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REGIONAL GRAVITY SURVEY OF BELUGA BASIN AND ADJACENT AREA, COOK INLET REGION, SOUTH-CENTRAL ALASKA

By Steve W. Hackett

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REGIONAL GRAVITY SURVEY OF THE BELUGA BASIN AND ADJACENT AREA COOK INLET REGION, SOUTH-CENTRAL ALASKA[1]

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ABSTRACT

Over 200 new gravity stations were occupied in a previously unsurveyed area between latitudes 60^{o} and 62^{o} N. and longitudes 151^{o} and 153^{o} W. The area of major tectonic concern contains 1) the junction of the Alaska and Aleutian mountain ranges, 2) the termination of the active Aleutian volcanic arc, 3) the junction of several major fault systems, and 4) gas-, oil-, and coal-bearing sedimentary basins of Tertiary age.

A simple Bouguer gravity map, compiled from reconnaissance data from both this survey and the U.S. Geological Survey, indicates that the tectonic framework of the region differs in many respects from that previously published. Steep gravity gradients and low Bouguer values imply basement discontinuities and indicate several new subdivisions within the Cook Inlet petroleum province. Abrupt, asymmetric gravity gradients suggest high angle, reverse nature for the Castle Mountain, Bruin Bay, and Beluga Mountain faults. The Beluga Mountain fault, a newly recognized major lineament, has a large amount of vertical displacement and coincides with a postulated hinge zone in the subducting Pacific plate.

Major Mesozoic and Cenozoic tectonic elements have also been delineated in this investigation. The Mesozoic Talkeetna Geanticline, represented by areas of high Bouguer values, appears to be offset by a pre-Tertiary basement fault. Portions of the upper Cenozoic Shelikof Trough are outlined by the Bouguer gravity data, providing a generalized picture of the large structural configuration and thickness of the Tertiary subprovinces (Cook Inlet, Beluga, Susitna, and Yentna basins). These younger basins appear to be controlled by deep-seated basement discontinuities.

Recently acquired and compiled gravity data will assist in reevaluating the petroleum, coal, mineral, uranium, and possible geothermal resources of this area as well as providing a basis for more detailed geophysical and geological investigations. This regional geophysical interpretation significantly furthers our understanding of the tectonic history of south-central Alaska and could spur new exploration activity and scientific interest in the Cook Inlet region.

INTRODUCTION

The data and interpretations presented in this paper are derived from a concentrated two-year geological and geophysical study of the Cook Inlet region (fig. 1). Results presented represent a synthesis of many integrated projects including gravity, magnetics, seismicity and structural geology. With the presentation of this paper and a forthcoming Alaska Division of Geological and Geophysical Surveys (DGGS) report (Hackett, in press,

[1]Reprint of a paper delivered at 45th Annual International Meeting of the Society of Exploration Geophysicists, October 13, 1975 at Denver, Colorado.

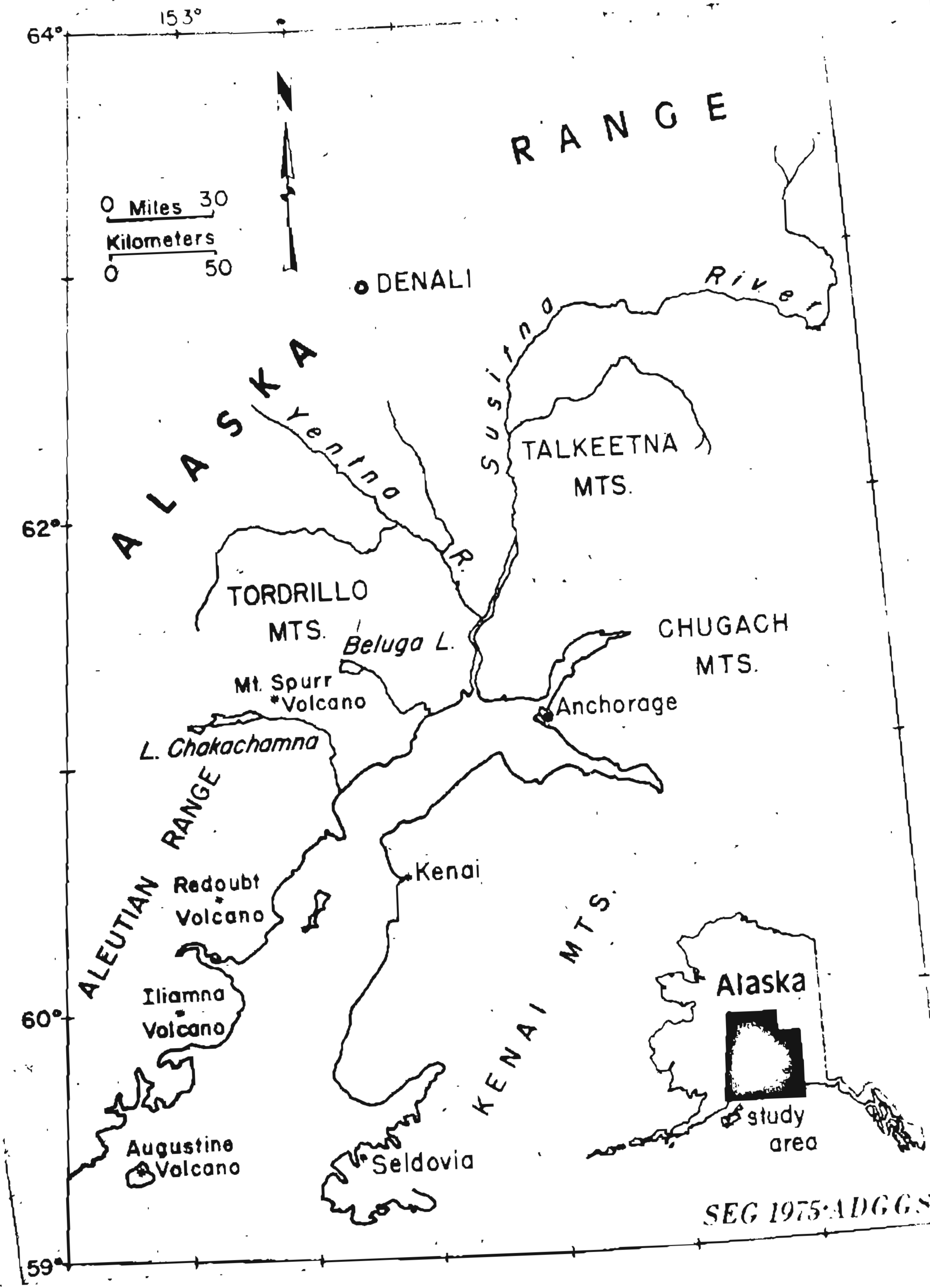


Figure 1. Index map of the Cook Inlet region, south-central Alaska

a) virtually the entire USGS and DGGS gravity network of about 2500 stations in 6000 mi^2 (156,000 km^2) along with related magnetic and known geologic data will be available to the public. Newly acquired data from over 200 gravity stations in a previously unsurveyed area between latitudes 60° and 62° N. and longitudes 151° and 153° W. (fig. 2) will be specifically emphasized.

Several commercial geophysical companies have conducted detailed gravity surveys over selected parts of the Cook Inlet region, but an integrated regional study of the gravity field is not known to the author. A gravity map of the State of Alaska will soon be published by USGS and DGGS at a scale of 1:2,500,000 (David Barnes, USGS, project supervisor). This map should help define the gross regional gravity field over south-central Alaska and should stimulate additional reconnaissance and detailed surveys over anomalous areas.

The Beluga Basin occupies approximately 600 mi^2 (15,600 km^2) in the west-central portion of the Cook Inlet Lowland, a long narrow embayment in the south-central coast of Alaska. The Cook Inlet region, which includes the Cook Inlet, Beluga, Susitna, and Yentna Basins (fig. 3), is bordered on the east by the Kenai, Chugach, and Talkeetna Mountains, and on the north and west by the Alaska and Aleutian Ranges. These highland areas enclose a lowland embayment that is underlain by oil-, gas-, and coal-bearing beds of Tertiary age which form numerous exposures along the Cook Inlet shoreline and river systems. The region is generally mantled by surficial deposits of glacial and fluvial origin. Exposed bedrock units ranging in age from Permo-Triassic through middle Tertiary have been identified in the region. Several major fault systems and their junctions are present in the upper Cook Inlet region.

The purposes of the Beluga Basin gravity study are: 1) to partially fill in a regional gravity data void in south-central Alaska (Barnes, 1967), 2) to incorporate, compile, and interpret the regional gravity and aeromagnetic data over the Cook Inlet Region, 3) to outline and trace the Mesozoic and Cenozoic tectonic elements and structural features throughout the area, 4) to delineate the basement configuration and gross thickness of the Tertiary sediments in the northern portion of the Shelikof Trough, 5) to assist in determining the regional subsurface and bedrock geology as it may relate to oil, gas, coal, uranium, metallic minerals and geothermal resources, and 6) to provide a general framework for a more detailed geophysical and geological investigations in south-central Alaska.

GRAVITY SURVEY

A LaCoste-Romberg gravimeter (No. 248) acquired from the University of Alaska Geophysical Institute and standard field and data reduction procedures were used during the Beluga Basin survey.

Gravity stations were plotted on USGS 1:63,360- and 1:250,000-scale topographic maps of the Tyonek and Kenai quadrangles (fig. 4). Surveyed and photogrammetric spot elevations (from 1" to 1 mile topo sheets) were occupied as much as possible. Elevation control was obtained from either VABM, spot elevations, river gradients, and/or altimetry to establish good regional gravity coverage. Simple Bouguer anomalies have been computed using a reduction density of 2.67 gm/cm^3 (fig. 5). A Bouguer anomaly contour map and principal facts of the gravity observations will be published shortly as a DGGS geologic report (Hackett, in press, a).

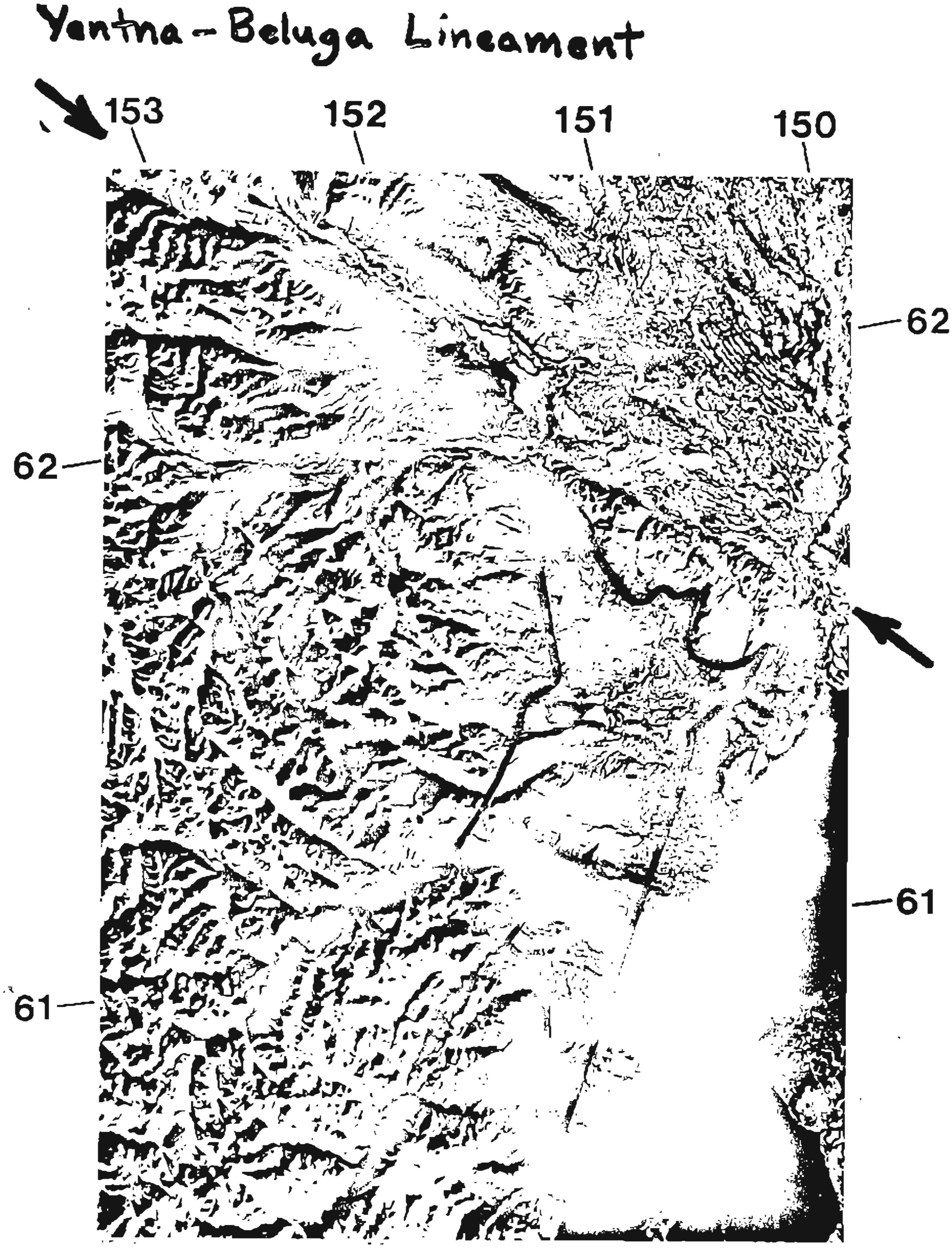


Figure 2. ERTS-1 mosaic of Beluga Basin and adjacent area, Alaska

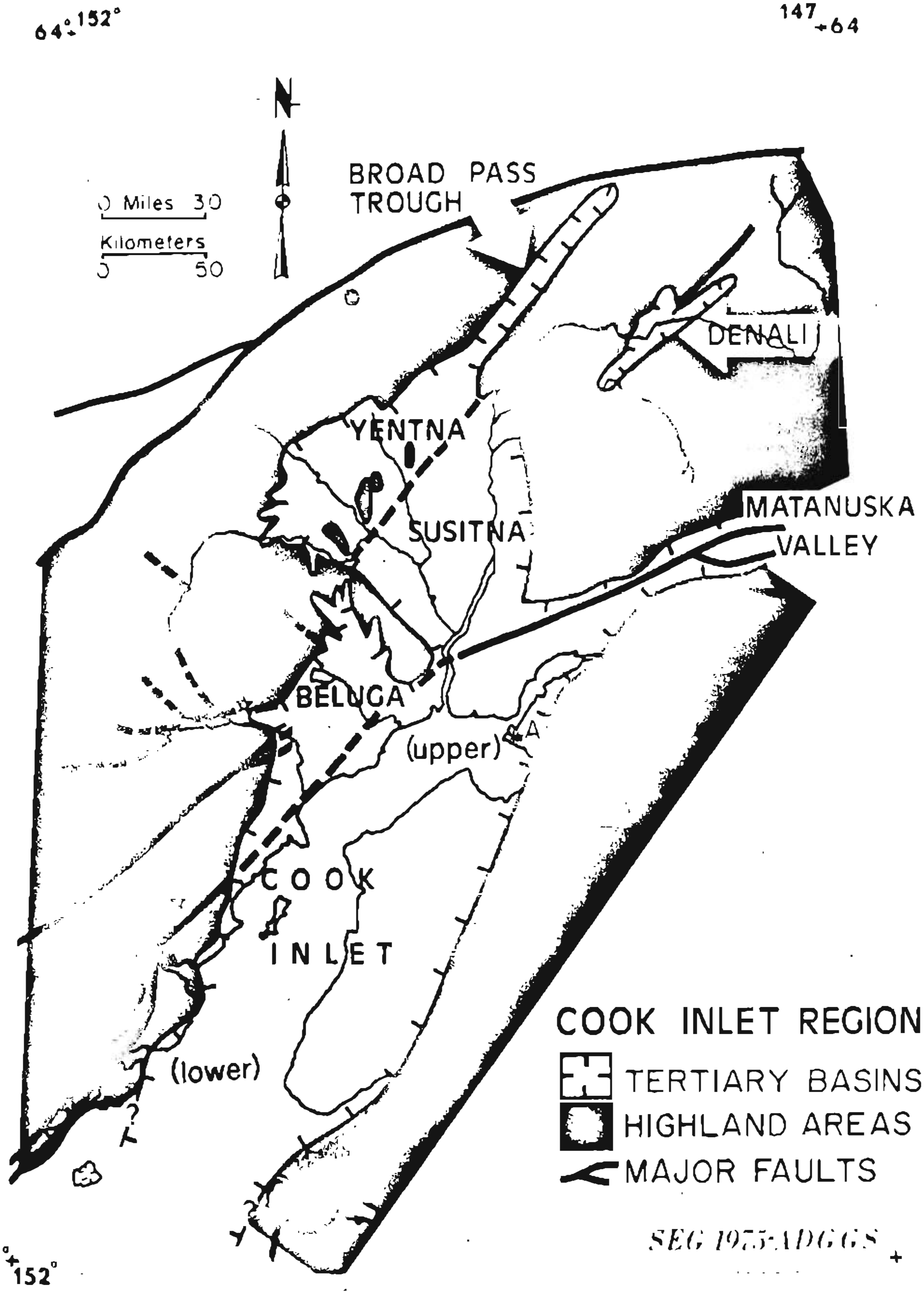


Figure 3. Outline of Tertiary basins enclosed within the upper Shelikof Trough, Cook Inlet region, Alaska

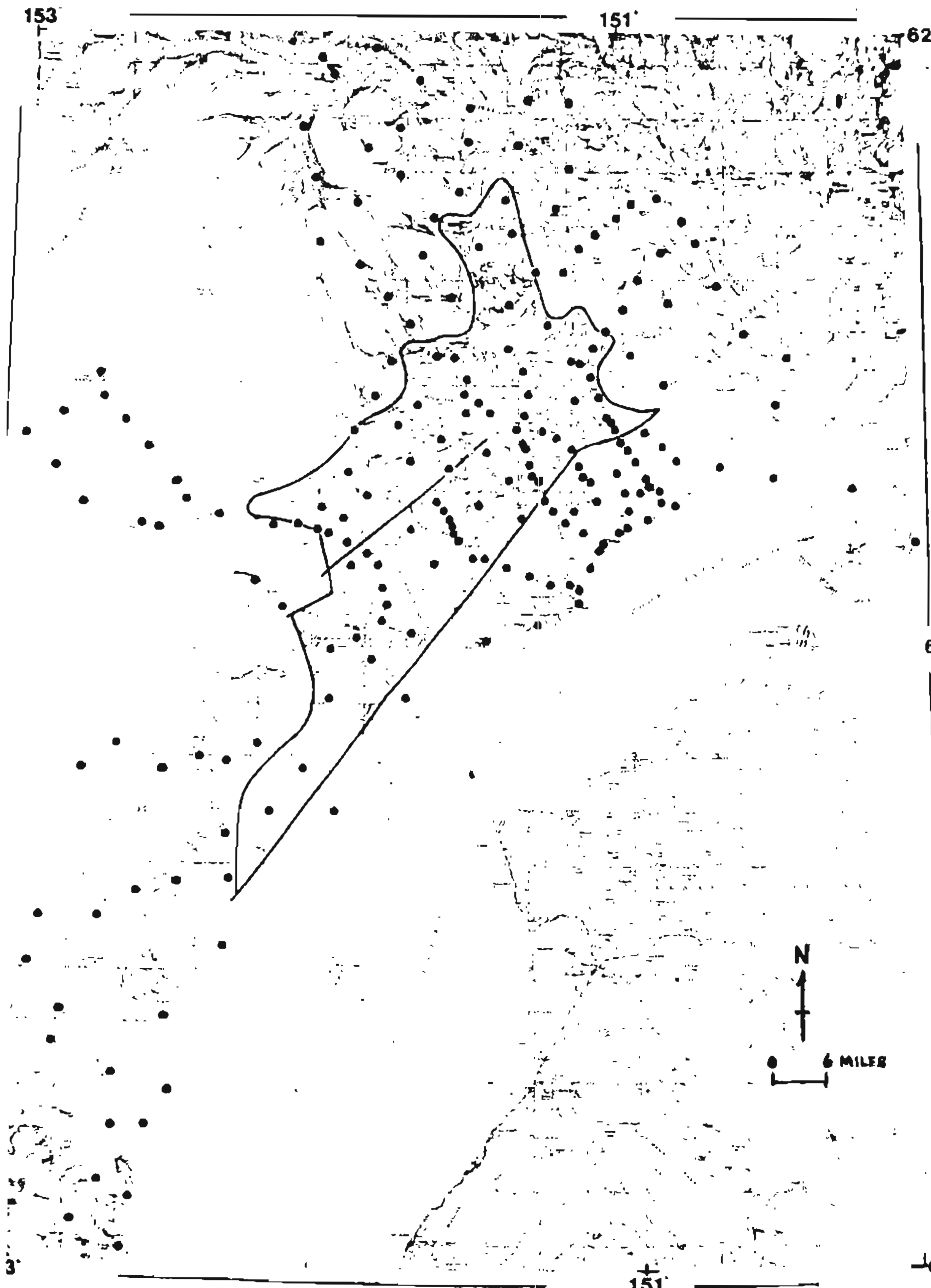


Figure 4. New gravity stations (Tyonek and Kenai quadrangles), Beluga Basin and adjacent area, Alaska

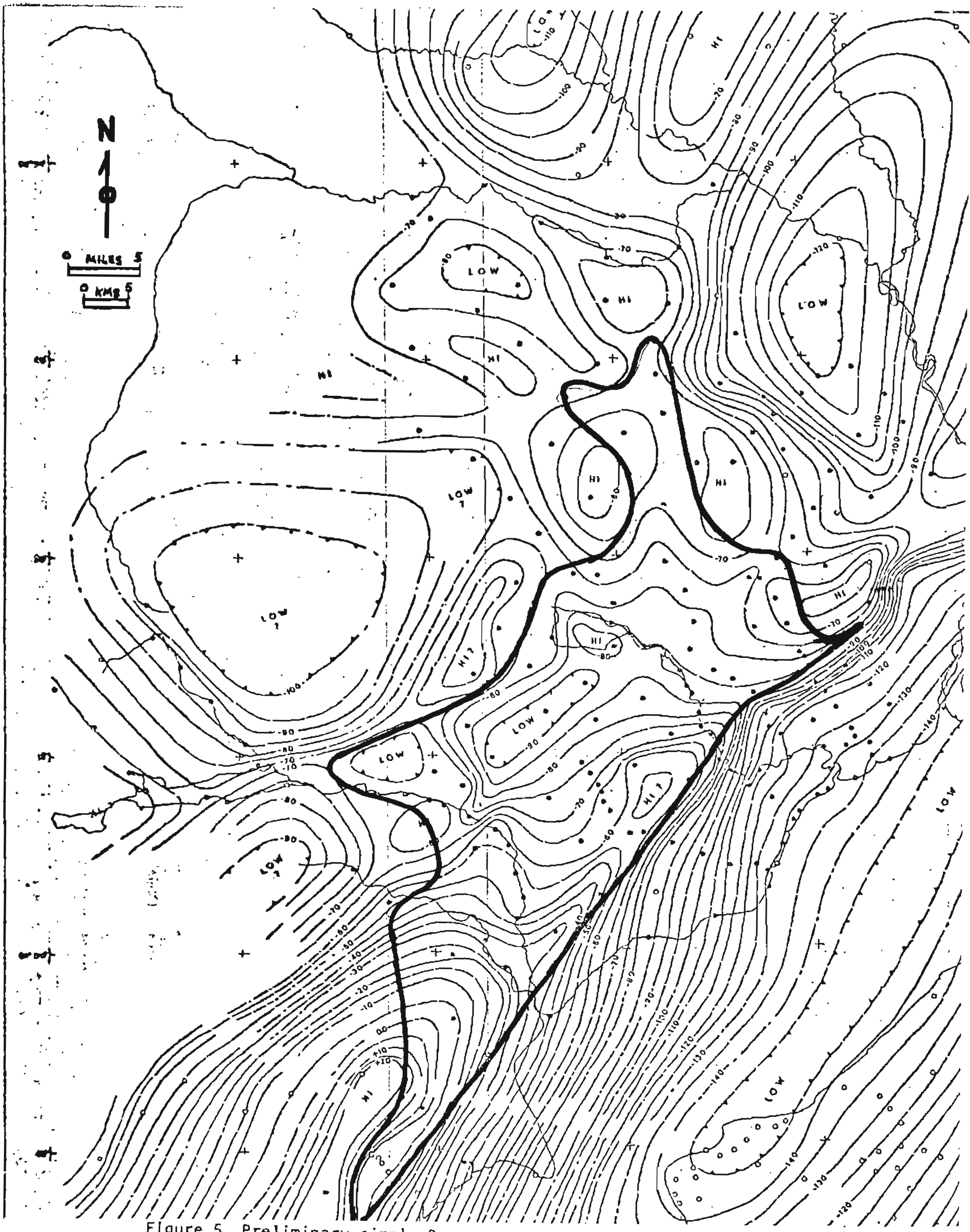


Figure 5. Preliminary simple Bouguer anomaly map of Beluga Basin, Alaska

It is recognized that the wide distribution of the gravity stations in this study permits only a generalized definition of the gravity field. Data analysis has, therefore, been confined to areas where elevation control permitted relatively close station spacing. Even in these areas, however, depth estimates are only approximate and highly interpretative.

A regional simple Bouguer anomaly map was constructed by synthesizing data acquired from the Beluga Basin gravity survey and former reconnaissance surveys completed by the USGS (fig. 6). The regional gravity field apparently decreases to the west and north over south-central Alaska. This general decrease in the regional field is probably a deep-seated phenomenon that is caused by northwest thickening of the crust over the region. Superimposed on the regional field are many significant anomalies. Locally in the Cook Inlet region the field culminates in four closed localized gravity lows, and three wedge- and elongated-shaped highs outlining the upper Shelikof Trough. The closed lows over the Cook Inlet, Beluga, Susitna, and Yentna lowlands are interpreted to be caused by thick stratigraphic sequences of clastic rocks, mostly of Tertiary age, which occupy tectonic basins. The large northeast-trending high on the west side of Cook Inlet partially coincides with the Mesozoic rocks of the Talkeetna Geanticline. The broad wedge-shaped composite gravity highs of Mt. Susitna, Beluga Mountain, and northern Beluga Basin are interpreted to be the apex of the Tordrillo Block (Hackett, unpublished), (fig. 7). This uplifted and fault-bounded basement block contains pre-Tertiary metasedimentary, metavolcanic, and igneous rocks. The other less extensive and more poorly defined lows and highs within the study area can be related to local density variations within the Cenozoic and Mesozoic rock units. Large anomalies over the Cook Inlet Lowland are believed to be caused by changes of lithology in pre-Tertiary basement and/or by relief on the pre-Tertiary basement surface. This conclusion has been reached because most anomaly amplitudes are too large to originate within the Tertiary stratigraphic sequence and/or the gradients are too steep to originate deep in the earth's crust. Partially defined large gravity lows over the Tordrillo Mountains, northern Chigmit Mountains, and southern Alaska Range indicate that these batholithic complexes cover a wide areal extent and probably extend to great depths.

The simple Bouguer gravity map of Beluga Basin and adjacent areas (fig. 5) indicates that the tectonic framework of the region differs in many respects from that shown in previous publications. Detailed analysis of most of the gravity anomalies cannot be justified at this time because the gravity field is not sufficiently defined; however, approximations of density contrasts and basement depths can be made in some areas. In the preliminary analyses of selected gravity profiles it is assumed that the sedimentary rocks of Tertiary age overlying the basement are substantially less dense than the average pre-Tertiary complexes; the density contrast assigned is $p=0.4$ gms/cm^3, but larger extremes are surely possible.

A cursory well data study of the subsurface pre-Tertiary rocks in the Cook Inlet Basin indicates that major larger gravity anomalies are caused by changes in basement lithology. Steep gravity gradients and low Bouguer values within the lowlands and along the mountain fronts imply basement discontinuities and indicate several structural subdivisions within the Cook Inlet petroleum province. The problems resulting from wide

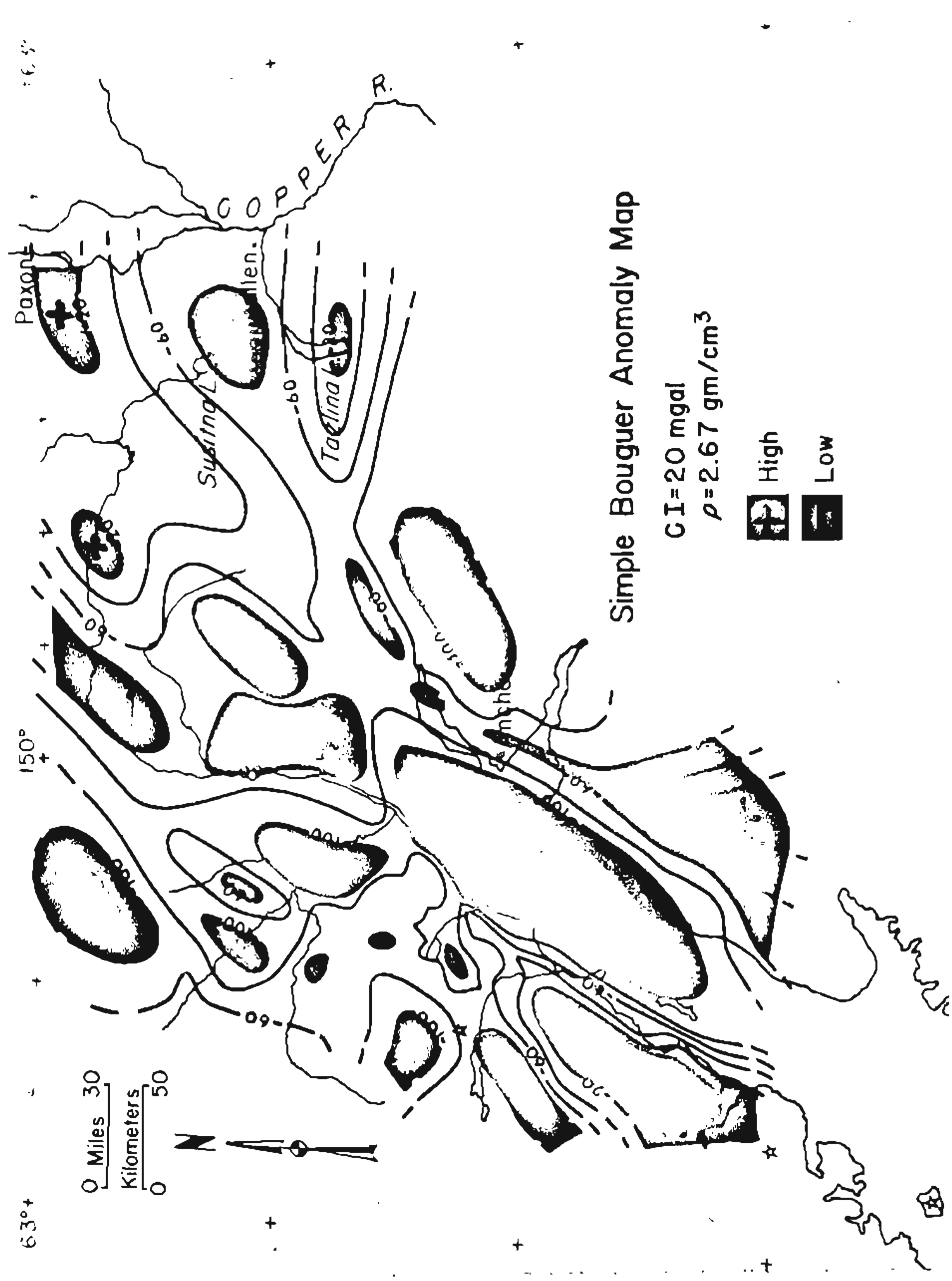


Figure 6. A generalized regional simple Bouguer gravity map of south-central Alaska

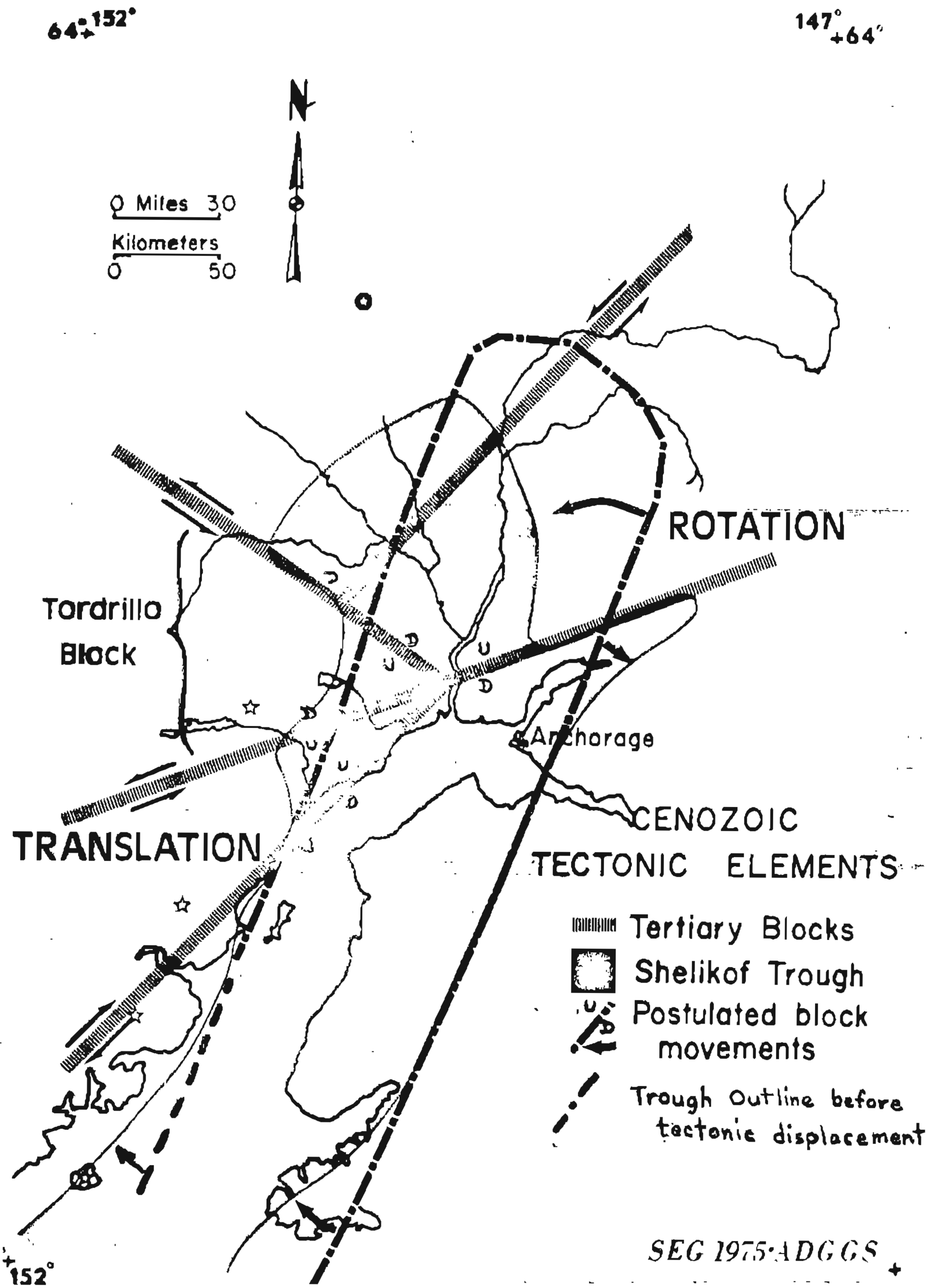


Figure 7. Cenozoic tectonic elements showing block outlines and postulated movements

ranges in bulk density within the Mesozoic and Cenozoic rocks will not be resolved until an extensive random rock sampling program can be initiated.

Two-dimensional gravity models were constructed along four profile lines (fig. 8) using computer programs modified after Talwani, et al. (1959). Agreement between the measured and computed anomalies is good and the models used are believed to grossly represent subsurface basement configurations. Because of the inherent uncertainties and ambiguities caused by the regional gravity data net, no efforts have been made to exactly match measured and computed anomalies.

Although the available gravity and magnetic coverage over the Beluga Basin and adjacent areas is not detailed enough to permit a quantitative depth analysis, it was possible to preliminarily analyze the high gradient areas and the more conspicious minimums. The east-west gravity profiles along section A-A' indicate that the Castle Mountain fault has approximately 12,000 ft (3600 m) of high-angle relief (fig. 9); the Cook Inlet and Beluga Basins apparently have a maximum thickness of 10,000 ft (3000 m) and 2,500 ft (750 m), respectively, in this area. The depth of the basins, the throw of the high-angle reverse fault, and the stratigraphic thicknesses computed by a two-dimensional model agree closely with the measured gravity field.

The gravity low over Beluga Basin along the northwest-southeast profiles B-B' has been vertically tied into the 10,717 ft (3,215 m) Pan American Chuit St. #1 well on the western side of Cook Inlet Basin (fig. 10). This subsurface well information provided some basement constraints during modeling. The Beluga low is interpreted to be caused mainly by 5,000-ft.-thick (1,500 m) section of low-density Tertiary sediments contrasting with a higher density pre-Tertiary basement. This gravity minimum coincides in part with the area of low gradient magnetic pattern noted by Grantz, Zietz, and Andreasen (1963). High gravity gradients along the southeastern flank of the Elongate gravity ridge correlate well with a recognized magnetic signature, the Moquawkie contact. These gradients are interpreted to delineate the Bruin Bay fault zone and the western boundary of the Cook Inlet Basin. High Bouguer values and high-amplitude magnetic anomalies occur over the Mesozoic rocks along the extreme western portion of the Cook Inlet region.

Profile C-C' depicts an east-west cross section from the middle of Cook Inlet Basin to the Chigmit Mountain front (fig. 11). The Bruin Bay fault bounding the Cook Inlet Basin was assumed to be a high-angle reverse fault with 5,000 ft (1,500 m) of throw toward the east. Based upon available surface data, reconnaissance aeromagnetic information, and the Shell Kustatan River #1 well which terminated at 6,715 ft (1,915 m) in Jurassic volcanics, the Tertiary section is believed to be thicker than 10,000 ft (3,000 m) in the extreme eastern portion of the profile line.

The theoretical model computed from the southeast-northeast gravity profile D-D' indicates two thick sedimentary sequences of Tertiary rocks, one centered in the Beluga Basin and the other centered in the Susitna Basin (fig. 12). The abrupt, asymmetrical gravity gradient and gravity maximums are offset to the west of the Yentna-Beluga lineament and suggest that the mass is concentrated in the same direction. The fault bounding the western edge of Susitna Basin was, therefore, inferred to be a high-angle reverse

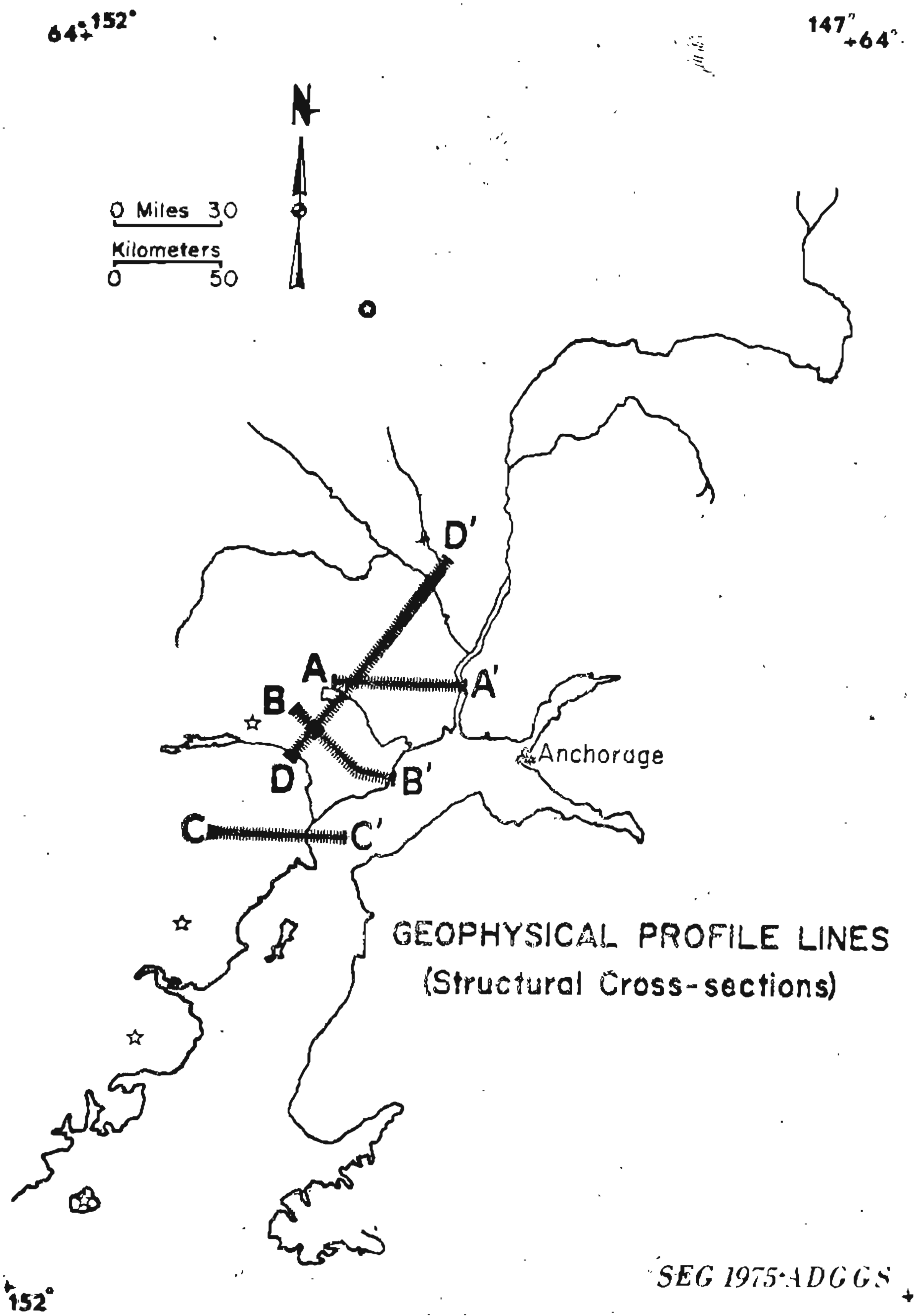


Figure 8. Index map of geophysical profiles and structural cross sections, Cook Inlet region

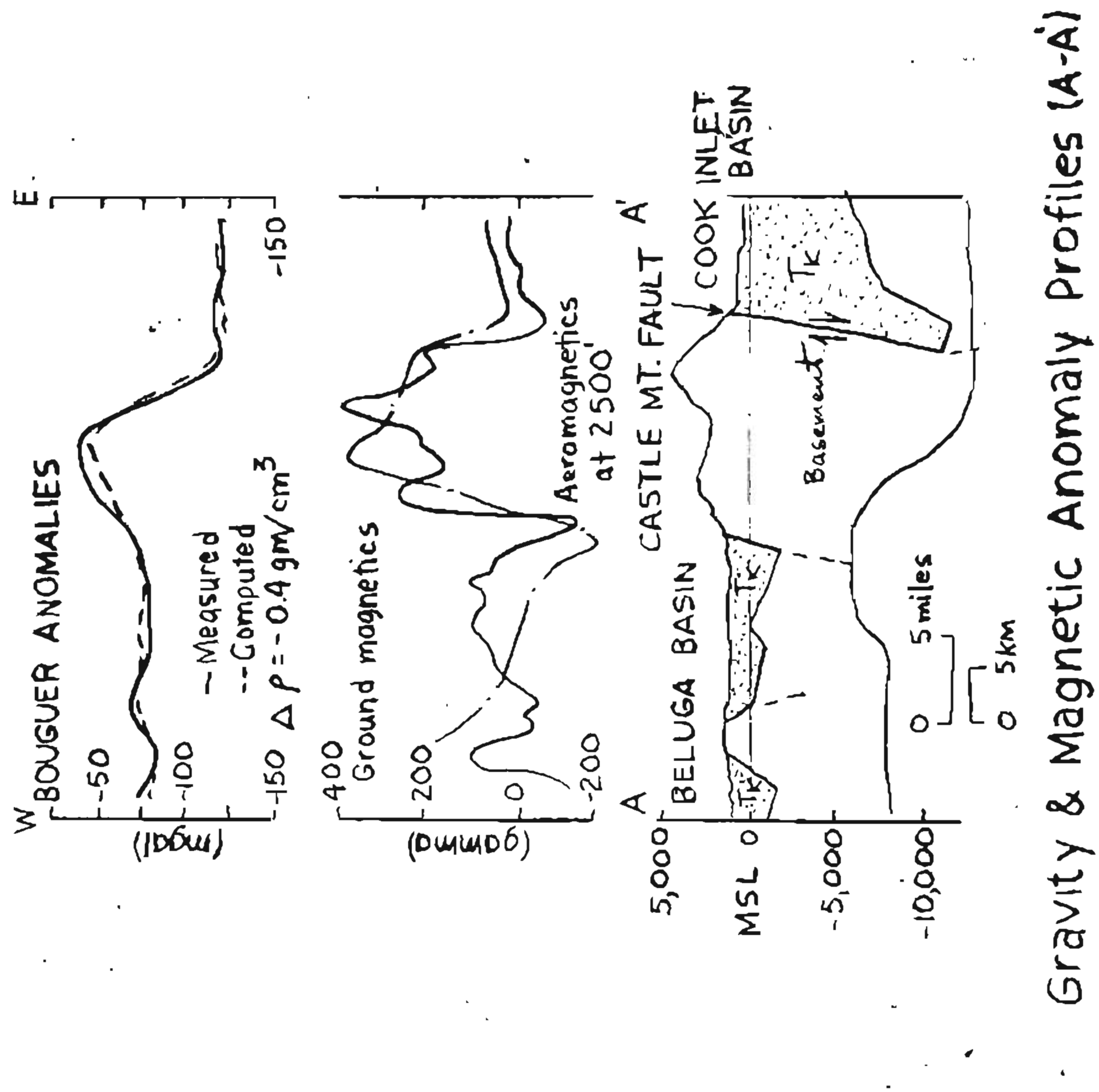


Figure 9. West-east geophysical profiles and structural cross section (A-A')

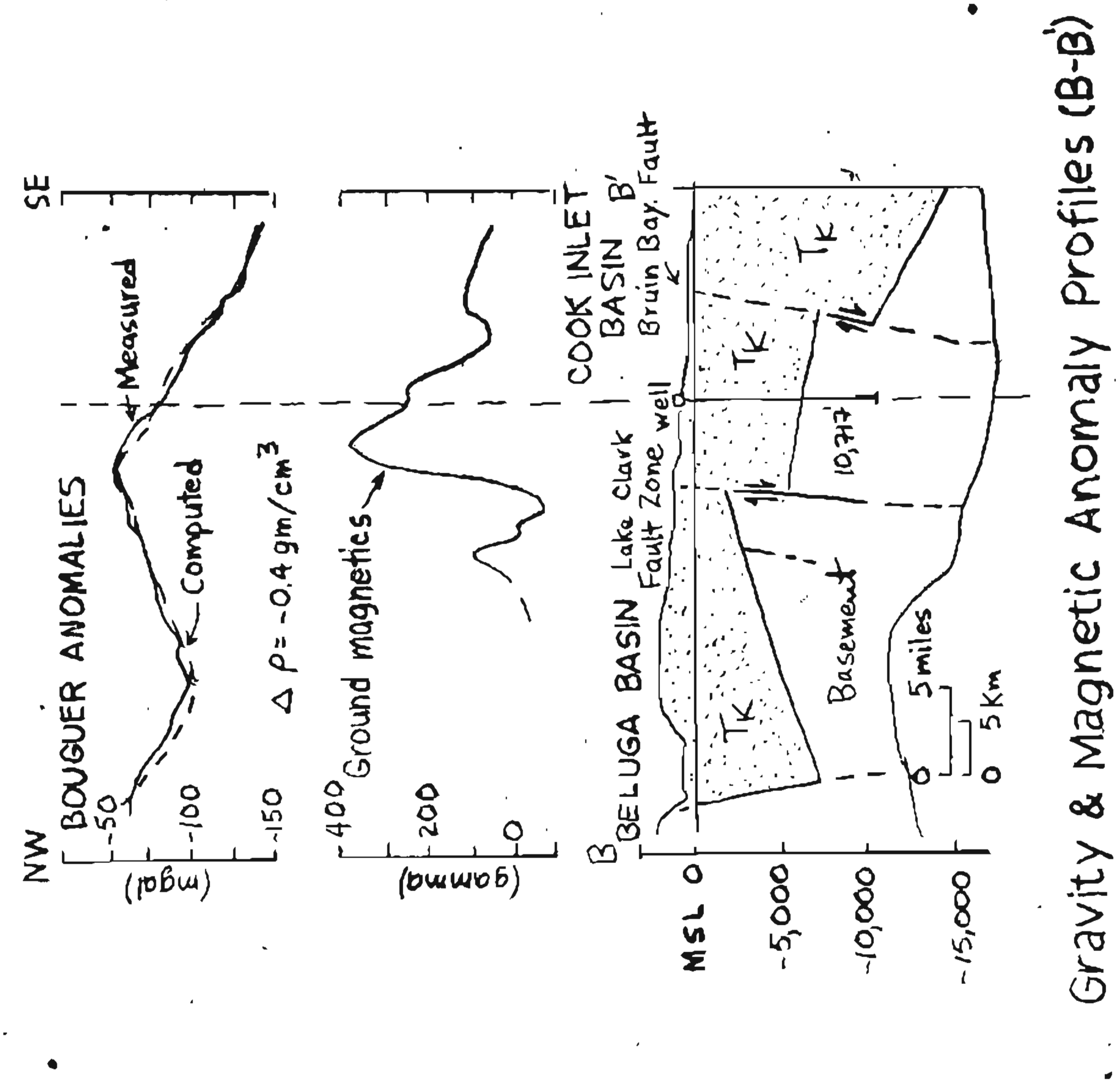


Figure 10. Southeast-northwest geophysical profiles and structural cross section (B-B')

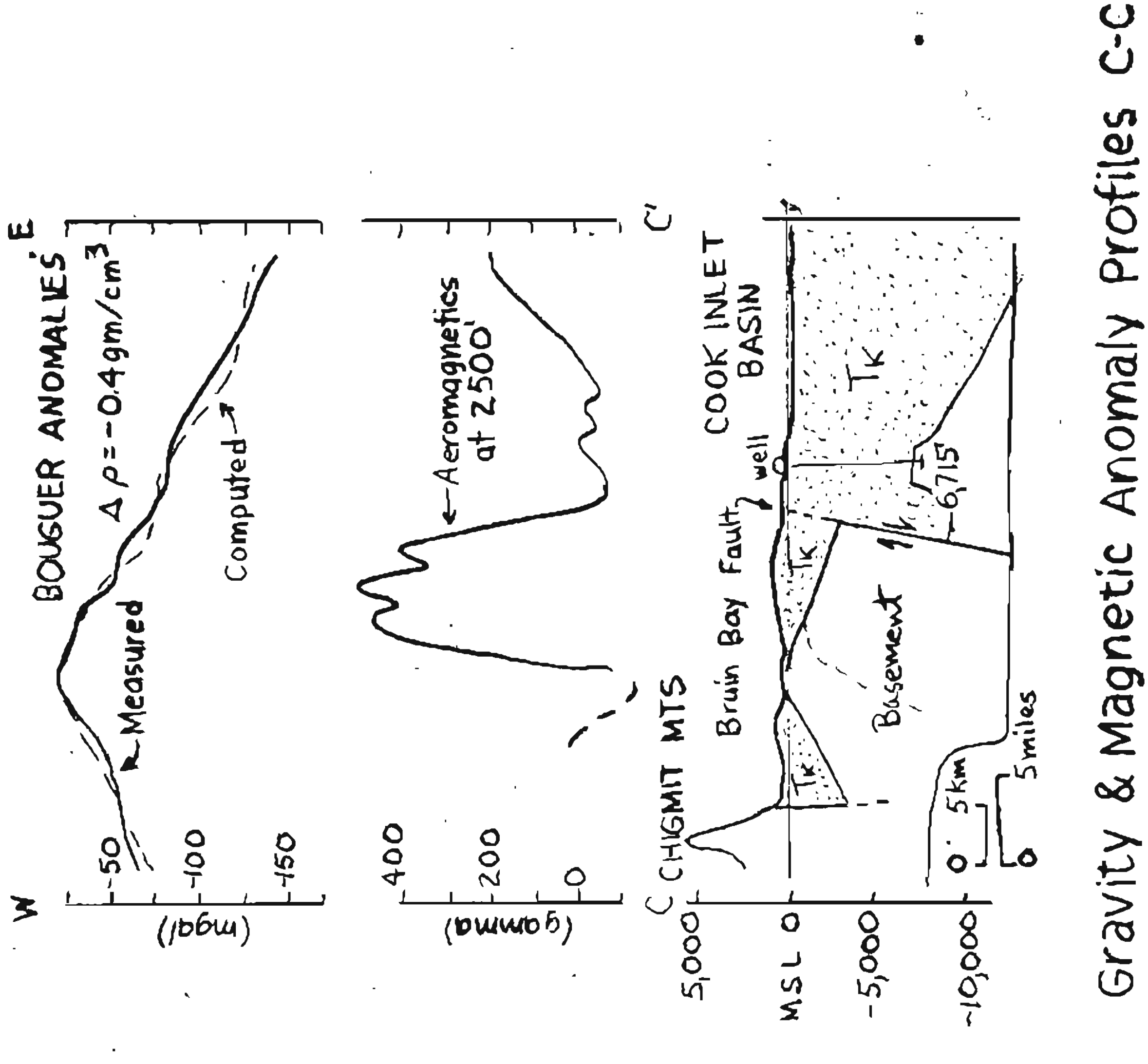


Figure 11. West-east geophysical profiles and structural cross section (C-C')

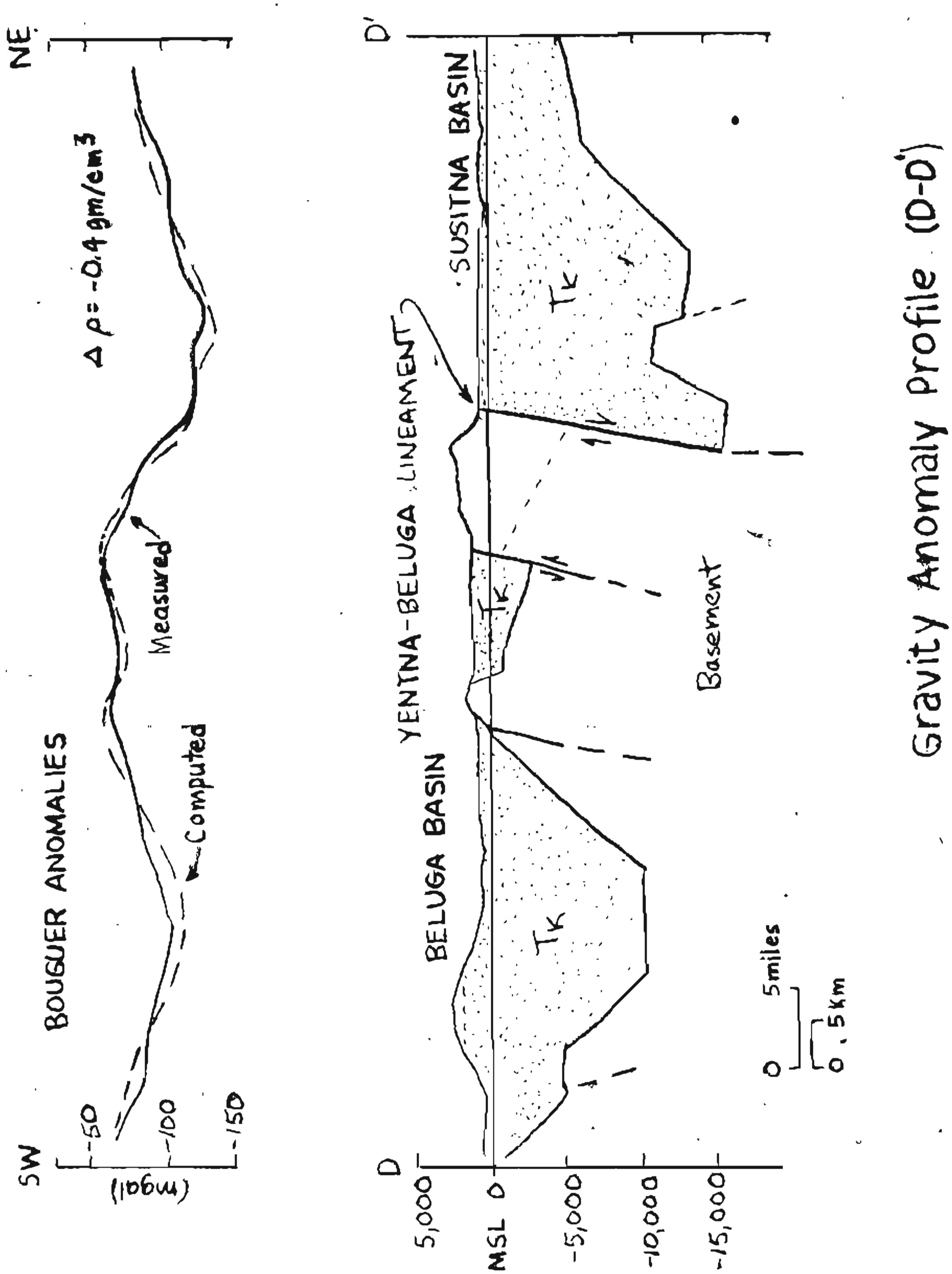


Figure 12. Southwest-northeast geophysical profiles and structural cross section (D-D')

fault. The gravity data implies more than 12,000 ft (3,600 m) of reverse throw for this fault. The pre-Tertiary basement surface in Beluga Basin is believed to slope down 10,000 ft (3,000 m) towards the southeast from the Kitty pluton located in the west-central portion of the basin. Areas of gravity minimums over the Beluga and Susitna basins coincide in part with areas of low-gradient magnetic pattern noted by Grantz, Zietz, and Andreasen (1963). Because of uncertainties relating to density distributions, these four models are considered a gross representation of the actual Tertiary thickness and consequently are very interpretative.

The Aleutian volcanic arc system appears to be composed of relatively short, narrow tectonic blocks having straight trends (fig. 13). These volcanic segments are believed to be seismically independent (West, 1951; Sykes, 1971). Mt. Spurr volcano, just west of Beluga Basin, marks the northern termination of the active Aleutian volcanic arc. Recent hypocenter distribution studies (fig. 14) show that the Benioff zone associated with the Aleutian arc terminates in south-central Alaska. In the Yentna River-Prince William Sound area, there appears to be a break in the subducting Pacific plate which separates two seismically independent blocks (Van Wormer, Davies, and Gedney, 1974). The northern or McKinley Block extends northwest beyond the Denali Fault to the northern edge of the Alasks Range massif and dips more steeply than the adjacent southern Kenai Block (fig. 15). A seismic discontinuity trending along the Yentna River and Beluga Mountain front is postulated to be a hinge zone in the subducting Pacific plate. This seismically defined hinge zone coincides with the Yentna-Beluga lineament. Continuing seismic studies at the Geophysical Institute, University of Alaska, indicate that the subduction zone in the northeastern Aleutian Arc is possibly represented by the Shelikof Strait-Cook Inlet-Susitna River topographic low and has not completely been offshore in the trench east of Kodiak Island. The continental material between the Mesozoic abyssal plain (Chugach-Kenai Mountains) and the subduction zone (Aleutian Trench) has been hypothesized to be a "raft" of material riding on the Pacific plate. Van Wormer and others (1974) speculate that the great 1964 earthquake, a shallow thrust mechanism (e.g., Plafker, 1969), was a result of the Pacific plate "underthrusting" the continental material of the Kenai Block.

STRUCTURAL FEATURES - TECTONIC ELEMENTS

The newly compiled geological maps by Helen Beikman (1974) and current information from USGS and DGGS personnel (fig. 16) make it possible to objectively redefine the major lithological units of south-central Alaska in more detail than heretofore possible and on a more objective basis. There is also now enough detail concerning known and inferred faults, fault blocks, and folded structures to permit relatively close delineation of major structural features in Cook Inlet region (fig. 17). Figures 16 and 17 are the author's generalized structural syntheses based on currently available geological and geophysical data from state and federal government agencies and industry.

Generalized regional structural trends and major tectonic elements in south-central Alaska were first delineated by Payne (1955) (fig. 18), who recognized that this area is dominated by five narrow, parallel, and arcuate tectonic features developed in Mesozoic time. A subparallel trough (Shelikof Trough) was superimposed upon these areas in early Cenozoic time. The pre-

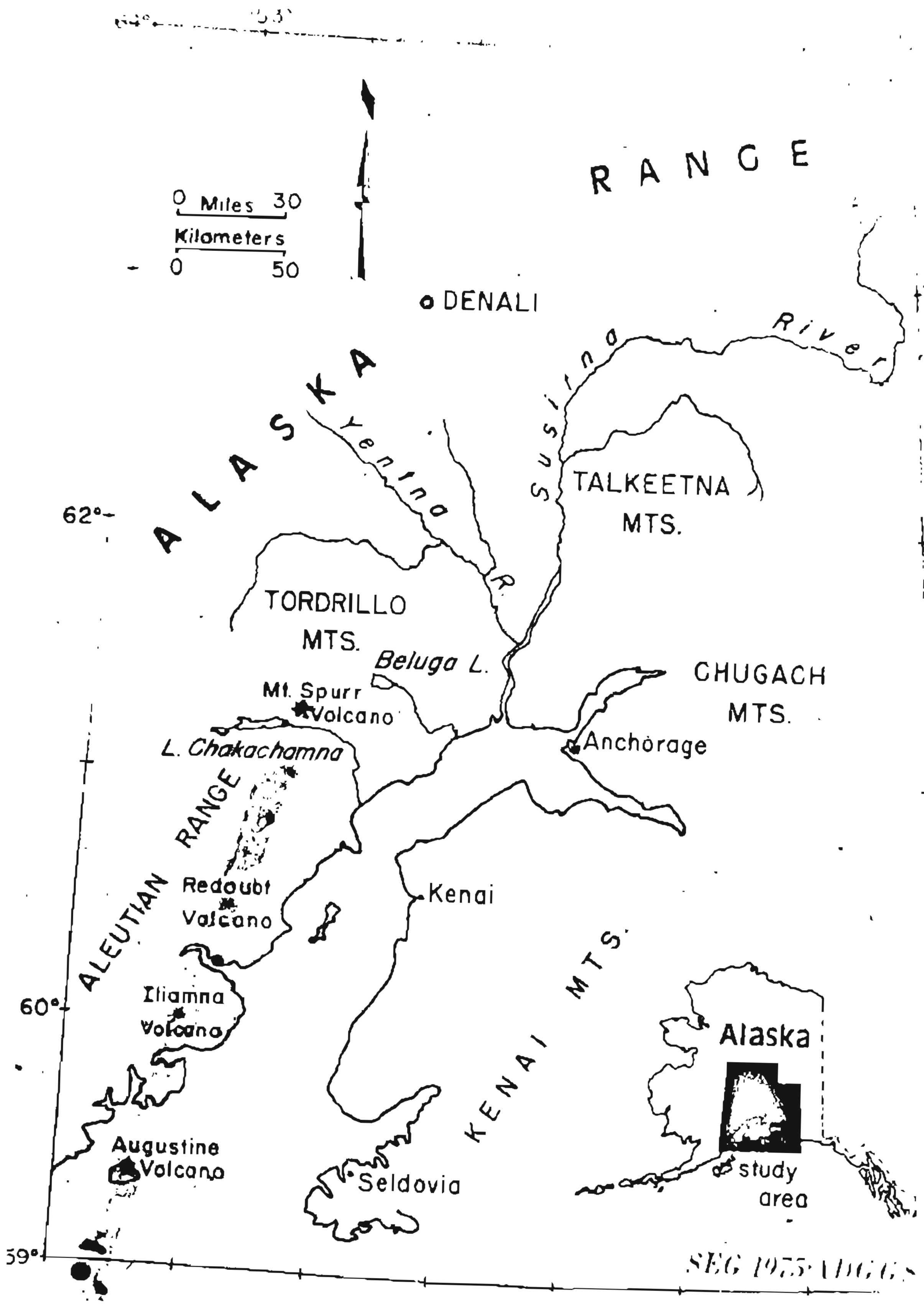


Figure 13. Alignment and trend of the northern Aleutian volcanic arc

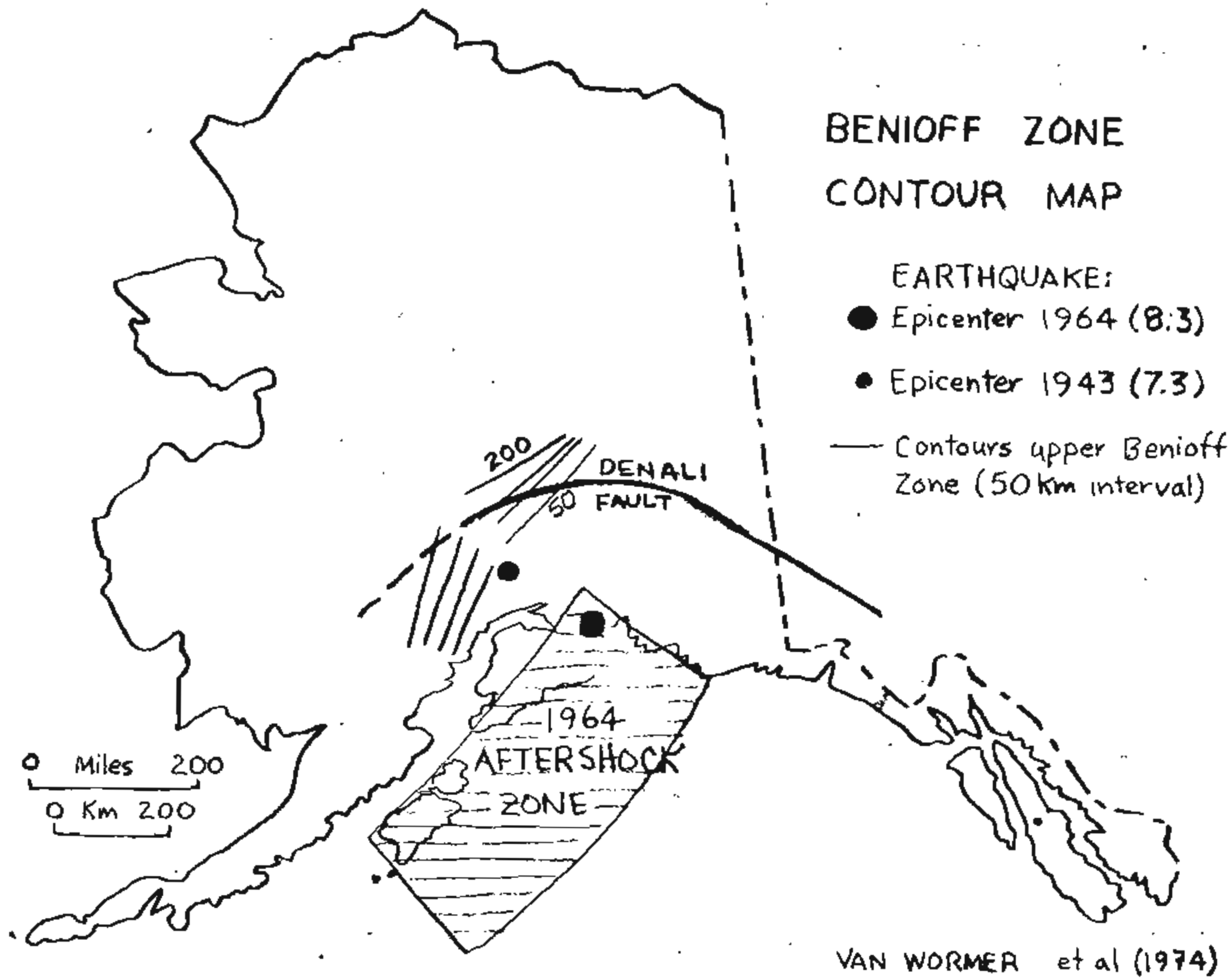


Figure 14. Earthquake hypocenter distribution studies (Benioff zone-major earthquake epicenters)

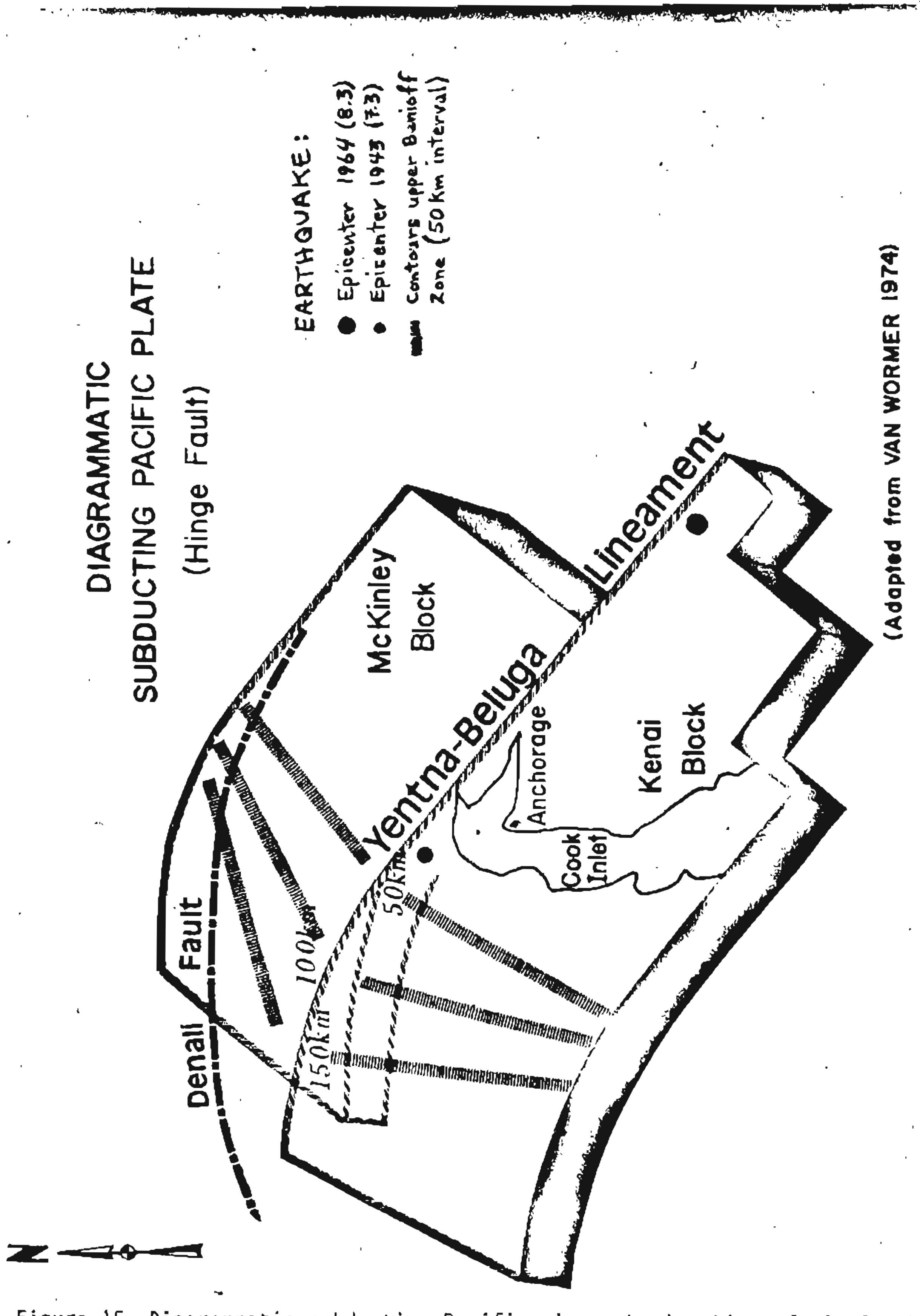
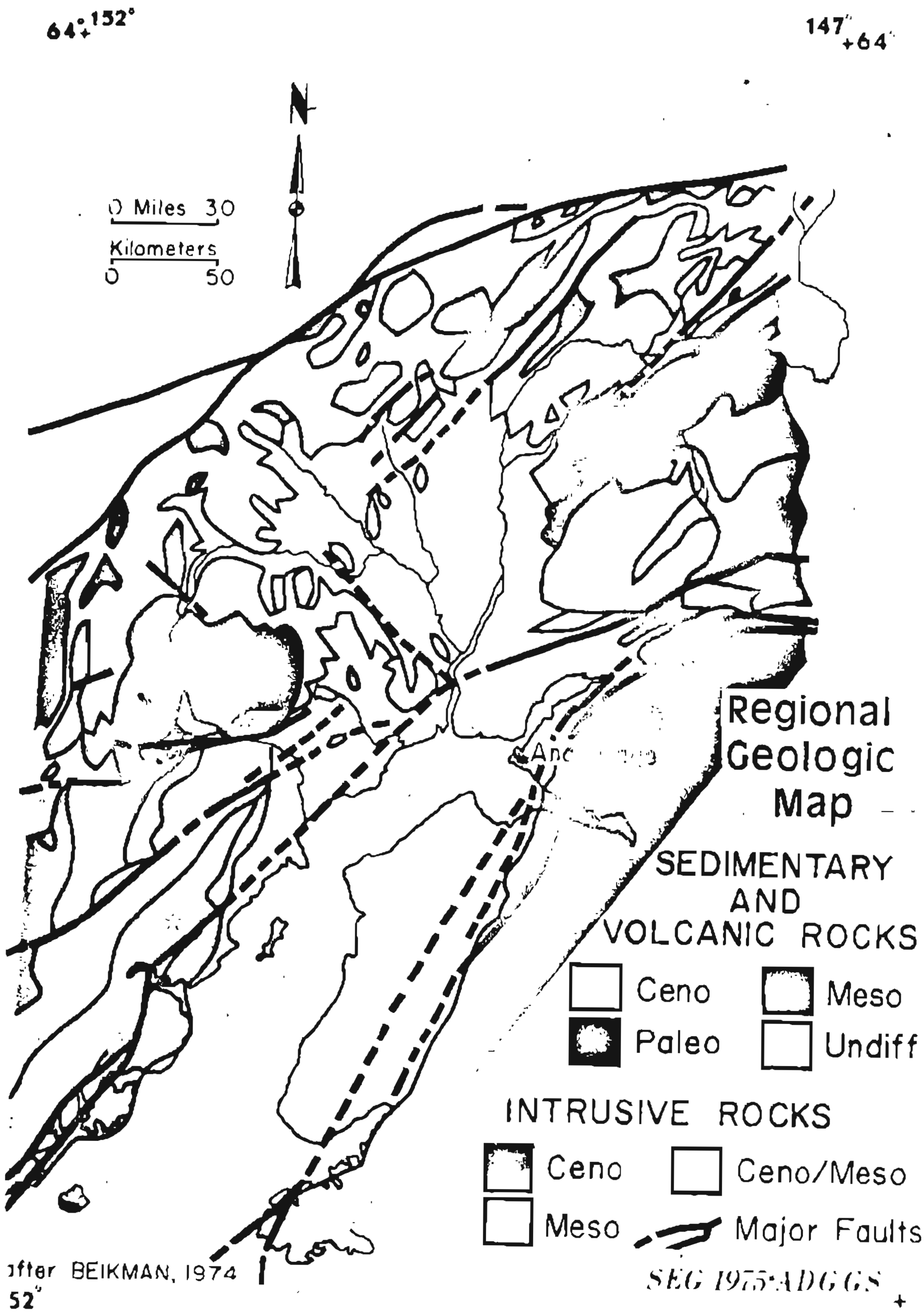


Figure 15. Diagrammatic subducting Pacific plate showing hinge fault in the upper Cook Inlet region



.Figure 16. Generalized geologic map of the Cook Inlet region, south-central Alaska (after H. Beikman, 1974)

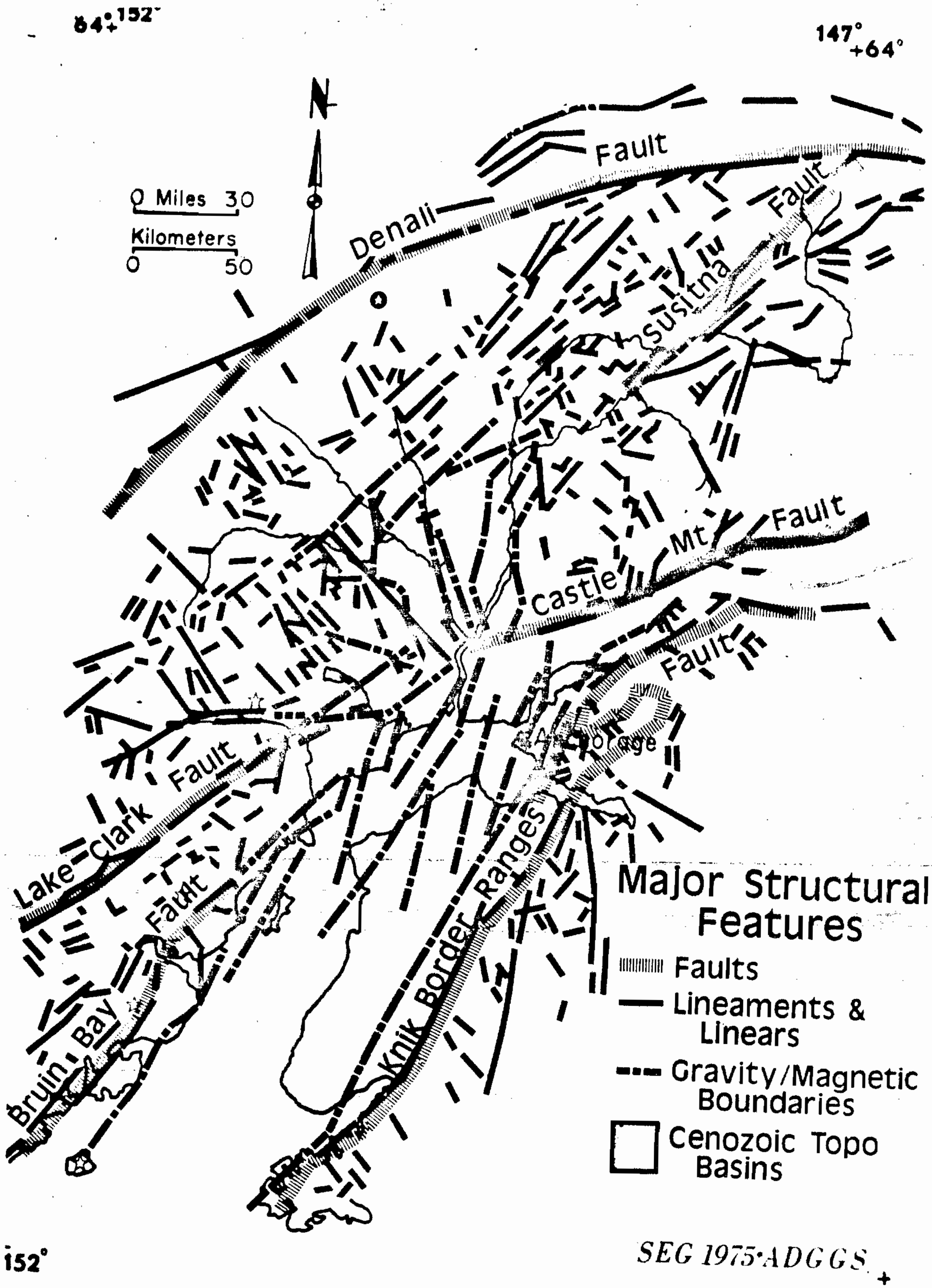


Figure 17. Major structural features from geological and geophysical data, Cook Inlet

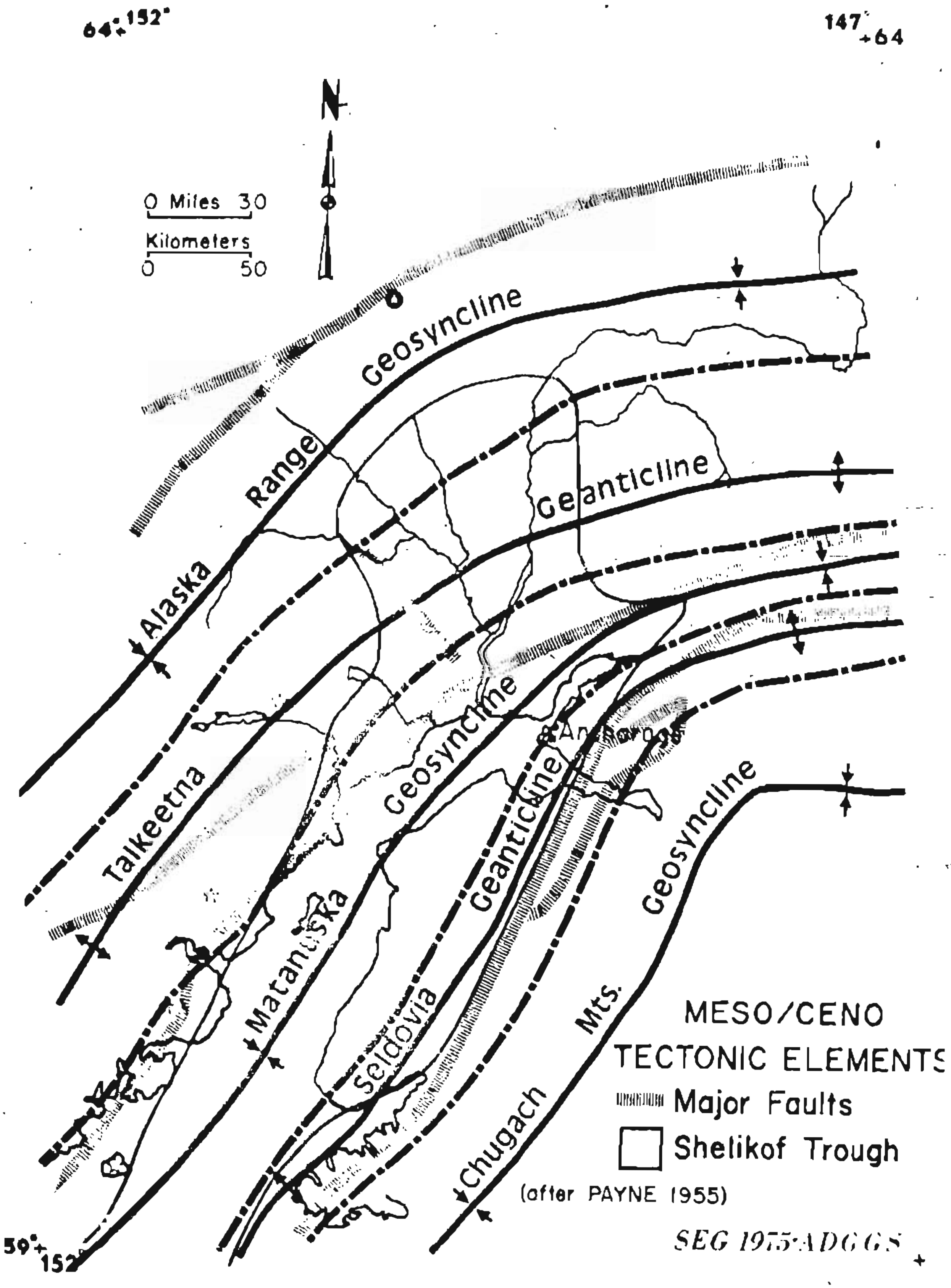


Figure 18. Mesozoic and Cenozoic tectonic elements in the Cook Inlet region, Alaska (after Payne, 1955)

dominant strike of geologic contacts and major faults and folds throughout western south-central Alaska seemingly either parallel or cut obliquely across these Mesozoic and Cenozoic tectonic elements. Formational contacts are often locally offset by large northwestward dipping reverse faults, e.g., the Castle Mountain-Lake Clark fault and Bruin Bay fault systems adjacent and oblique to the Talkeetna geanticline (fig. 19).

Gates and Gryc (1963) noted that the Cenozoic features (Shelikof Trough) are apparently superimposed on all the older tectonic elements and their shapes are probably not controlled by the older elements. Deflections of gravity contours and magnetic patterns within the Beluga Basin and adjacent areas reveal major structural features that probably are indications of crustal configurations which existed prior to or just preceding Tertiary deposition (fig. 20). The arcuate Talkeetna geanticline, a sequence of Jurassic plutonic, volcanic, and marine sedimentary rocks, appears to be offset by transform faults in the Cook Inlet region (figs. 19 and 21). The Mesozoic Talkeetna geanticline is grossly represented by areas of dextrally offset high-Bouguer values.

Analysis of structural features and fault patterns within and adjacent to the Shelikof Trough reveal additional evidence of rotational and translational deformation believed to be caused by an oblique stress field during Late Cretaceous or early Tertiary times (Hackett, unpub.; in press, b; Gedney and others, 1975). The Shelikof Trough is postulated to be a pull-apart structure (figs. 22 and 23) that resulted from rifting along the strike-slip boundary separating the Pacific and North American plates since Late Mesozoic time (Hackett, in press, b). Subsequent rotational and translational block movements have reoriented the Tertiary basins into the positions they occupy today (fig. 7). Rotational movements of other tectonic blocks in Alaska have similarly been postulated by Grantz (1966) and Freeland and Dietz (1973).

In summary, portions of the upper Cenozoic Shelikof Trough are believed outlined by the Bouguer gravity data. Broad negative anomalies reflect the large structural configuration and possible thick sedimentary rock sequences in Tertiary subprovinces (fig. 24). The younger Cook Inlet, Beluga, Susitna, and Yentna Basins appear to be controlled by deep-seated basement blocks and discontinuities.

PETROLEUM AND COAL POTENTIAL

Initial commercial oil production within the Cook Inlet region began in 1957 with the discovery of the Swanson River field (fig. 25). Seven oil fields and six gas fields are currently on production, McArthur River-Trading Bay oil fields and the Kenai gas field being the main producers. Current petroleum production appears to be concentrated in the flanks of the Cook Inlet Basin gravity minimum which is coincident to the Tertiary depocenter axis.

Only one exploration well has been drilled in the northern Susitna Basin area. In 1964 the Union-Texas Kahiltna River State well was drilled to a total depth of 7,265 ft (2,180 m) through 3,500 ft (1,050 m) of Tertiary section. Integrated reconnaissance gravity and magnetic data indicate that greater thicknesses of Tertiary section are found in Susitna Basin, south and southwest of this well. Regional gravity data also indicate that other Tertiary depo-

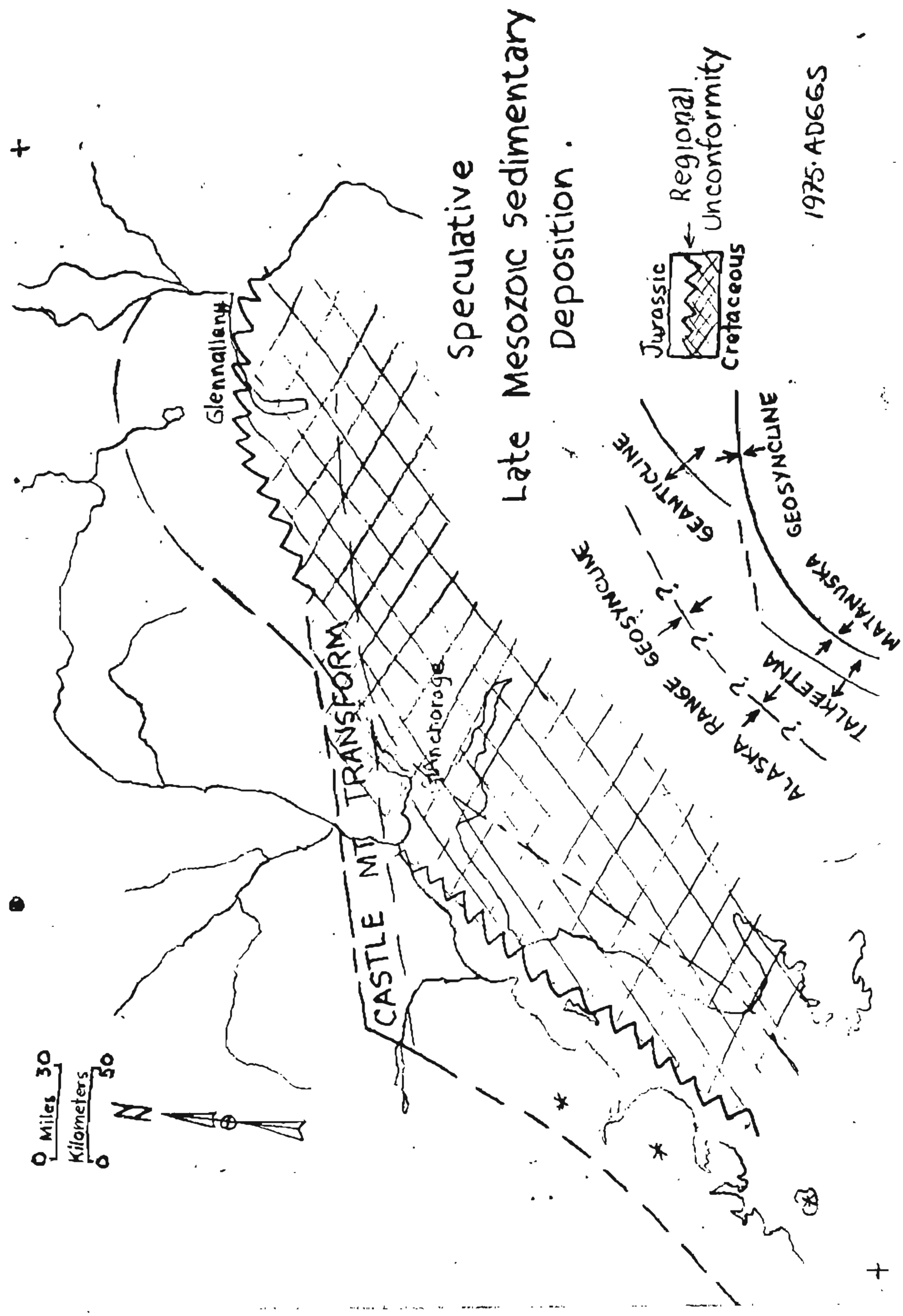


Figure 19. Speculative Late Mesozoic sedimentary deposition in south-central Alaska

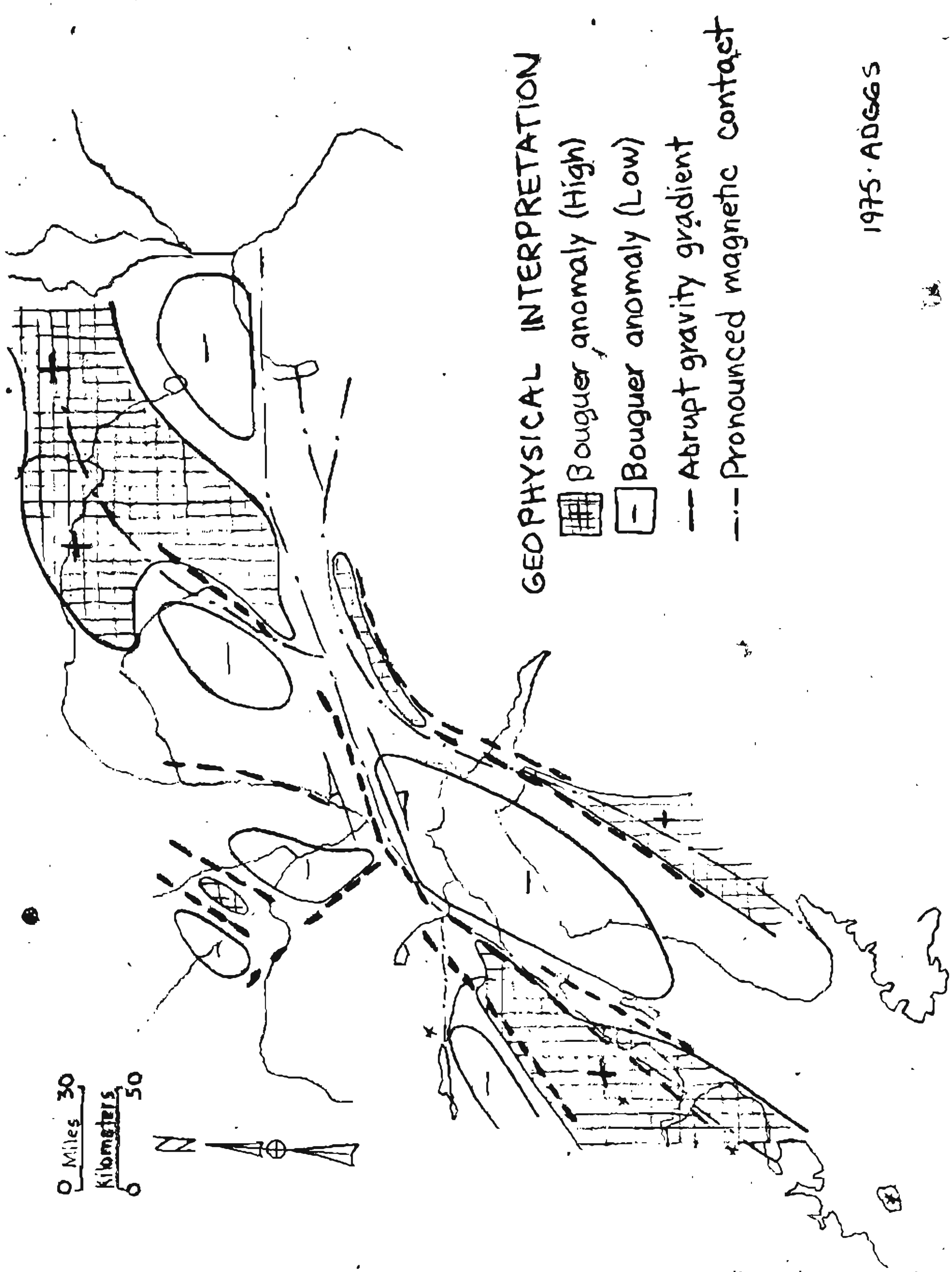


Figure 20. Geophysical interpretation of regional gravity and magnetic data, south-central Alaska

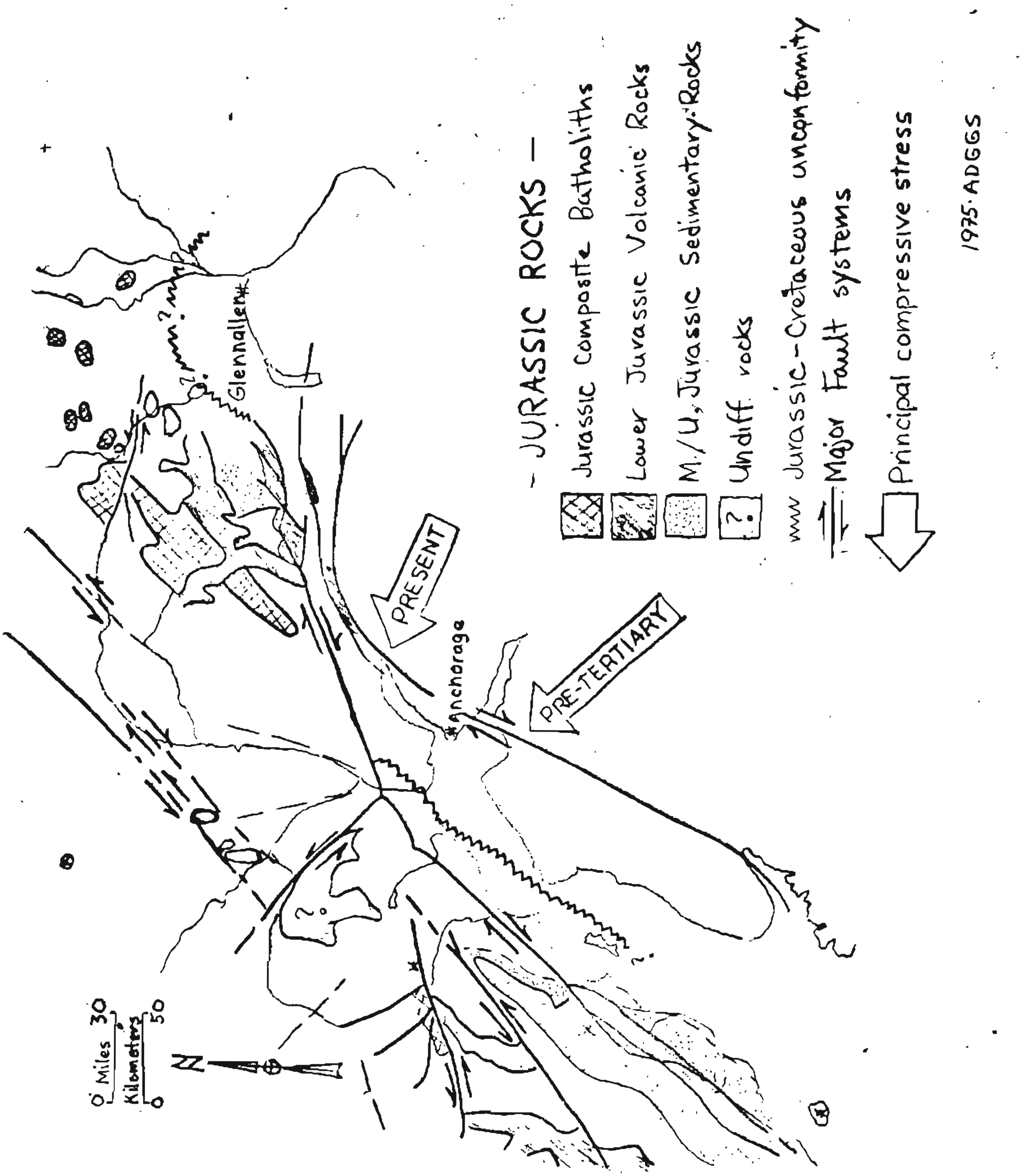


Figure 21. Outcrop map of Jurassic rocks, south-central Alaska

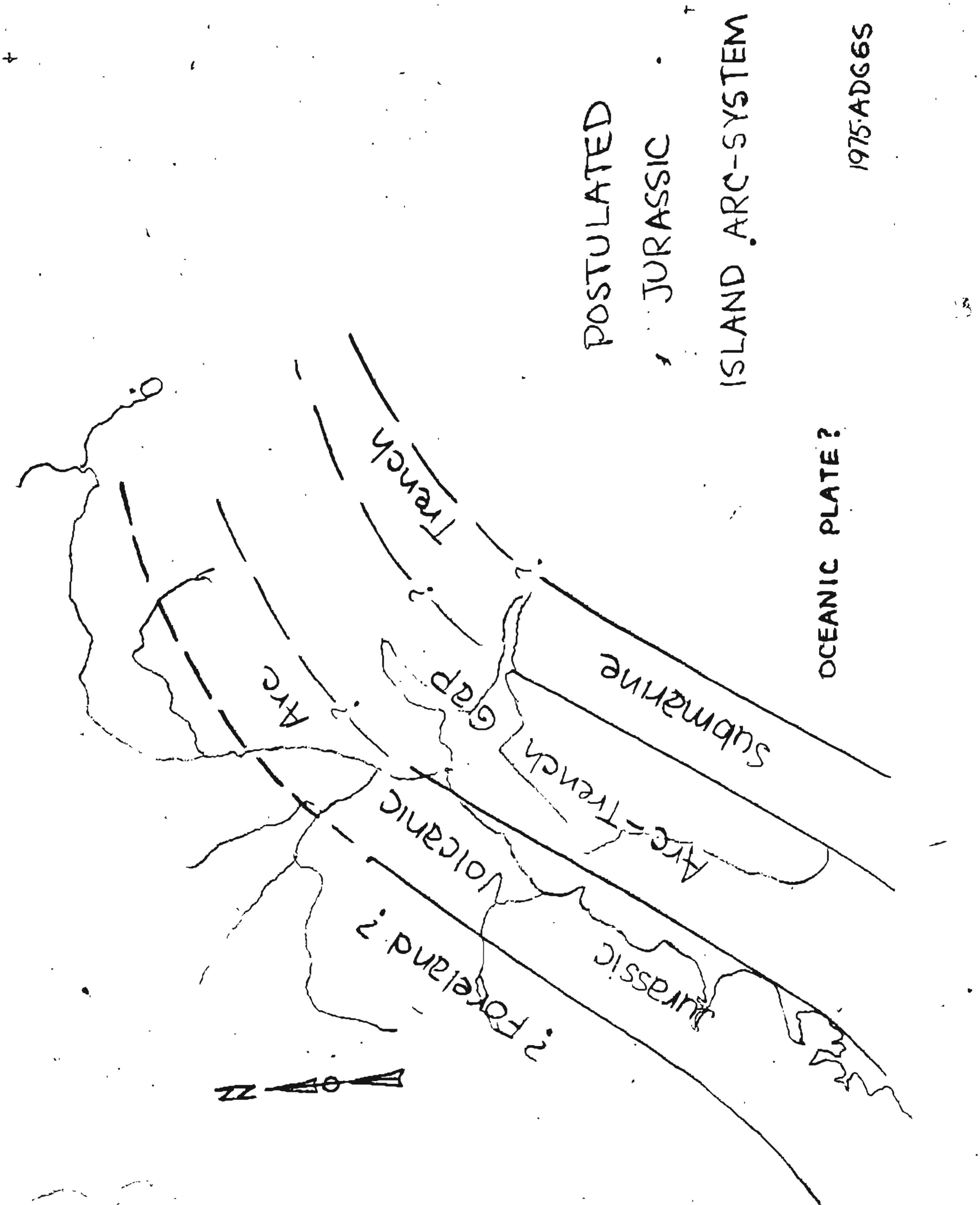


Figure 22. Reconstructed Jurassic island arc system, south-central Alaska

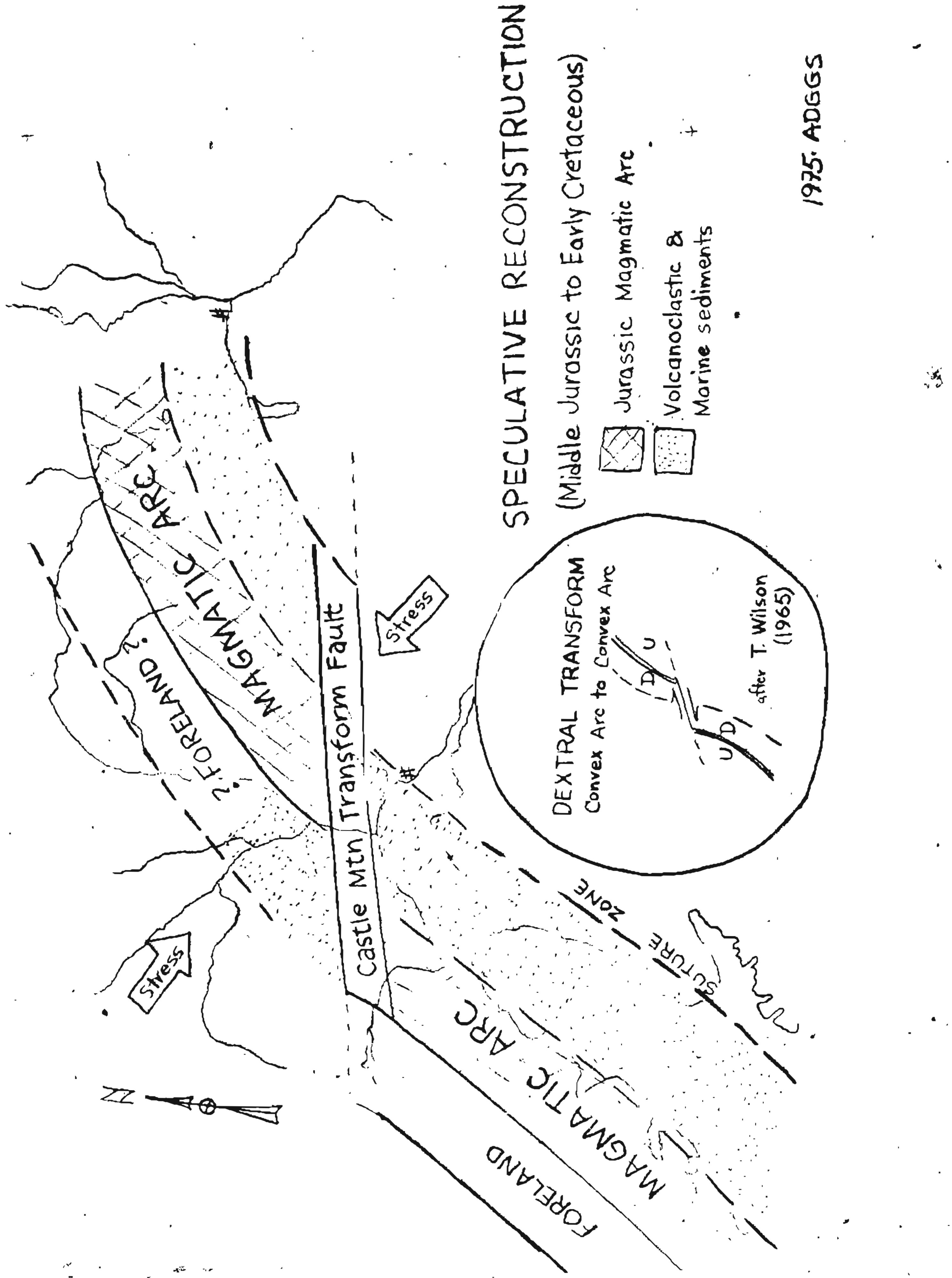


Figure 23. Speculative Mesozoic tectonic reconstruction, south-central Alaska

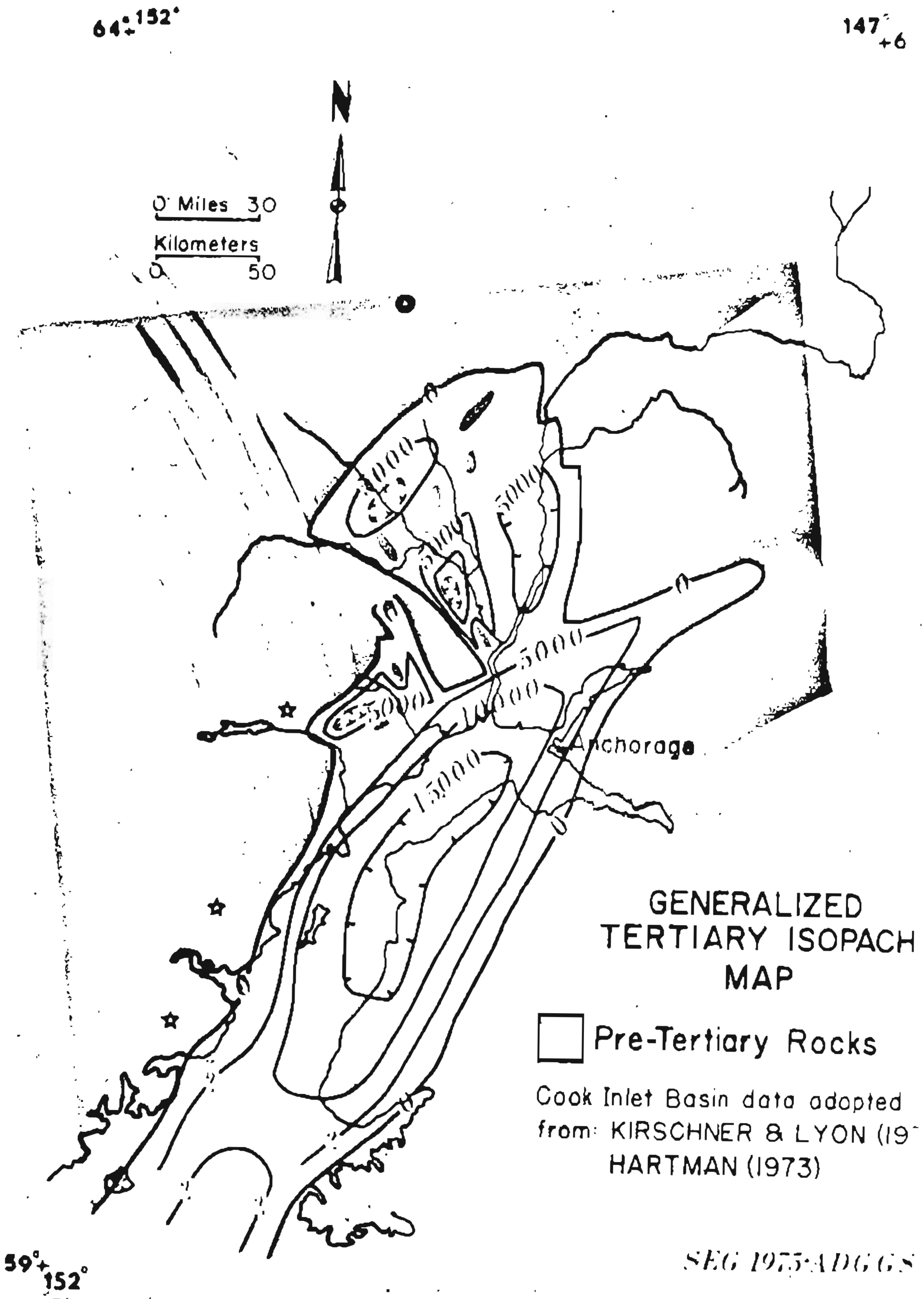


Figure 24. Generalized Tertiary isopachous contour map, Cook Inlet region

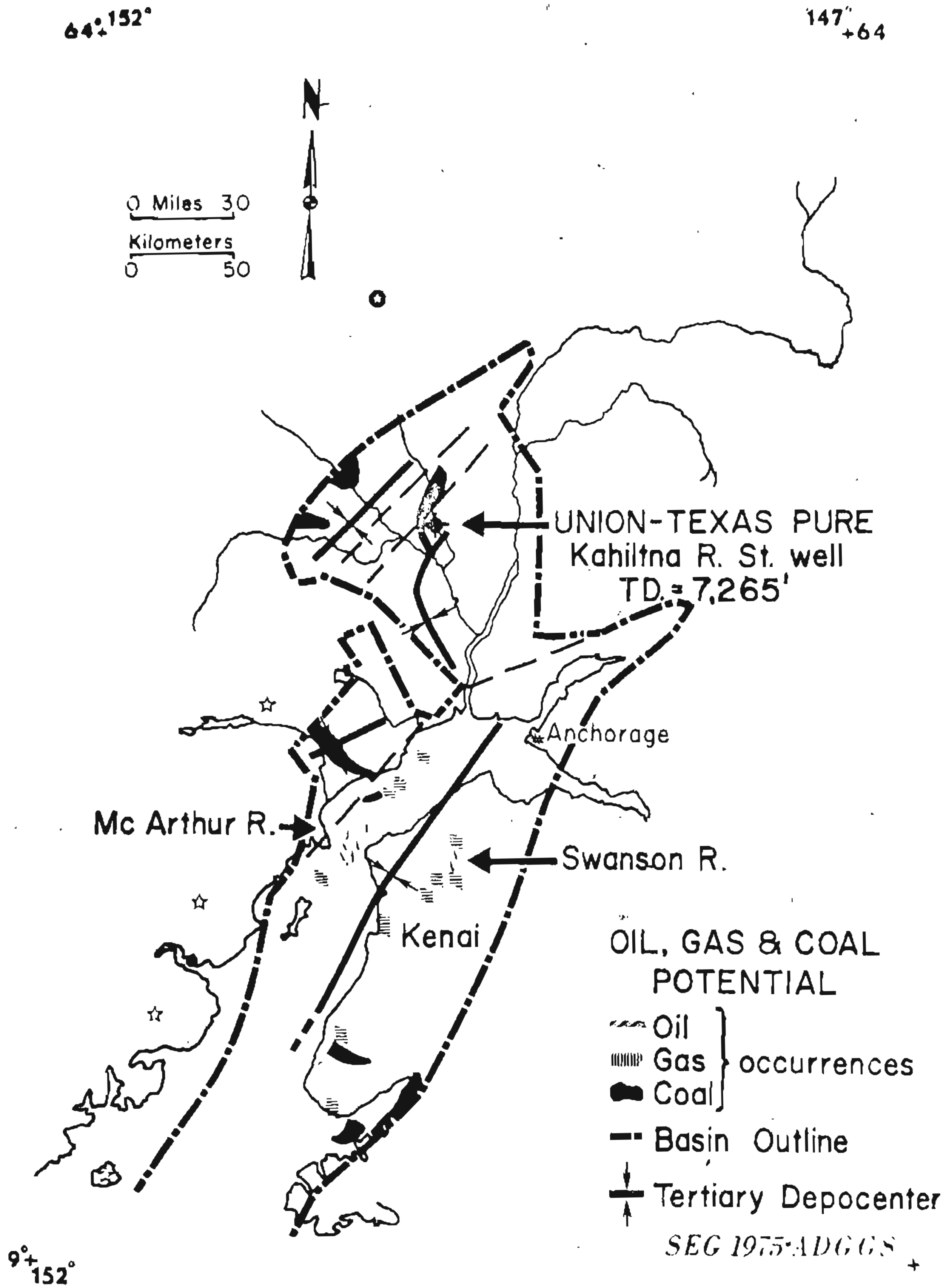


Figure 25. Oil, gas, and coal resource potential in Cook Inlet region, Alaska

centers defined by gravity lows are present in the Yentna and Beluga Basins. No exploration wells to date have tested these inferred Tertiary depocenter areas in the Cook Inlet region.

Barnes (1966) estimated that coal-bearing rocks underlie at least 3,500 mi^2 (9,100 km^2) of the northern Cook Inlet lowlands. High potential reserves include the 600-mi^2 (,1560-km^2) Beluga Basin and adjacent areas, where subbituminous coal seams up to 30 feet thick are exposed. Other potentially coal-rich areas include the flanks of the Yentna, Susitna, and Cook Inlet Basins where Tertiary coal-bearing beds are flat lying, at shallow depths, and exposed.

Mineral Potential

A wide variety of metallic minerals occur in lode, placer, and disseminated deposits in the mountains and foothills enclosing the upper Shelikof Trough (fig. 26). Major production to date has been from the Willow Creek, Chulitna-Yentna, Peters Creek, and Knik areas and the Kenai Peninsula. Extensive unexplored areas include portions of the Talkeetna Mountains, the Alaska-Aleutian Range, and the Chugach-Kenai Mountains. Maps by Cobb (1972) and Clark and others (1974) show known metallic occurrences and generally outline the metal provinces in south-central Alaska. Elongate belts and local mineralized areas are prevalent and can be grossly related to the regional gravity trends in this region (table 1).

Table 1

Mineralization	Geologic feature	Regional gravity trend
(Cu, Au, Ag, Cr, Pt)	Lineaments, transcurrent and transform faults	Steep gravity gradients
(Au, Ag, Cu, Zn, Pb, Po, W)	Intrusive bodies	Large localized gravity lows and high
(Cr, Ni)	Ultramafic rocks	Narrow linear gravity highs
(Fe, Cu)	Axis and flanks of Mesozoic geosynclines or geanticlines (metavolcanics and metasediments)	Broad elongate gravity lows and highs

Known mineralization and inferred metallic potential has been grossly categorized (fig. 26) to simplify relating potential metal provinces and regional gravity trends.

Uranium Potential

Recent studies and compilation by Eakins (1975) indicate that the Cook Inlet Region is a potential uranium resource area (fig. 27). The granitic rocks of the Alaska-Aleutian Range batholithic complex become progressively more acidic with decreasing age (Reed and Lanphere, 1972). The most favorable

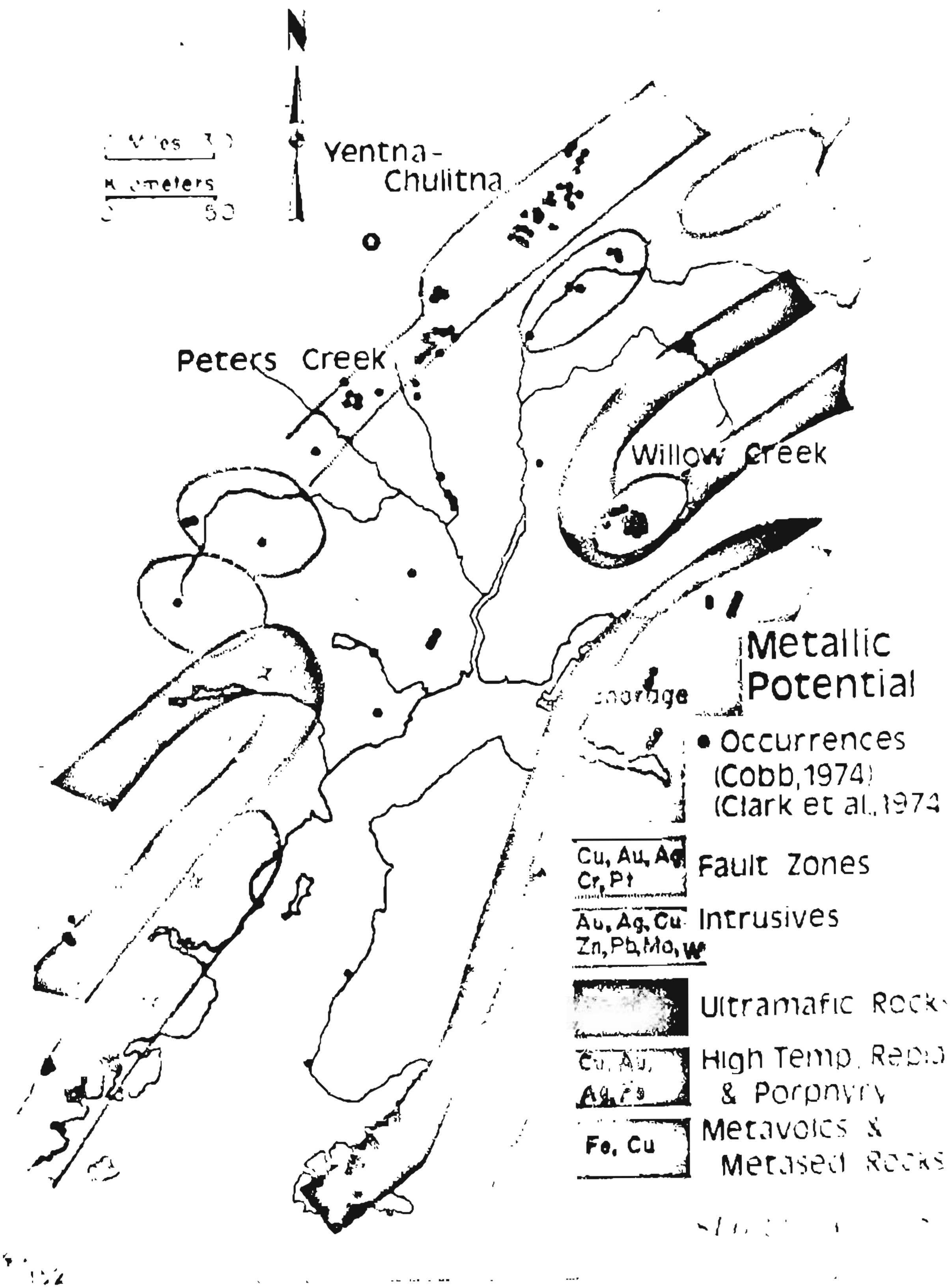


Figure 26. Metallic mineral resource potential in Cook Inlet region, Alaska

area of the complex for uranium probably is the Cretaceous and Tertiary plutons which are adjacent to the Cook Inlet and Susitna Lowlands. Reports of sedimentary uranium occurrences in the upper Shelikof Trough have been noted by Eakins (1975) in the Beluga, Susitna, and Yentna areas. Areas suggested for possible uranium exploration in the Cook Inlet region are: 1) nonmarine Tertiary and Jurassic sedimentary rocks underlying the Cook Inlet region, 2) late-stage granitic rocks in the northern Aleutian and southern Alaska Range, and 3) felsic plutons with associated vein and disseminated uranium deposits in the Chigmit and Talkeetna Mountains. The regional gravity anomaly map (fig. 6) outlines the configuration of Tertiary basins which are adjacent to numerous acidic plutonic rocks and could be favorable environments for sedimentary uranium deposits.

Geothermal Potential

Mt. Spurr, the most northerly active volcano in the Aleutian chain, marks the termination of a line of active volcano vents (fig. 28) that stretch 2,500 miles (4,000 kilometers) along the Aleutian Islands and Alaska Peninsula. Spurr, Redoubt, Iliamna, and Augustine volcanoes are areas having a high potential for geothermal energy as well as for environmental hazards. Potential geothermal targets in Alaska have been recently outlined by Forbes and others (1975) and include both surface and subsurface resources. Both of these general geothermal targets are available along the northern end of the active Aleutian volcanic arc adjacent to the Cook Inlet waters. Thermal hot springs and deep-seated thermal centers commonly are 1) adjacent to Quaternary volcanics, 2) associated with Tertiary granitic plutons, 3) in zones which may be involved in transform fault systems, 4) present in zones of high heat flow, and 5) in lakes within volcano vents. Cenozoic and Mesozoic sedimentary rocks, which occur adjacent to active volcanoes, for example the Tertiary clastics just southeast of Mt. Spurr, contain permeable rock units and may provide good geothermal reservoirs. Relative increases in the concentration of alkalies, siliceous, calcareous, and associated geothermal deposits may cause local high Bouguer anomalies. Deep fault zones defined by steep gravity gradients may locally be zones of high heat flow.

SUMMARY

The recently acquired and compiled gravity data should assist in reevaluating the petroleum, coal, metallic mineral, uranium, and possible geothermal resource potential of the Beluga Basin and adjacent areas and should provide a basis for future detailed geophysical and geological investigations. This regional geophysical synthesis and interpretation is offered in the hope that it will further our understanding of the tectonic history of south-central Alaska and spur new exploration activity and scientific interest in the Cook Inlet region.

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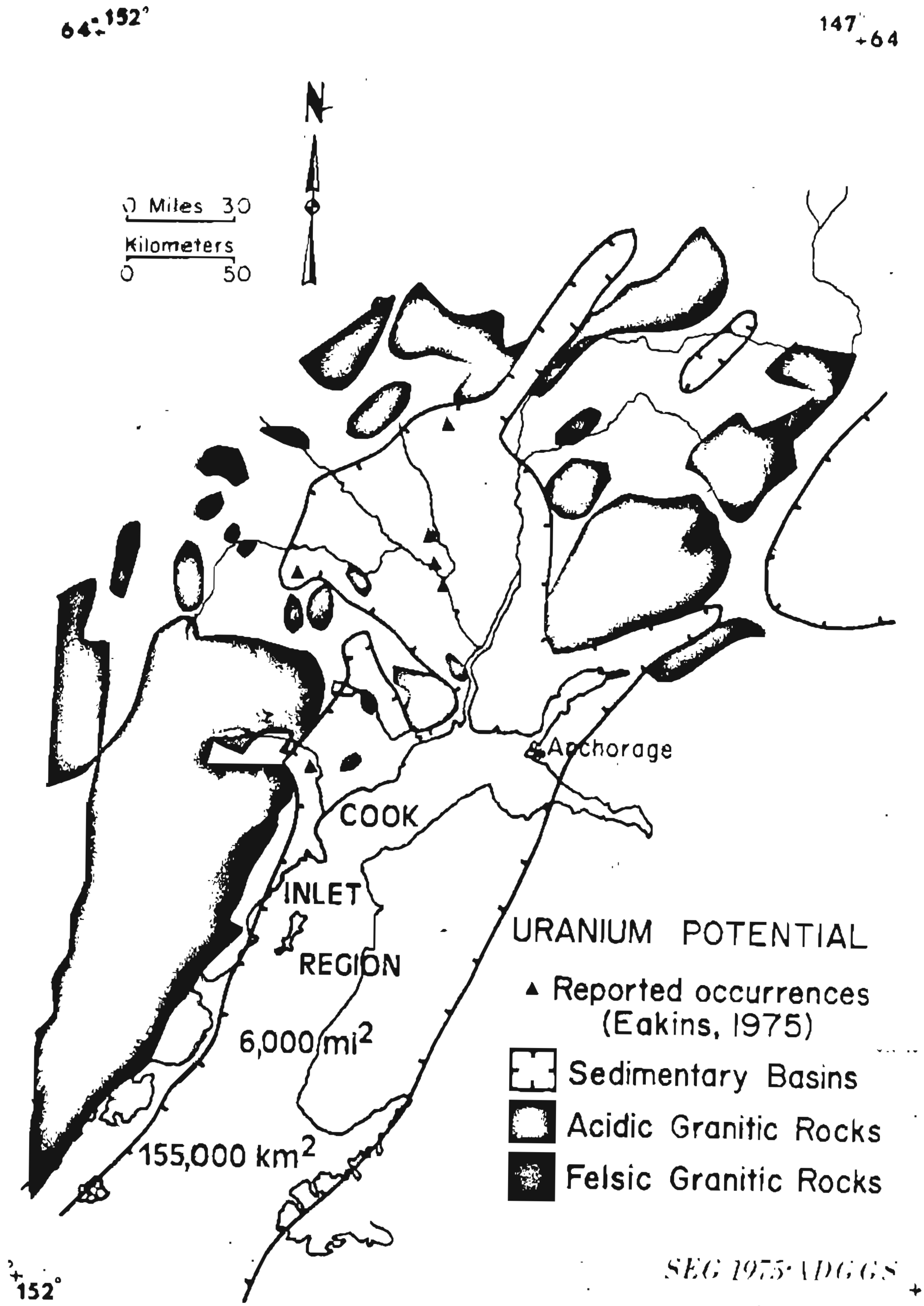

Figure 27. Uranium resource potential in Cook Inlet region, Alaska

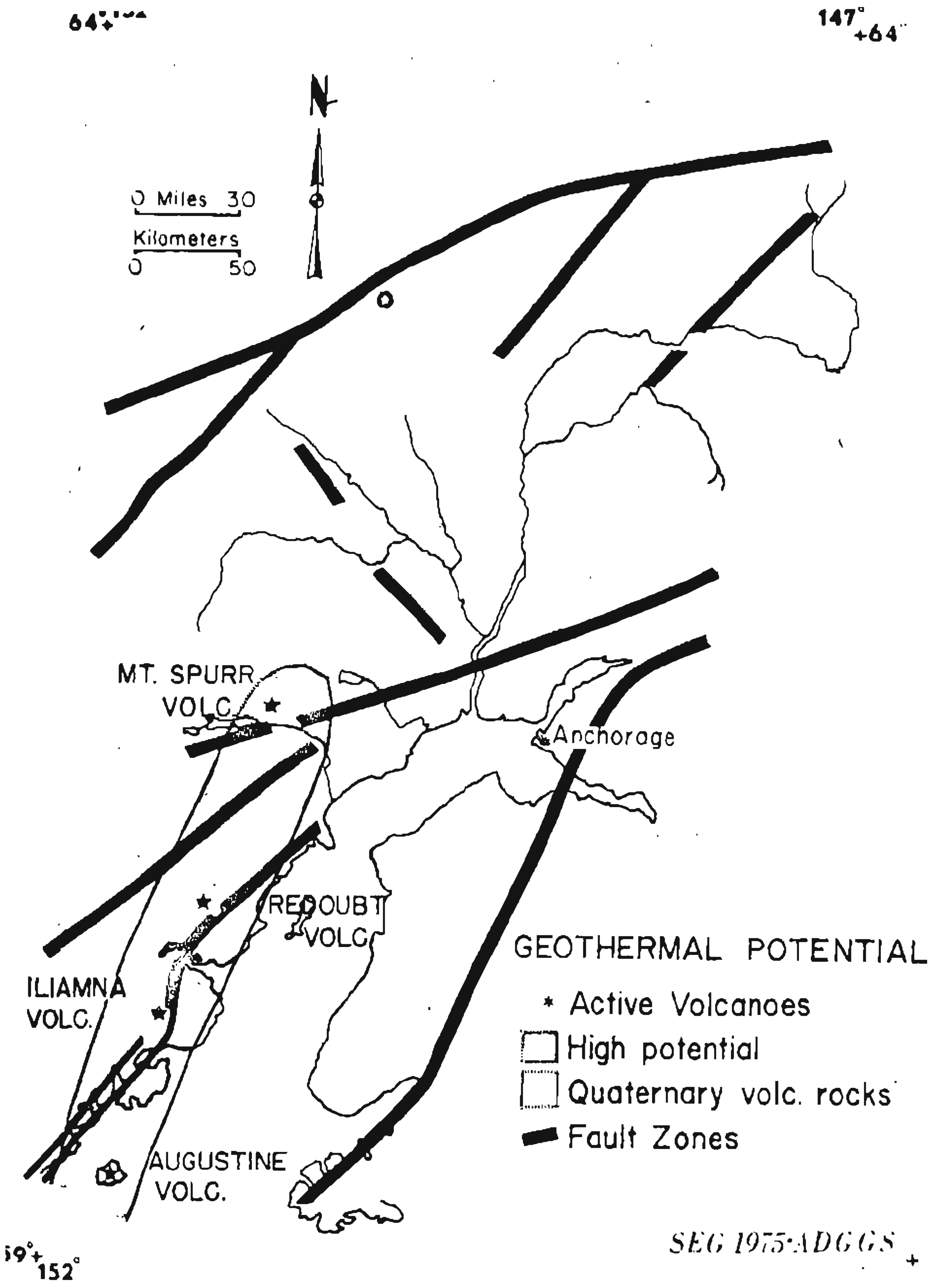

Figure 28. Geothermal resource potential in Cook Inlet region, Alaska

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