	---	000	---	---
		21:30	45.0			--	---	000	---	000	---	---
		21:35	45.0			--	---	005	---	005	0.5	---
		21:40	45.0			--	---	000	---	000	---	---
		21:45	45.0			--	---	000	---	000	---	---
		21:50	45.0			--	---	000	---	000	---	---
		22:40	42.0			--	---	000	---	000	---	---
		22:45	42.0			--	---	000	---	000	---	---
		22:50	43.5			-30	030	007	1.4	010	0.5	020
		22:55	43.5			--	---	006	---	006	0.5	---
		23:00	42.0			-30	030	010	1.4	014	0.5	---
		23:05	42.0			--	---	004	---	004	0.5	010
		23:10	41.5			-30	030	006	1.4	009	0.5	---
		23:50	33.0			--	---	000	---	000	---	---
		23:55	32.5			--	---	000	---	000	---	---
	221	00:00	32.5			-30	030	030	1.4	042	0.5	005
		00:05	30.5			-50	010	035	1.0	035	0.5	005
		00:10	28.0			--	---	000	---	000	---	---
		00:15	28.0			--	---	000	---	000	---	---
		00:20	27.0			+10	070	015	2.3	034	0.5	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
12	221	00:25	28.0	7	060	--	---	000	---	000	---	---
		00:30	28.0			--	---	042	---	042	0.5	008
		00:35	26.5			-35	025	025	1.5	038	0.5	005
		00:40	30.0			-20	040	013	1.7	022	0.5	018
		00:45	31.0			-20	040	003	1.7	008	0.5	---
		00:50	32.0			--	---	000	---	000	---	---
		00:55	33.0			--	---	000	---	000	---	---
13	221	02:00	36.0	6	133	--	---	000	---	000	---	---
		02:05	35.5			--	---	000	---	000	---	---
		02:10	35.0			--	---	000	---	000	---	---
		02:15	34.5			--	---	002	---	002	1.0	---
		02:20	34.0			--	---	000	---	000	---	---
		02:25	34.0			--	---	007	---	007	---	---
		02:30	33.5			--	---	003	---	003	0.5	---
		02:35	33.0			--	---	006	---	006	0.5	---
		02:40	33.0			--	---	009	---	009	0.5	010
		02:45	31.0			-30	103	010	1.4	014	1.0	015
		03:00	27.0			-35	098	018	1.3	023	1.0	008
		03:05	24.0			-20	113	011	1.7	018	1.0	030
		03:10	25.0			-30	103	013	1.4	019	1.0	030
		03:15	24.0			-30	103	028	1.4	040	1.0	015
		03:20	23.0			-20	113	026	1.7	043	0.5	---
		03:25	22.0			--	---	008	---	008	0.5	---
		03:30	22.0			-30	103	013	1.4	019	0.5	008
		04:25	22.5	7	000	-25	335	005	1.5	008	1.0	---
		04:30	24.5			-25	335	004	1.5	006	1.0	---
14	221	08:00	51.0	7	065	--	---	000	---	000	---	---
		08:05	51.0			-10	055	004	2.3	009	1.0	025
		08:10	51.5			-20	045	008	1.7	014	1.0	025
		08:15	52.5			--	---	002	---	002	0.5	008
		08:20	53.0			-40	025	014	1.2	017	1.0	---
		08:25	53.0			-30	035	005	1.3	006	0.5	---
		08:30	53.0			--	---	000	---	000	---	---
		08:35	53.5			-30	035	005	1.3	006	0.5	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
15	221	10:50	53.0	7	035	--	---	000	---	000	---	---
		10:55	53.0			--	---	000	---	000	---	---
		11:00	54.0			--	---	000	---	000	---	---
		11:05	56.0			--	---	000	---	000	---	---
		11:10	56.0			--	---	000	---	000	---	---
		11:15	54.5			--	---	000	---	000	---	---
		11:20	52.0			--	---	000	---	000	---	---
		11:25	51.0			--	---	000	---	000	---	---
		11:30	53.0			--	---	000	---	000	---	---
		11:35	55.0			--	---	000	---	000	---	---
		11:40	70.0			--	---	000	---	000	---	---
		12:40	54.0		040	--	---	000	---	000	---	---
		12:45	55.0			--	---	000	---	000	---	---
		12:50	55.5			--	---	000	---	000	---	---
		12:55	54.0			--	---	000	---	000	---	---
		13:00	55.0			--	---	000	---	000	---	---
		13:05	55.0			--	---	000	---	000	---	---
		13:10	73.0			--	---	000	---	000	---	---
16	221	14:50	108	4	235	--	---	000	---	000	---	---
		14:58	107			--	---	000	---	000	---	---
		15:06	101			--	---	000	---	000	---	---
		15:14	100			--	---	000	---	000	---	---
		15:20	95.0	6		--	---	000	---	000	---	---
		15:25	89.0			--	---	000	---	000	---	---
		15:31	82.0			--	---	000	---	000	---	---
		15:36	92.0			--	---	000	---	000	---	---
		15:41	90.0			--	---	000	---	000	---	---
		15:46	88.0			--	---	000	---	000	---	---
		15:51	87.0		220	--	---	000	---	000	---	---
		15:56	85.0			--	---	000	---	000	---	---
		16:01	86.0			--	---	000	---	000	---	---
		16:06	89.0			--	---	000	---	000	---	---
		16:11	89.0			--	---	000	---	000	---	---
		16:17	87.0			--	---	000	---	000	---	---
		16:23	86.0		235	--	---	000	---	000	---	---
		16:29	86.0			--	---	000	---	000	---	---
		16:34	82.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM^2	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
16	221	16:40	75.0	6	220	--	---	000	---	000	---	---
		16:45	71.0			--	---	000	---	000	---	---
		16:51	58.0			--	---	006	---	006	0.5	---
		16:57	53.0			--	---	005	---	005	0.5	---
		17:02	51.0			--	---	009	---	009	0.5	---
		17:30	57.0		200	--	---	007	---	007	0.5	---
		17:35	53.0			--	---	000	---	000	---	---
		17:40	56.0			--	---	000	---	000	---	---
		17:45	56.0			--	---	000	---	000	---	---
		17:51	53.0			+10	210	012	2.3	028	0.5	025
		17:57	45.0			+50	250	o43	1.0	043	1.0	015
		18:05	40.0			+20	220	079	1.7	131	1.0	010
		18:10	41.0			+20	220	046	1.7	079	0.5	010
		18:16	41.0			+25	225	036	1.5	054	1.0	---
		18:21	40.0			+25	225	042	1.5	063	0.5	010
		18:27	38.0			+30	230	051	1.4	072	0.5	---
		18:33	37.0			+20	220	058	1.5	086	1.0	---
		18:38	38.0			+40	240	046	1.2	055	1.5	---
		18:44	36.0		225	+30	255	025	1.4	035	0.5	---
		18:50	37.0			-25	200	029	1.5	044	1.5	050
		18:56	37.0			-15	210	037	2.0	074	1.5	050
		19:01	32.5			+30	255	065	1.4	090	1.0	020
		19:07	38.0			+30	255	048	1.4	067	1.0	---
		19:12	35.0		280	+10	290	075	2.3	170	1.0	012
		19:20	----			-35	245	048	1.3	063	1.0	010
		19:50	57.0		180	--	---	000	---	000	---	---
		19:56	58.0			--	---	000	---	000	---	---
		20:02	58.5			--	---	000	---	000	---	---
		20:08	57.0		195	--	---	000	---	000	---	---
		20:14	54.0			--	---	000	---	000	---	---
		20:20	55.0			--	---	000	---	000	---	---
		20:26	52.0			--	---	000	---	000	---	---
		20:31	47.0			+25	220	019	1.5	028	0.5	---
		20:37	46.0			+30	225	033	1.4	046	0.5	---
		20:43	44.5			+30	225	048	1.4	067	1.5	060
		20:49	43.0			+30	225	030	1.4	042	1.0	---
		20:56	41.0			+30	225	020	1.4	028	1.0	012
		21:02	41.5			+30	225	023	1.4	032	0.5	---
		21:08	40.0			+30	225	058	1.4	081	1.0	015
		21:14	38.0			+30	225	022	1.4	031	1.0	020

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
16	221	21:19	37.0	6	195	+15	210	023	2.0	046	1.0	---
		21:25	36.0		202	+10	212	026	2.3	060	1.5	---
		21:30	33.5			+20	222	022	1.7	034	1.0	---
		21:36	32.0			+70	272	019	1.0	019	1.0	030
		21:41	32.0			+35	237	028	1.3	036	0.5	---
		21:46	28.0			+30	232	008	1.4	011	0.5	040
		21:55	27.0	7		+50	252	010	1.0	010	0.5	010
		22:00	----		285	--	---	---	---	---	---	---
		22:05	26.0			-50	235	019	1.0	019	1.0	010
		22:10	31.0			-40	245	007	1.2	008	1.5	010
		22:15	36.0			-15	270	014	2.0	028	1.0	015
		22:20	38.5			-05	280	011	3.0	033	1.0	---
		22:25	39.0			-30	255	010	1.4	014	0.5	015
		22:30	39.5			--	---	000	---	000	---	---
		22:35	40.5			-15	270	016	2.0	032	0.5	---
		22:40	42.0			-20	265	014	1.7	024	0.5	---
		22:50	43.5			-20	265	016	1.7	027	1.0	015
		22:55	44.0			-25	260	016	1.5	024	1.0	---
17	223	06:10	50.0	7	232	-20	212	009	1.7	015	1.0	---
		06:15	49.0			-10	222	011	2.4	027	0.5	---
		06:20	50.0			--	---	004	---	004	1.0	---
		06:25	51.0			--	---	000	---	000	---	---
		07:00	51.0			--	---	000	---	000	---	---
		07:05	51.0			--	---	001	---	001	---	---
		07:10	49.0			--	---	001	---	001	1.0	---
		07:15	49.5			--	---	000	---	000	---	---
		07:20	49.5			--	---	000	---	000	---	---
		07:25	49.5			-10	222	008	2.4	019	1.0	025
		07:30	49.5			-05	227	013	3.0	039	1.0	020
		07:35	48.5			--	---	005	---	005	0.5	---
		07:40	48.0			--	---	006	---	006	0.5	---
		07:45	47.0			--	---	006	---	006	1.0	025
		07:50	46.0			--	---	019	---	019	1.0	015
		07:55	45.0			+20	252	017	1.7	029	1.5	020
		08:00	44.5			+30	262	020	1.4	042	1.0	010
		08:05	44.5		285	+30	315	018	1.4	025	1.0	---
		08:10	44.5			--	---	013	---	013	1.5	010

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM²	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
17	223	08:15	44.0	7	285	-30	255	011	1.4	015	1.0	015
		08:25	44.0			-20	265	021	1.7	035	1.0	012
		08:30	45.0			-30	255	013	1.4	018	1.5	015
		08:40	50.0		200	--	---	000	---	000	---	---
		08:45	51.0			+40	240	006	1.2	007	1.5	015
		08:50	46.5			+40	240	009	1.2	011	1.5	---
		08:55	46.0			+35	235	014	1.3	018	1.0	---
		09:00	45.0			+30	230	023	1.4	041	1.5	---
		09:05	44.0			+40	240	013	1.2	016	1.0	---
		09:10	43.0			+20	220	012	1.7	020	1.0	---
		09:15	43.0			--	---	006	---	006	1.0	---
		09:30	40.0			+45	245	015	1.1	016	1.0	010
		09:35	39.0			+30	230	015	1.4	021	1.0	---
		09:40	37.0			+30	230	021	1.4	030	1.0	020
		09:45	37.0			--	---	007	---	007	1.0	---
		09:50	34.5			+20	220	006	1.7	010	1.0	---
		09:55	35.0			+40	240	029	1.2	035	1.5	010
		10:00	34.0			+50	250	033	1.0	033	1.5	015
		10:05	33.0			+30	230	021	1.4	029	1.5	---
		10:10	32.5			+70	270	046	1.0	046	2.0	010
		10:15	30.0			+40	240	030	1.4	042	1.5	010
		10:25	27.0		290	+20	310	035	1.7	034	1.5	---
		10:30	28.0			-50	240	025	1.0	025	1.0	010
		10:35	30.0			-30	260	021	1.4	029	1.0	---
		10:40	32.0			-50	240	026	1.0	026	1.0	---
		11:00	33.0		237	+50	287	024	1.0	024	1.0	015
		11:05	32.0			+35	272	025	1.3	032	1.0	015
		11:10	31.0			+40	277	018	1.2	022	1.0	---
		11:15	31.0			+10	247	013	2.3	030	1.0	015
		11:20	31.0			--	---	010	---	010	0.5	---
		11:25	30.5			+05	242	015	3.0	045	1.0	020
		11:30	30.0			+30	267	021	1.4	029	1.0	060
		11:35	28.5			+30	267	032	1.4	045	1.0	---
		11:40	27.0			+60	297	036	1.0	036	2.0	020
		11:45	26.0			+60	297	034	1.0	034	1.5	008
		12:10	24.0			+80	317	094	1.0	094	1.0	008
		12:15	23.0			-70	167	096	1.0	096	1.0	010
		12:20	21.5			+80	317	125	1.0	125	1.0	008
		12:45	21.5		044	+60	104	024	1.0	024	1.0	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
17	223	12:50	21.0	7	044	+50	094	041	1.0	041	1.0	---
		12:55	21.0			+40	084	039	1.2	044	1.0	---
		13:00	22.0			+30	074	029	1.4	041	1.0	---
		13:05	24.5			--	---	010	---	010	1.0	---
		13:10	25.5			+30	074	011	1.4	015	1.0	---
		13:20	26.0			+35	079	028	1.3	037	1.0	---
		13:25	26.5			+35	079	012	1.3	014	1.0	---
		13:30	28.0			+30	074	011	1.4	013	1.0	---
		13:35	28.0			--	---	010	---	010	1.0	---
		13:40	29.0			--	---	022	---	022	1.5	---
		13:45	29.0		065	--	---	---	---	---	---	---
		13:50	29.0			+30	095	021	1.4	029	1.0	010
		13:55	30.0			-10	055	014	2.3	032	1.0	---
		14:00	31.0			-40	025	014	1.2	017	0.5	---
		14:05	31.5			--	---	013	---	013	1.0	---
		14:10	30.0			--	---	016	---	016	1.0	---
		14:15	31.0			00	065	013	4.0	052	1.0	---
		14:20	31.0			-15	050	015	2.0	030	1.0	010
		14:25	31.0			--	---	008	---	008	1.0	---
18	224	06:15	68.0	6	265	--	---	000	---	000	---	---
		06:20	69.0			--	---	000	---	000	---	---
		06:25	70.0			--	---	000	---	000	---	---
		06:30	72.0			--	---	000	---	000	---	---
		06:35	62.0			--	---	000	---	000	---	---
		06:40	58.0			--	---	000	---	000	---	---
		06:45	58.0			--	---	000	---	000	---	---
		06:52	57.0			--	---	000	---	000	---	---
19	224	09:03	47.0	6	290	-25	265	040	1.5	060	0.5	018
		09:08	48.0			-20	270	035	1.7	060	0.5	020
		09:14	47.5			-20	270	029	1.7	049	0.5	015
		09:20	47.0			-15	275	031	2.0	062	0.5	025
		09:26	46.5			-10	280	028	2.3	064	1.0	025
		09:31	46.5			-10	280	033	2.3	078	1.0	025
		09:37	46.0			--	---	026	---	026	1.0	015

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY (/KM.)	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
19	224	09:43	46.9	6	290	--	---	011	---	011	0.5	010
		09:49	46.0			--	---	012	---	012	0.5	---
		09:55	46.0			--	---	008	---	008	0.5	---
20	224	12:18	47.0	6	275	--	---	003	---	003	0.5	---
		12:24	47.0			-20	255	007	1.7	012	0.5	---
		12:30	46.5			-10	265	011	2.3	025	0.5	---
		12:36	46.5			-15	260	015	2.0	030	0.5	---
		12:42	46.5			-15	260	005	2.0	010	0.5	---
		12:48	46.5			-30	245	013	1.4	018	0.5	---
		12:54	46.5			-15	260	006	2.0	012	0.5	---
		13:00	47.0			-25	250	009	1.5	013	0.5	025
		13:05	47.0			-50	225	011	1.0	011	0.5	---
		13:11	47.0			--	---	005	---	005	0.5	---
21	224	15:21	47.0	6	241	+20	261	009	1.7	015	0.5	025
		15:27	47.0			+20	261	007	1.7	012	1.0	020
		15:32	47.0			+15	256	004	2.0	008	1.0	---
		15:38	47.0			--	---	002	---	002	0.5	---
		15:44	47.0			+20	261	008	1.7	013	1.0	---
		15:50	47.0			+25	266	013	1.5	019	1.0	025
		15:55	47.0			+20	261	019	1.7	033	1.0	020
		16:01	47.0			+30	271	006	1.4	008	1.0	010
		16:07	47.0			+15	256	003	2.0	006	0.5	---
		16:12	47.0			-20	221	008	1.7	-13	0.5	---
		16:18	47.0			+25	266	008	1.5	012	0.5	---
22	224	19:07	47.5	7	241	--	---	000	---	000	---	---
		19:12	47.5			--	---	000	---	000	---	---
		19:17	47.5			--	---	000	---	000	---	---
		19:22	47.5			--	---	000	---	000	---	---
		19:27	47.0			+20	261	002	1.7	004	0.5	---
		19:32	47.0			--	---	000	---	000	---	---
		19:37	47.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM²	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
22	224	19:43	47.0	7	241	+40	281	006	1.2	007	0.5	010
		19:48	47.0			--	---	002	---	002	0.4	010
23	224	22:12	44.0	6	180	+50	230	003	1.0	003	1.0	---
		22:17	44.0			+40	220	004	1.2	005	0.5	---
		22:22	45.0			--	---	004	---	004	0.5	---
		22:28	45.0			--	---	006	---	006	0.5	---
		22:34	45.0			-65	115	007	1.0	007	1.0	---
		22:40	45.0			-40	140	007	1.2	008	1.0	---
		22:45	45.0			+50	230	017	1.0	017	1.5	065
		22:50	45.0			--	---	000	---	000	---	---
		22:56	45.0			+40	220	006	1.2	007	0.5	---
24	225	02:00	44.0	6	180	--	---	006	---	006	0.5	---
		02:05	44.0			+20	200	008	1.7	013	0.5	---
		02:10	44.0			--	---	002	---	002	0.5	---
		02:16	44.0			--	---	000	---	000	---	---
		02:21	44.0			--	---	000	---	000	---	---
		02:26	43.5			+25	205	004	1.5	006	0.5	---
		02:31	43.5			+25	205	003	1.5	005	1.0	---
		02:37	43.5			--	---	000	---	000	---	---
		02:42	44.0			+20	200	004	1.7	007	1.0	---
		02:47	43.0			+30	210	008	1.4	011	1.0	---
		02:52	43.0			+25	205	009	1.5	013	0.5	---
25	225	06:15	40.0	6	186	+30	216	002	1.4	003	0.5	---
		06:20	40.0			+20	206	009	1.7	015	1.0	090
		06:25	39.5			--	---	000	---	000	---	---
		06:31	39.5			+25	211	006	1.5	009	0.5	---
		06:36	39.5			--	---	007	---	007	0.5	---
		06:41	39.5			--	---	000	---	000	---	---
		06:47	39.5			-45	141	001	1.1	001	0.5	---
		06:53	39.5			+30	216	004	1.4	006	0.5	---
		06:58	39.5			+30	216	003	1.4	004	0.5	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY (/KM)	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
26	225	09:30	34.0	6	186	--	---	000	---	000	---	---
		09:35	34.0			--	---	000	---	000	---	---
		09:40	34.0			--	---	000	---	000	---	---
		09:45	34.5			--	---	000	---	000	---	---
		09:50	34.0			--	---	000	---	000	---	---
		09:55	34.0			--	---	000	---	000	---	---
		10:00	34.0			--	---	000	---	000	---	---
27	225	12:08	29.0	6	180	+05	185	008	3.0	024	0.5	003
		12:13	28.5			00	180	022	4.0	088	0.5	---
		12:19	27.5			00	180	008	4.0	032	0.5	---
		12:24	27.5			--	---	001	---	001	0.5	---
		12:29	27.0			+30	210	001	1.4	001	0.5	---
		12:34	27.0			--	---	000	---	000	---	---
		12:40	27.0			-10	170	035	2.3	081	0.5	020
		12:46	26.5			-10	170	032	2.3	073	0.5	---
		12:51	26.0			-10	170	009	2.3	020	0.5	---
28	225	14:40	23.0	6	299	--	---	000	---	000	---	---
		14:45	22.0			--	---	000	---	000	---	---
		14:51	18.5			--	---	000	---	000	---	---
		15:45	26.0	7	295	--	---	000	---	000	---	---
		15:50	27.0			+10	305	018	2.3	041	0.5	005
		15:55	27.0			+10	305	017	2.3	040	0.5	---
		16:00	27.5			+05	300	014	3.0	042	0.5	---
		16:05	27.5			+05	300	015	3.0	045	0.5	015
		16:10	28.0			--	---	008	---	008	0.5	---
		16:16	27.5		305	--	---	003	---	003	0.5	---
		16:21	28.5			-10	295	026	2.3	060	0.5	005
		16:26	28.0			-10	295	033	2.3	076	0.5	003
		16:31	28.5			-15	290	010	2.0	020	0.5	---
		16:36	29.0			-15	290	014	2.0	028	0.5	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
29	225	18:10	34.5	4	301	--	---	000	---	000	---	---
		18:18	34.0			--	---	000	---	000	---	---
		18:26	34.0			--	---	000	---	000	---	---
		18:32	34.5			--	---	000	---	000	---	---
		18:38	34.5			--	---	000	---	000	---	---
30	226	01:05	43.0	5	220	--	---	000	---	000	---	---
		01:11	43.0			--	---	000	---	000	---	---
		01:17	43.0			--	---	000	---	000	---	---
		01:23	43.0			--	---	000	---	000	---	---
		01:30	43.0			--	---	000	---	000	---	---
		01:36	43.0			-05	215	003	3.0	009	0.5	---
		01:43	43.0			-10	210	003	2.3	007	0.5	022
		01:49	43.0			+45	265	007	1.0	007	0.5	075
31	226	04:04	49.0	5	157	--	---	000	---	000	---	---
		04:10	49.0			--	---	000	---	000	---	---
		04:16	49.0			--	---	000	---	000	---	---
		04:22	49.0			--	---	000	---	000	---	---
		04:29	49.0			--	---	000	---	000	---	---
		04:35	49.0			--	---	000	---	000	---	---
		04:41	49.0			--	---	000	---	000	---	---
		04:47	49.0			--	---	000	---	000	---	---
32	226	06:03	47.0	5	157	--	---	000	---	000	---	---
		06:10	47.0			--	---	000	---	000	---	---
		06:16	47.0			--	---	000	---	000	---	---
		06:23	47.0			--	---	000	---	000	---	---
		06:30	47.0			--	---	000	---	000	---	---
		06:36	47.0			--	---	000	---	000	---	---
		06:43	46.0			--	---	000	---	000	---	---
		06:49	45.5			--	---	000	---	000	---	---
		06:55	45.0			--	---	000	---	000	---	---
		07:01	45.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY (KM.)	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
33	226	10:20	32.0	5	240	-25	215	019	1.6	030	1.0	025
		10:26	32.0			-60	180	009	1.0	009	---	060
		10:34	32*			-30	210	008	1.4	011	---	015
		10:40	32*			--	---	000	---	000	---	---
		10:46	32*			--	---	000	---	000	---	---
		10:52	30*		243	+20	263	005	1.7	009	---	---
		10:58	30*			+45	288	035	1.1	039	---	---
		11:05	30*			-20	223	038	1.7	064	---	---
		11:11	30*			+30	273	026	1.4	036	---	---
		11:17	30*			--	---	000	---	000	---	---
		11:24	30*			+90	333	042	1.0	042	---	---
		11:35	29.0		236	-60	176	040	1.0	040	1.0	---
		11:41	29.0		238	-30	208	026	1.4	036	1.0	---
		11:47	29.0			-45	193	019	1.1	021	1.0	025
		11:54	29.0		241	00	241	012	4.0	048	1.0	009
		12:02	29.0			-40	201	004	1.2	005	1.0	030
		12:08	29*			-80	161	006	1.0	006	---	---
		12:14	29*			-80	161	006	1.0	006	---	---
		12:21	29*			--	---	002	---	002	---	---
		12:27	29*			-40	201	002	1.2	003	---	---
		12:33	29*			--	---	000	---	000	---	---
		12:40	29*			-35	206	007	1.3	009	---	---
		12:46	29*			--	---	000	---	000	---	---
		12:52	29*			-35	206	055	1.3	072	---	---
		13:01	29*			--	---	000	---	000	---	---
		13:07	29*			-05	236	003	3.0	009	---	---
		13:14	29*			--	---	000	---	000	---	---
		13:20	29*			-55	186	011	1.0	011	---	---
		13:27	29*			--	---	000	---	000	---	---
		13:33	29*			--	---	000	---	000	---	---
		13:39	29*			--	---	000	---	000	---	---
		14:17	39.0		245	--	---	000	---	000	---	---
		14:29	43.0		210	--	---	000	---	000	---	---
		14:35	41.5			--	---	000	---	000	---	---
		14:41	42.0			--	---	000	---	000	---	---
		14:47	44.0			--	---	000	---	000	---	---
		14:53	46.0			--	---	000	---	000	---	---
		15:00	48.0			--	---	000	---	000	---	---
		15:06	43.5			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
33	226	15:12	46.0	5	210	--	---	000	---	000	---	---
		15:19	48.0			--	---	000	---	000	---	---
		15:25	45.0			--	---	000	---	000	---	---
34	226	16:25	47.5	5	124	--	---	000	---	000	---	---
		16:31	46.0			--	---	000	---	000	---	---
		16:38	47.5			--	---	000	---	000	---	---
		16:44	47.0			--	---	000	---	000	---	---
		16:50	47.0			--	---	000	---	000	---	---
		16:56	44.0			--	---	000	---	000	---	---
		17:02	44.0			--	---	000	---	000	---	---
		17:08	39.5			+25	159	003	1.5	005	0.5	004
		17:15	41.0			--	---	000	---	000	---	---
		17:21	41.5			+45	169	003	1.1	004	0.5	030
		17:27	40.0			+45	169	003	1.1	004	0.5	---
		17:33	39.5			--	---	000	---	000	---	---
		17:40	37.5			+20	144	012	1.7	021	1.0	---
		18:00	37.0			--	---	000	---	000	---	---
		18:06	37.0			--	---	000	---	000	---	---
		18:12	37.0			--	---	000	---	000	---	---
		18:19	37.0			--	---	000	---	000	---	---
		18:25	38.0			--	---	000	---	000	---	---
		18:31	39.5			--	---	000	---	000	---	---
		18:37	40.0			--	---	000	---	000	---	---
		18:43	41.0			--	---	000	---	000	---	---
		18:50	41.0			--	---	000	---	000	---	---
		18:56	41.5			--	---	000	---	000	---	---
		19:02	41.5			--	---	000	---	000	---	---
		19:08	41.0		175	--	---	000	---	000	---	---
		19:14	41.0	6	120	--	---	000	---	000	---	---
		19:20	41.0			--	---	000	---	000	---	---
		19:26	40.0		110	--	---	000	---	000	---	---
		19:32	39.0			--	---	000	---	000	---	---
		19:38	39.0			--	---	000	---	000	---	---
		19:44	37.5			--	---	000	---	000	---	---
		19:50	36.0			--	---	000	---	000	---	---
		19:55	36.0			---	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
34	226	20:00	35.0	6	110	+40	150	002	1.2	003	0.5	015
		20:05	35.0			+40	150	004	1.2	005	0.5	015
		20:10	35.0			--	---	000	---	000	---	---
		20:15	35.0			--	---	000	---	000	---	---
		20:20	34.5			--	---	000	---	000	---	---
		20:25	33.5			+40	150	012	1.2	014	0.5	020
		20:31	32.5			+40	150	002	1.2	003	0.5	---
		20:36	32.0			--	---	000	---	000	---	---
		20:41	32.0			--	---	000	---	000	---	---
		20:46	31.5			--	---	000	---	000	---	---
		20:51	29.0			--	---	000	---	000	---	---
		20:57	29.0			--	---	000	---	000	---	---
		21:08	27.0			--	---	000	---	000	---	---
		21:13	25.0			+30	140	016	1.4	023	0.5	---
		21:18	26.0		130	--	---	000	---	000	---	---
		21:24	26.0			--	---	000	---	000	---	---
		21:30	26.0			--	---	000	---	000	---	---
		21:35	26.0			--	---	000	---	000	---	---
		21:41	26.0			--	---	000	---	000	---	---
35	227	00:07	39.0	6	195	--	---	000	---	000	---	---
		00:12	40.0			--	---	000	---	000	---	---
		00:17	41.0			--	---	000	---	000	---	---
		00:23	41.0			--	---	000	---	000	---	---
		00:28	41.5			--	---	000	---	000	---	---
		00:33	43.0			--	---	000	---	000	---	---
		00:38	44.0			--	---	000	---	000	---	---
		00:44	44.0			--	---	000	---	000	---	---
		00:50	46.0			--	---	000	---	000	---	---
		00:55	46.5			--	---	000	---	000	---	---
		01:00	47.0			--	---	000	---	000	---	---
		01:05	47.0			--	---	000	---	000	---	---
		01:10	47.0			--	---	000	---	000	---	---
		01:15	47.0			--	---	000	---	000	---	---
		01:21	47.0			--	---	000	---	000	---	---
		01:26	48.0			--	---	000	---	000	---	---
		01:32	49.0			--	---	000	---	000	---	---
		01:37	50.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
36	227	04:48	56.5	6	080	--	---	000	---	000	---	---
		04:54	56.0			--	---	000	---	000	---	---
		04:59	57.0			--	---	000	---	000	---	---
		05:04	57.0			--	---	000	---	000	---	---
		05:10	56.0			--	---	000	---	000	---	---
		05:15	56.0			--	---	000	---	000	---	---
		05:20	56.0			--	---	000	---	000	---	---
		05:26	56.0			--	---	000	---	000	---	---
		05:31	56.0			--	---	000	---	000	---	---
		05:37	56.0			--	---	000	---	000	---	---
		05:42	57.0			--	---	000	---	000	---	---
		05:48	57.0			--	---	000	---	000	---	---
37	227	08:08	37.0	5	085	--	---	000	---	000	---	---
		08:13	36.0			--	---	000	---	000	---	---
		08:18	36.0			--	---	000	---	000	---	---
		08:24	35.0			--	---	000	---	000	---	---
		08:30	35.0			--	---	000	---	000	---	---
		08:35	35.0			--	---	000	---	000	---	---
		08:41	34.0			--	---	000	---	000	---	---
		08:47	34.0			--	---	000	---	000	---	---
		08:53	33.0			--	---	000	---	000	---	---
		08:59	32.5			--	---	000	---	000	---	---
		09:05	32.0			--	---	000	---	000	---	---
		09:11	31.0			--	---	000	---	000	---	---
		09:17	30.0			--	---	000	---	000	---	---
		09:23	29.0			--	---	000	---	000	---	---
38	227	10:38	24.0	5	125	+20	145	015	1.7	026	0.5	040
		10:49	24.0			+70	195	002	1.0	002	0.5	---
		10:55	25.0			+45	170	009	1.1	010	0.5	---
		11:01	25.5			+35	160	003	1.3	004	0.5	---
		11:10	23.0			--	---	000	---	000	---	---
		11:16	23.0			--	---	000	---	000	---	---
		11:22	22.5			+35	160	004	1.3	005	0.5	---
		11:28	22.5			+30	155	005	1.4	007	0.5	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY/KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
38	227	11:34	22.5	5	125	--	---	008	---	008	0.5	---
		11:40	21.0			--	---	021	---	021	0.5	---
		11:48	22.0			+20	145	015	1.7	025	0.5	---
		11:54	22.0			+30	155	009	1.4	013	0.5	---
		12:00	22.0			+40	165	005	1.2	006	0.5	---
		12:06	22.0			+30	155	006	1.4	009	0.5	---
		12:12	22.0			+35	160	022	1.3	029	0.5	---
39	227	21:04	21.5	6	004	--	---	000	---	000	---	---
		21:09	21.0			--	---	000	---	000	---	---
		21.14	21.0			--	---	000	---	000	---	---
		21.20	21.0			--	---	000	---	000	---	---
		21.25	21.0			--	---	000	---	000	---	---
		21:31	21.0			--	---	000	---	000	---	---
		21:36	21.5			--	---	000	---	000	---	---
		21:41	22.0			--	---	000	---	000	---	---
		21:46	22.5			--	---	000	---	000	---	---
		21:51	22.5			--	---	000	---	000	---	---
40	227	23:45	26.0	5	047	--	---	000	---	000	---	---
		23:51	26.0			--	---	000	---	000	---	---
		23:57	26.5			--	---	000	---	000	---	---
	228	00:03	26.5			--	---	000	---	000	---	---
		00:07	27.0			--	---	000	---	000	---	---
41	228	02:00	28.0	5	271	--	---	000	---	000	---	---
		02:06	28.0			--	---	000	---	000	---	---
		02:12	28.0			+20	291	002	1.7	004	0.5	025
42	228	04:32	28.0	4	270	--	---	000	---	000	---	---
		04:40	28.0			--	---	000	---	000	---	---
		04:48	28.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
42	228	04:56	28.0	4	270	--	---	000	---	000	---	---
		05:04	28.0			--	---	000	---	000	---	---
		05:12	28.0			--	---	000	---	000	---	---
		05:20	28.0			--	---	000	---	000	---	---
		05:28	28.0			--	---	000	---	000	---	---
43	228	09:08	32.0	5	323	+15	338	003	2.0	006	0.5	005
		09:14	32.0			--	---	000	---	000	---	---
		09:20	32.0			--	---	000	---	000	---	---
		09:26	32.0			--	---	000	---	000	---	---
		09:32	32.0			--	---	000	---	000	---	---
44	228	11:37	46.0	5	343	--	---	000	---	000	---	---
		11:43	46.0			--	---	000	---	000	---	---
		11:53	46.5		318	--	---	000	---	000	---	---
		12:05	46.0			--	---	000	---	000	---	---
		12:11	47.0			--	---	000	---	000	---	---
45	228	16:45	63.0	5	000	--	---	000	---	000	---	---
		16:51	63.0			--	---	000	---	000	---	---
		16:57	63.0			--	---	000	---	000	---	---
		17:03	63.0			--	---	000	---	000	---	---
		17:09	63.0			--	---	000	---	000	---	---
46	228	19:28	59.0	5	278	--	---	000	---	000	---	---
		19:34	60.0			--	---	000	---	000	---	---
		19:40	60.0			--	---	000	---	000	---	---
		19:46	60.0			--	---	000	---	000	---	---
		19:52	60.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
47	229	10:00	48.0	5	097	--	---	000	---	000	---	---
		10:06	48.0			--	---	000	---	000	---	---
		10:12	47.0			--	---	000	---	000	---	---
		10:18	47.0			--	---	000	---	000	---	---
		10:24	47.0			--	---	000	---	000	---	---
		10:30	47.0			--	---	000	---	000	---	---
		10:36	47.0			--	---	000	---	000	---	---
		10:42	47.0			--	---	000	---	000	---	---
		10:48	47.0			--	---	000	---	000	---	---
		10:54	47.0			--	---	000	---	000	---	---
		11:00	47.0			--	---	000	---	000	---	---
		11:12	47.0			--	---	000	---	000	---	---
		11:18	46.0			--	---	000	---	000	---	---
		11:24	45.0			--	---	000	---	000	---	---
		11:30	42.5			--	---	000	---	000	---	---
		11:36	42.0			--	---	000	---	000	---	---
		11:42	44.0			--	---	000	---	000	---	---
		11:48	43.5			--	---	000	---	000	---	---
		11:52	42.0			--	---	000	---	000	---	---
		11:58	43.0			--	---	000	---	000	---	---
		12:04	42.0			--	---	000	---	000	---	---
		12:12	42.0			--	---	000	---	000	---	---
		12:18	40.0			--	---	000	---	000	---	---
		12:24	40.0			--	---	000	---	000	---	---
		12:30	39.0		147	--	---	000	---	000	---	---
		12:36	38.0			--	---	000	---	000	---	---
		12:42	38.0			--	---	000	---	000	---	---
		12:50	38.0		265	--	---	000	---	000	---	---
		13:00	40.0			--	---	000	---	000	---	---
		13:06	40.0			--	---	000	---	000	---	---
		13:12	41.0			--	---	000	---	000	---	---
		13:18	42.0			--	---	000	---	000	---	---
		13:24	43.0			--	---	000	---	000	---	---
		13:30	43.0			--	---	000	---	000	---	---
48	229	21:17	50.0	5	220	--	---	000	---	000	---	---
		21:23	50.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M.)
48	229	21:29	50.0	5	220	--	---	000	---	000	---	---
		21:35	50.0			--	---	000	---	000	---	---
		21:41	50.0			--	---	000	---	000	---	---
		21:47	50.0			--	---	000	---	000	---	---
49	229	23:45	54.0	5	220	--	---	000	---	000	---	---
		23:51	54.0			--	---	000	---	000	---	---
		23:57	54.0			--	---	000	---	000	---	---
	230	00:03	54.0			--	---	000	---	000	---	---
		00:09	54.0			--	---	000	---	000	---	---
50	230	03:55	53.0	5	000	--	---	000	---	000	---	---
		04:01	53.0			--	---	000	---	000	---	---
		04:07	53.0			--	---	000	---	000	---	---
		04:13	53.0			--	---	000	---	000	---	---
		04:19	53.0			--	---	000	---	000	---	---
51	230	09:15	46.0	5	000	--	---	000	---	000	---	---
		09:21	46.0			--	---	000	---	000	---	---
		09:28	46.0			--	---	000	---	000	---	---
		09:34	45.0			--	---	000	---	000	---	---
		09:41	45.0			--	---	000	---	000	---	---
		11:10	45.5			--	---	000	---	000	---	---
		11:16	45.5			--	---	000	---	000	---	---
		11:23	46.0			--	---	000	---	000	---	---
		11:29	46.0			--	---	000	---	000	---	---
52	230	16:55	39.0	5	000	+30	030	014	1.4	020	0.5	---
		17:01	39.0			+25	025	008	1.6	013	0.5	---
		17:07	39.0			--	---	000	---	000	---	---
		17:14	39.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M.)
53	230	21:10	33.5	5	000	--	---	014	---	014	0.5	010
		21:20	33.5			+50	050	033	1.1	035	0.5	030
		21:32	33.0			--	---	027	---	027	0.5	062
		21:38	32.0			--	---	016	---	016	0.5	063
		21:44	31.0			+20	020	016	1.7	027	0.5	065
		21:50	30.0			-20	340	014	1.7	024	0.5	025
54	230	22:40	26.0	5	000	--	---	000	---	000	---	---
		22:46	26.0			--	---	000	---	000	---	---
		22:52	27.0			--	---	000	---	000	---	---
		22:58	27.0			--	---	000	---	000	---	---
		23:04	26.5			--	---	000	---	000	---	---
		23:11	27.0			--	---	000	---	000	---	---
	231	00:24	30.0			--	---	000	---	000	---	---
		00:30	30.0			--	---	000	---	000	---	---
		00:36	31.0			-30	330	009	1.4	013	0.5	015
		00:43	31.0			-30	330	003	1.4	004	0.5	---
55	231	02:45	42.0	5	000	--	---	000	---	000	---	---
		02:51	42.5			--	---	000	---	000	---	---
		02:57	42.5			--	---	000	---	000	---	---
		03:03	42.5			--	---	000	---	000	---	---
		03:09	42.5			--	---	000	---	000	---	---
56	231	05:37	43.0	5	000	--	---	000	---	000	---	---
		05:48	43.0			--	---	000	---	000	---	---
		05:54	42.5			--	---	000	---	000	---	---
		06:00	42.5			--	---	000	---	000	---	---
		06:06	42.5			--	---	000	---	000	---	---
57	231	18:57	43.0	5	000	--	---	000	---	000	---	---
		19:03	43.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY (KM.)	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
57	231	19:10	43.0	5	000	--	---	000	---	000	---	---
		19:16	43.0			--	---	000	---	000	---	---
		19:22	43.0			--	---	000	---	000	---	---
58	231	22:41	47.0	5	000	--	---	000	---	000	---	---
		22:47	47.0			--	---	000	---	000	---	---
		22:53	47.0			--	---	000	---	000	---	---
		23:00	47.0			--	---	000	---	000	---	---
		23:06	47.0			--	---	000	---	000	---	---
59	232	01:15	46.0	5	095	--	---	000	---	000	---	---
		01:21	46.0			--	---	000	---	000	---	---
		01:27	46.0			--	---	000	---	000	---	---
		01:33	46.0			--	---	000	---	000	---	---
		01:40	46.0			--	---	000	---	000	---	---
60	232	04:10	45.0	5	095	--	---	000	---	000	---	---
		04:16	45.0			+40	135	004	1.2	005	1.5	---
		04:22	45.0			--	---	000	---	000	---	---
		04:28	45.0			--	---	000	---	000	---	---
		04:34	45.0			--	---	000	---	000	---	---
61	232	07:21	46.0	5	090	-85	005	004	1.0	004	3.0	---
		07:27	46.0			-65	025	004	1.0	004	2.0	---
		07:33	46.0			--	---	000	---	000	---	---
		07:39	46.0			--	---	000	---	000	---	---
		07:45	46.0			--	---	000	---	000	---	---
		07:51	46.0			--	---	000	---	000	---	---
		07:57	46.0			--	---	000	---	000	---	---
		08:03	45.0			--	---	000	---	000	---	---
		08:09	45.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY (/KM.)	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
62	232	10:10	44.0	5	090	-25	065	004	1.6	006	2.0	---
		10:16	44.0			--	---	006	---	006	1.0	---
		10:22	44.0			+40	130	003	1.2	004	1.0	---
		10:29	44.0			--	---	000	---	000	---	---
		10:35	44.0			--	---	008	---	008	1.0	---
		10:41	45.0			-30	060	014	1.4	020	3.0	---
63	232	13:26	42.0	5	147	-65	082	009	1.0	009	2.5	---
		13:33	42.0			--	---	000	---	000	---	---
		13:39	42.0		198	-65	133	004	1.0	004	0.5	---
		13:45	42.0			--	---	000	---	000	---	---
		13:51	42.0			+55	253	004	1.1	004	1.0	---
		13:57	42.0			--	---	000	---	000	---	---
		14:03	42.0			+30	228	003	1.4	004	2.0	---
		14:09	42.0			--	---	002	---	002	1.0	---
		14:15	42.0			--	---	002	---	002	0.5	---
		14:21	42.0			--	---	000	---	000	---	---
		14:28	41.5		240	+50	290	004	1.1	004	1.0	---
		14:34	41.0			+60	300	003	1.0	003	1.5	---
		14:40	41.0			-70	170	002	1.0	002	2.0	---
		14:47	40.0			-25	215	011	1.6	018	2.0	---
		14:53	40.0			-20	220	006	1.7	010	1.5	---
		15:00	40.0			-30	210	001	1.4	001	0.5	---
		15:06	40.0			--	---	006	---	006	0.5	---
		15:13	39.0			-90	150	002	1.0	002	4.0	---
		15:19	39.0			-90	150	005	1.0	005	---	---
		15:25	39.0			-85	155	004	1.0	004	2.0	---
		15:31	39.0		210	+35	245	003	1.3	004	0.5	---
		15:41	39.0			+45	255	003	1.1	003	1.0	---
		15:47	38.0			-30	180	005	1.4	007	---	---
		15:53	38.0			-65	145	004	1.0	004	4.5	---
		16:00	38.0			-60	150	003	1.0	003	0.5	---
		16:06	37.0			-45	165	006	1.2	007	1.0	---
		16:13	37.0			+55	265	004	1.1	004	1.5	---
		16:45	35.0		220	+35	255	007	1.3	009	1.0	---
		16:51	35.0			-25	195	008	1.6	013	0.5	---
		16:57	35.0			-30	190	035	1.4	049	1.0	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
63	232	17:03	35.0	5	220	--	---	035	---	035	0.5	---
		17:09	35.0			+20	240	035	1.7	060	1.0	---
		17:16	34.5		205	+40	245	031	1.2	037	1.0	---
		17:22	34.0		200	-20	180	013	1.7	022	0.5	---
		17:28	34.0			+20	220	015	1.7	026	1.0	---
		17:34	34.0			-45	155	018	1.1	020	1.5	---
64	232	18:51	34.0	5	195	-35	160	012	1.2	014	1.5	075
		18:57	34.0		200	-20	180	009	1.7	015	1.5	040
		19:03	34.0			+40	240	011	1.2	013	0.5	025
		19:09	34.0			+30	230	003	1.4	004	0.5	045
		19:15	34.0			+35	235	001	1.2	001	0.5	---
		19:21	34.0		195	+45	240	006	1.2	007	0.5	---
		19:27	34.0			+25	220	006	1.6	010	0.5	062
		19:33	34.0			--	---	010	---	010	1.5	025
65	232	21:34	34.0	5	195	--	---	000	---	000	---	---
		21:40	34.0			--	---	000	---	000	---	---
		21:46	34.0			+20	215	003	1.7	005	0.5	020
		21:56	35.0			-80	115	002	1.0	002	0.5	072
		22:02	35.0			+50	245	002	1.1	002	0.5	---
		22:08	35.0			-20	175	001	1.7	002	0.5	035
66	232	23:30	35.0	5	355	--	---	000	---	000	---	---
		23:36	35.0			--	---	000	---	000	---	---
		23:42	35.0			+85	080	002	1.0	002	0.5	012
		23:48	35.0			+20	015	001	1.7	002	0.5	012
		23:54	35.0			--	---	000	---	000	---	---
	234	00:10	35.0		228	-15	213	002	2.0	004	0.5	060
		00:16	35.0			-15	213	002	2.0	004	0.5	060
		00:22	35.0			+60	288	001	1.0	001	0.5	---
		00:28	35.0			--	---	001	---	001	0.5	005
		00:34	35.0			+35	263	001	1.2	001	0.5	---
		00:50	34.0			-50	178	005	1.1	006	0.5	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
66	233	00:56	34.0	5	228	-45	183	004	1.2	005	0.5	060
		01:02	34.0			--	---	003	---	003	0.5	007
		01:07	35.0			+40	268	001	1.2	001	0.5	---
		01:12	35.0			--	---	002	---	002	0.5	010
		01:17	35.0			+50	278	001	1.1	001	0.5	035
67	233	02:00	35.0	6	228	--	---	000	---	000	---	---
		02:05	35.0			--	---	000	---	000	---	---
		02:10	35.0			--	---	000	---	000	---	---
		02:15	35.0			+90	318	001	1.0	001	0.5	013
		02:20	35.0		173	--	---	000	---	000	---	---
		02:25	35.0			--	---	000	---	000	---	---
		02:40	34.0			--	---	000	---	000	---	---
		02:45	34.0			-50	123	001	1.1	001	0.5	026
		03:00	33.0			-55	118	004	1.0	004	0.5	018
		03:05	33.0			-85	088	005	1.0	005	0.5	035
		03:11	34.0			--	---	001	---	001	0.5	---
		03:16	34.0			--	---	001	---	001	0.5	015
		03:21	34.0			+85	258	005	1.0	005	0.5	015
		03:26	34.0			--	---	000	---	000	---	---
		03:31	34.0		185	--	---	000	---	000	---	---
		03:37	34.0			--	---	000	---	000	---	---
		03:42	34.0			+25	210	003	1.5	005	1.5	035
		03:47	34.0			--	---	005	---	005	0.5	---
		03:53	34.0			+30	215	010	1.4	014	0.5	040
		03:58	35.0			--	---	000	---	000	---	---
		04:08	36.0		173	--	---	000	---	000	---	---
		04:12	36.5			--	---	000	---	000	---	---
		04:17	37.0			--	---	000	---	000	---	---
		04:23	37.0			+80	253	003	1.0	003	2.0	085
		04:28	37.0			--	---	000	---	000	---	---
		04:33	37.0			--	---	000	---	000	---	---
		04:39	37.0			+90	263	001	1.0	001	0.5	020
		04:45	37.0			-70	103	002	1.0	002	1.0	030
		04:51	37.0			-90	083	004	1.0	004	1.0	055
		04:56	37.0		158	-70	088	006	1.0	006	1.0	020
		05:00	36.5			-75	083	005	1.0	005	0.5	015
		05:05	36.5			+45	203	004	1.2	005	0.5	030

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
68	233	06:05	36.0	6	148	-25	123	011	1.6	018	1.0	045
		06:10	36.0			--	---	004	---	004	0.5	020
		06:16	36.0			--	---	000	---	000	---	---
		06:21	36.5			+35	183	007	1.3	009	0.5	---
		06:26	36.5			+85	233	013	1.0	013	1.0	110
		06:32	36.5			--	---	000	---	000	---	---
		06:37	36.0			--	---	004	---	004	1.5	055
		06:42	36.0			+55	203	010	1.0	010	1.0	050
		06:47	36.0			+20	168	008	1.7	013	1.5	040
		06:52	36.5			-60	088	006	1.0	006	1.0	040
		06:58	37.0			+30	178	004	1.4	006	1.0	015
		07:04	37.0			-55	203	013	1.0	013	1.0	040
		07:11	38.0			-90	058	001	1.0	001	---	---
		07:16	38.5			-90	058	002	1.0	002	0.5	045
		07:25	39.0			--	---	000	---	000	---	---
		07:31	39.0			--	---	000	---	000	---	---
		07:36	39.0			--	---	000	---	000	---	---
		07:50	39.5			-30	118	002	1.4	003	0.5	030
		07:55	39.5			-60	088	001	1.0	001	0.5	015
		08:01	39.5			-30	118	001	1.4	001	0.5	010
		08:09	39.5		113	-10	103	001	2.5	003	---	010
		08:14	39.5			-50	063	005	1.1	005	---	010
69	234	01:44	40.5	5	308	-30	278	012	1.4	017	0.5	---
		01:49	40.0			-30	278	017	1.4	023	1.0	030
		01:55	40.0			-20	288	023	1.7	039	1.0	040
		02:00	39.5			-15	293	021	2.0	042	0.5	---
		02:15	39.5			-70	238	023	1.0	023	1.0	055
		02:20	40.0			-50	258	019	1.1	021	1.0	095
		02:26	41.0			-60	248	016	1.0	016	1.0	080
70	234	10:55	27.0	2	349	-25	324	066	1.6	105	0.5	---
		11:10	26.0			+25	014	056	1.6	090	0.5	---
		11:20	26.0	3	015	--	---	025	---	025	0.5	---
		11:32	26.5			-05	010	063	3.0	189	0.5	---
		11:35	26.5		003	+10	013	028	2.4	031	0.5	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY / KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
70	234	11:40	26.5	3	015	+20	035	047	1.7	080	0.5	---
		11:45	26.5		018	+30	048	018	1.4	025	0.5	---
		11:50	26.5		015	+25	040	022	1.6	035	0.5	---
		11:55	26.5		020	+10	030	024	2.4	058	0.5	---
		12:06	26.5	5		+20	040	021	1.7	036	0.5	---
		12:16	26.5		030	-05	025	025	3.0	075	0.5	---
		12:29	26.0	3	055	+45	100	067	1.2	080	0.5	---
		12:38	26.0		026	+15	041	042	2.0	084	0.5	---
		12:46	27.0		050	+30	080	080	1.4	112	0.5	---
		12:58	27.0			-05	045	100	3.0	300	1.0	---
		13:10	25.0			-20	030	049	1.7	083	1.0	---
		13:17	25.5		083	00	083	091	4.0	364	1.5	---
		13:29	23.0			00	083	023	4.0	092	0.5	---
71	236	00:55	43.5	5	226	+20	246	060	1.7	102	1.5	---
		01:01	43.0			+55	281	062	1.1	068	1.5	---
		01:07	44.0			+35	261	042	1.3	055	1.5	---
		01:14	44.0			+25	251	028	1.6	045	2.0	---
		01:20	44.0			+20	246	033	1.7	056	2.0	---
72	236	07:06	50.0	5	090	00	090	009	4.0	036	---	---
		07:13	50.0			+15	105	016	3.0	048	---	---
		07:19	---			+20	110	017	1.7	029	---	---
		07:25	---			-20	070	012	1.7	020	---	---
73	236	10:24	49*	5	090	--	---	000	---	000	---	---
		10:30	49*			--	---	000	---	000	---	---
		10:42	49*			-25	065	011	1.6	018	---	---
		10:48	49*			-20	070	018	1.7	031	---	---
		10:54	49*			--	---	000	---	000	---	---
		11:00	49*			-55	035	002	1.1	002	---	---
		11:06	49*			--	---	000	---	000	---	---
		11:11	49*			--	---	000	---	000	---	---
		11:17	49*			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM^2	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
73	236	11:23	49*	5	090	--	---	000	---	000	---	---
		11:30	49*			--	---	003	---	003	---	---
		11:37	49*			-35	055	012	1.2	014	---	---
		11:43	49*			--	---	032	---	032	---	---
		11:55	---			+20	110	013	1.7	022	---	---
74	237	23:06	---	5	270	--	---	002	---	002	---	---
		23:12	---			-40	230	006	1.2	007	---	---
		23:17	---			-25	245	002	1.6	003	---	---
		23:23	---			-20	250	002	1.7	003	---	---
		23:30				-25	245	004	1.6	006	---	---
75	238	06:05	---	5	180	--	---	000	---	000	---	---
		06:11	---			--	---	000	---	000	---	---
		06:17	---			+30	210	003	1.4	004	---	---
		06:23	---			+30	210	002	1.4	003	---	---
		06:31	---			+55	235	001	1.1	001	---	---
		06:37	---			--	---	000	---	000	---	---
76	240	12:45	37.0	5	093	--	---	000	---	000	---	---
		12:51	36.0			+15	108	006	2.0	012	0.5	---
		12:57	35.0			+15	108	006	2.0	-12	0.5	---
		13:06	34.0			--	---	015	---	015	0.5	---
		13:13	33.0			--	---	018	---	018	0.5	---
		13:20	29.0			--	---	036	---	036	1.0	---
		13:26	25.0			+25	113	051	1.7	082	1.0	015
		13:41	25.0			--	---	025	---	025	1.0	---
77	240	15:10	29.0	5	093	--	---	000	---	000	---	---
		15:16	29.0			--	---	000	---	000	---	---
		15:23	29.0			--	---	000	---	000	---	---
		15:30	30.5		172	--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY (KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
77	240	15:36	28.0	5	172	--	---	000	---	000	---	---
		15:43	29.0			--	---	000	---	000	---	---
		15:49	30.0			--	---	000	---	000	---	---
		15:56	29.0			--	---	004	---	004	0.5	006
		16:02	29.0			--	---	012	---	012	0.5	---
		16:08	28.0			+05	177	036	3.0	108	---	---
		16:16	28.0			--	---	000	---	000	---	---
		16:22	----			--	---	000	---	000	---	---
		16:28	28*			--	---	000	---	000	---	---
		16:40	28*			--	---	000	---	000	---	---
		16:46	28*			-25	147	002	1.5	003	---	---
		16:52	25.0			+15	187	012	2.0	024	0.5	005
		16:58	28.0			+25	197	025	1.5	038	0.5	---
		17:05	29.0			-20	152	026	1.7	044	0.5	---
		17:11	29.0			--	---	009	---	009	0.5	---
		17:26	29.0			-40	132	002	1.2	003	0.5	---
		17:33	29.0			--	---	005	---	005	---	---
		17:39	30.0			--	---	000	---	000	---	---
		17:45	29.0			--	---	000	---	000	---	---
		17:52	32.0			+25	197	002	1.5	003	0.5	---
		17:59	33.0			--	---	000	---	000	---	---
		18:05	33.0			--	---	000	---	000	---	---
		18:11	33.0			--	---	000	---	000	---	---
		18:17	34.0			--	---	000	---	000	---	---
		18:24	34.0			--	---	000	---	000	---	---
		18:30	34.0			--	---	001	---	001	---	---
78	241	13:00	53.0	5	158	--	---	000	---	000	---	---
		13:06	52.0			--	---	000	---	000	---	---
		13:13	52.0			--	---	000	---	000	---	---
		13:23	52.0			--	---	000	---	000	---	---
		13:30	52.0			--	---	000	---	000	---	---
		13:36	50.0			--	---	000	---	000	---	---
79	241	16:10	44.0	5	145	--	---	000	---	000	---	---
		16:17	44.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY (KM	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
79	241	16:23	43.0	5	145	--	---	000	---	000	---	---
		16:29	44.0			--	---	000	---	000	---	---
		16:35	43.0			+60	205	003	1.0	003	0.5	003
		16:41	43.0			--	---	000	---	000	---	---
80	241	19:15	33.0	5	150	+40	190	016	1.2	019	0.5	010
		19:21	33.0			+40	190	017	1.2	020	0.5	---
		19:27	33.0			+45	195	004	1.1	004	0.5	---
		19:34	33.0			+40	190	006	1.2	007	0.5	---
		19:40	33.0			+40	190	009	1.2	011	0.5	---
		19:50	32.0			+50	200	004	1.0	004	0.5	006
81	241	22:11	32.0	5	243	-30	213	013	1.4	018	0.5	035
		22:17	32.0			-20	223	009	1.7	015	0.5	---
		22:23	31.0			-15	228	005	2.0	010	0.5	---
		22:30	31.0			-15	228	004	2.0	008	0.5	---
		22:36	31.0			-05	237	005	3.0	015	0.5	---
		22:43	30.0			--	---	007	---	007	---	---
		22:56	30.0			00	243	002	4.0	008	0.5	---
		23:03	30.0			-20	223	001	1.7	002	0.5	---
		23:09	30.0			--	---	000	---	000	---	---
		23:15	29.0			--	---	000	---	000	---	---
		23:22	29.0			-30	213	007	1.4	012	0.5	---
		23:28	29.0			--	---	000	---	000	---	---
		23:34	29.0			--	---	000	---	000	---	---
		23:40	28.0			--	---	000	---	000	---	---
82	242	00:00	28.0	5	243	--	---	000	---	000	---	---
		00:06	28.0			--	---	000	---	000	---	---
		00:13	27.0			+30	273	003	1.4	004	0.5	---
		00:19	27.0			--	---	000	---	000	---	---
		00:25	27.0			--	---	001	---	001	0.5	---
		00:32	27.0			--	---	000	---	000	---	---
		00:38	27.0			-50	193	003	1.1	003	0.5	005
		00:45	27.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY/KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
82	242	00:51	27.0	5	243	-40	203	002	1.2	003	0.5	---
		00:58	27.0			--	---	000	---	000	---	---
		01:04	26.5			--	---	000	---	000	---	---
		01:20	26.0			--	---	000	---	000	---	---
		01:26	26.0			--	---	000	---	000	---	---
		01:33	26.0			+10	253	003	2.3	008	0.5	007
		01:39	26.0			--	---	001	---	001	0.5	---
		01:45	26.0			-10	233	002	2.3	005	0.5	---
		01:51	26.0			--	---	000	---	000	---	---
		01:58	26.0			-30	213	011	1.4	016	0.5	---
		02:04	26.0			-25	218	007	1.5	010	0.5	---
		02:11	26.5			-20	223	009	1.7	015	---	---
		02:18	27.0			-30	213	006	1.4	007	---	---
		02:40	31.0			-50	193	005	1.1	005	0.5	---
		02:46	32.0			--	---	001	---	001	0.5	---
		03:02	33.0			--	---	000	---	000	---	---
		03:08	35.0			-35	208	002	1.3	003	0.5	---
		03:14	38.0		160	--	---	000	---	000	---	---
		03:20	41.0			--	---	000	---	000	---	---
		03:27	41.0			--	---	000	---	000	---	---
83	242	05:15	37.0	4	185	--	---	000	---	000	---	---
		05:23	37.0			--	---	000	---	000	---	---
		05:38	37.0		195	--	---	000	---	000	---	---
		05:46	37.0			--	---	000	---	000	---	---
		05:54	37.0			--	---	000	---	000	---	---
		06:05	38.0			--	---	000	---	000	---	---
		06:13	38.0			--	---	000	---	000	---	---
		06:30	38.0			--	---	000	---	000	---	---
		06:38	38.0			--	---	000	---	000	---	---
		06:56	38.0			-20	175	007	1.7	012	0.5	008
		07:04	38.0			--	---	000	---	000	---	---

LINE SEGMENT	JULIAN DATE	TIME	WATER DEPTH (M.)	SHIP SPEED (KTS.)	COURSE (°T.)	DOMINANT AZIMUTH (RELATIVE)	DOMINANT AZIMUTH (°T)	GOUGES OBSERVED	CORRECTION FACTOR	GOUGE DENSITY /KM.	MAXIMUM INCISION (M.)	MAXIMUM INCISION WIDTH (M)
04	219	02:25	22.0	7	242	--	---	000	---	000	---	---
		02:30	22.0			--	---	000	---	000	---	---
		02:35	22.0			--	---	000	---	000	---	---
		02:40	22.0			--	---	000	---	000	---	---
		02:45	22.0			--	---	000	---	000	---	---
		02:50	22.0			--	---	000	---	000	---	---
		02:55	22.0			--	---	000	---	000	---	---
		03:00	22.0			--	---	000	---	000	---	---
		03:05	22.0			--	---	000	---	000	---	---
		04:00	28.0		298	-20	278	003	1.7	005	0.5	---
		04:05	28.0			-20	278	004	1.7	007	0.5	---
		04:10	28.0			-20	278	010	1.7	017	0.5	---
		04:15	28.0			-50	248	005	1.1	006	0.5	005
		04:20	28.0			--	---	000	---	000	---	---
		04:25	28.0			--	---	000	---	000	---	---
		04:30	28.0			--	---	000	---	000	---	---
		04:35	28.0		290	--	---	000	---	000	---	---
		04:40	28.0		284	--	---	000	---	000	---	---
		04:45	28.0			--	---	000	---	000	---	---
		04:50	28.0			--	---	000	---	000	---	---
		04:55	28.0			--	---	000	---	000	---	---
		05:00	28.0			--	---	000	---	000	---	---
		05:05	28.0			--	---	000	---	000	---	---
		05:10	28.0			-10	280	002	2.4	005	0.5	---
		05:15	28.0			--	---	000	---	000	---	---
		05:20	28.0			--	---	000	---	000	---	---
		05:25	28.0			--	---	000	---	000	---	---
		05:30	28.0			--	---	000	---	000	---	---
		05:35	28.0			--	---	000	---	000	---	---
		05:40	28.0			--	---	000	---	000	---	---
05	219	06:45	32.0	7	234	--	---	013	---	013	0.5	---
		06:50	32.0			--	---	005	---	005	0.5	---
		06:59	32.0			--	---	007	---	007	0.5	---
		07:04	32.0			--	---	003	---	003	0.5	---
		07:09	31.0			--	---	003	---	003	0.5	---
		07:14	31.0			--	---	000	---	000	---	---
		07:19	31.0			+12	246	008	2.4	019	0.5	010
		07:24	30.0			00	234	011	4.0	044	0.5	008