Analysis of the Tanana basin, Alaska for state sale 37, July 1982

Waller, S.F., Forrest, G.S., Pierini, W.J., and Amoco Oil Co.

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Amoco Production Company
Denver Region
Far West Division

AREA TANANA BASIN

STATE ALASKA

COUNTY _____

SUBJECT ANALYSIS OF THE TANANA BASIN, ALASKA FOR STATE SALE 37, JULY 1982

GEOLOGIC REPORT No. FW-11-82R

Date SEPTEMBER 1982

By STEVEN F. WALLER, GARY S. FORREST, WILLIAM J. PIERINI

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September, 1982

Far West Division Report FW-11-82R: Analysis of the Tanana Basin, Alaska for State Sale 37

Authors:

Stephen F. Waller (Geology)
Gary Forrest (Geophysics)
Bill Pierini (Land)

INTRODUCTION

This study analyzes the oil and the gas potential of the Middle Tanana Basin. This report was commissioned to prepare Amoco Production Company for Alaska State Sale 37, which was composed of large portions of the western part of the Middle Tanana Basin. Therefore, the geology within this report deals with, and is primarily applicable to, the western half of the basin only. State Sale 37 was the first state sale in the Tanana Basin; the only other leasing that has ever occurred for oil and gas in the Tanana in recent years has been Doyon Corporations leasing of tracts to Shell Oil Corporation in 1980.

Amoco management decided not to attend State Sale 37 in July 1982. The opportunity to lease was rejected primarily on economic grounds. While the geology of the Tanana Basin was favorable, the structures that we were able to define appeared to be too small to be economic. Structures were defined mainly on the basis of gravity surveys, as our seismic coverage was relatively sparse.

CONCLUSIONS

1. The Tanana Basin contains two excellent reservoir horizons, the Lignite Creek formation and the Suntrana formation. These are both clean, coarse, cross-bedded sandstones with porosities ranging from 20 to 30% (See Appendix B, p. 1). These reservoir sands range up to 1,800 feet thick.

2. The Tanana Basin contains numerous gas and condensate source rock intervals throughout the Tertiary Coal-Bearing Group. Most of these source rocks are thermally immature at the surface, and are rated very good to excellent source rocks (See Appendix C).

3. The Sanctuary formation, a lacustrine deposit, is the most significant source rock interval. The Sanctuary formation, lies close to the base of the Tertiary section, and was probably buried 12,000 to 20,000 feet deep. It is in an ideal position to source the overlying reservoirs. Computer subsidence models indicate that the entire Sanctuary formation would have generated prior to the Recent, and probably after the final seal in the Tertiary section was deposited.

4. While the Sanctuary formation has been analyzed to be a gas and a condensate source, it is possible that it is actually an oil source. This is hypothesized because the Sanctuary formation is an extensive, varved lacustrine deposit, and because the samples that were sent to the lab were weathered. The weathering may have selectively leached the amorphous kerogens.

5. The uppermost formation in the Tertiary coal-bearing group, the Grubstake formation, has some laterally extensive shale beds up to 90 feet thick. These should form effective seals, and were deposited prior to generation from the Sanctuary formation. Unfortunately, we do not know exactly how extensive these shales are as we only see them in a few outcrops in the south of the basin.

6. The Nenana Gravel, which overlies the coal-bearing group, has excellent porosity. However, the gravel is not prospective as it has no overlying seal.

7. There is extensive structural development in the Tanana Basin, but this is confined mainly to faulting.

8. The subsurface structure in the Tanana Basin can be predicted by analyzing the structural trends around the basin, and combining this knowledge with gravity and seismic data. In the subsurface of the western Tanana Basin, folds appear to be oriented east-northeast to west-southwest, normal faults appear to be oriented northwest to southeast, and strike-slip faults, such as the Minto Flats Graben fault, are oriented northeast to southwest.

9. The dominant structural feature in the western Tanana Basin is the Minto Flats Graben or Sub-basin. This basin is bounded by what appears to be right lateral strike-slip faults. The Minto Flats area probably formed by progressive pull-apart of the original graben. This resulted in block faulting throughout the main Minto Flats Sub-basin. This block faulting can be seen in the seismic lines that were shot across the graben (east-west), and it may also be seen on gravity. The localized high between the Minto Flats Graben and a smaller gravity low to the southwest, is probably a horst.

10. What appear to be smooth folds on the gravity, or noses of anticlines, are probably step-like, block-faulted areas. These block faults may result in good traps, but will be harder to define than would a simple anticline. Most of these structures are too small to be prospective at this time. However, the areas to the northeast and southwest of the large elongate horst bordering the west side of the Minto Flats Graben may be prospective (T2S, R11W and T5S, R12W). Although a dry hole has been drilled at the top of this horst, the dry hole did not penetrate the silty shales of the Grubstake formation. The Grubstake formation should be the seal to any traps in the area, so this interval in the Tanana Basin has not really been tested until a well has drilled below this seal.

11. There appear to be buried foothills on the south end of line TA-5. The top of these foothills may be the Oligocene unconformity. These hills are probably lithologically similar to the immature basal fill of the Healy Creek formation, because they are at the base of the section.

RECOMMENDATIONS

The following recommendations may be used as an initial guide to exploration provided that Amoco wishes to renew exploration efforts in the Tanana Basin.

1. That Amoco field check and measure sections in the Grubstake formation, to see whether the mudstones and shales may be correlated across the south of the basin. This may prove whether or not they are laterally extensive.

2. That Amoco drill a shallow core in the Usibelli Mine area, in the Sanctuary formation. By obtaining a truly unweathered piece of the Sanctuary shale, we may be

able to determine whether it is an oil source rock or not.

3. That Amoco shoot some seismic over the northeast and southwest ends of the major horst bounding the western side of the Minto Flats Graben.

4. Contingent upon the favorable returns of the aforementioned program in Recommendation 3, that we make minimum bids on these areas, northeast and southwest of the horst.

BIBLIOGRAPHY

Brooks, A. H., 1911, The Mt. McKinley Region, Alaska, With Descriptions of the Igneous Rock and of the Bonnifield and Kentitinia Districts, by L. M. Prindle: United States Geological Survey Professional Paper 70, 234 p.

Buffler, R. T., and Triplehorn, D. M., 1975, Depositional Environments of Continental Tertiary Deposits, Central Alaska. In: Miller, T. P. (Ed.), Recent and and Ancient Sedimentary Environments in Alaska: Proceedings of the 1975 Alaska Geological Society Symposium, Anchorage, Alaska, p. H1-H10.

Butzer, K. W., 1971, Recent History of an Ethopian Delta: University of Chicago, Department of Geography Research Paper No. 136, pp. 1-160.

Capps, S. R., 1912, the Bonnifield Region, Alaska: United States Geological Survey Bulletin 501, 64 p.

Capps, S. R., 1932, the Eastern Portion of Mt. McKinley National Park, In: Smith, P. S., and others, Mineral Resources of Alaska, Report on Progress of Investigations in 1930: United States Geological Survey Bulletin 836, pp. 219-300.

Capps, S. R., 1940, Geology of the Alaska Railroad Region: United States Geological Survey Bulletin 907, 201 p.

Chapman, R. M., and Yeend, W. E., 1972, Preliminary Geologic Map of the Northeastern Part of the Tanana Quadrangle, Alaska: United States Geological Survey, 1-p.

Foster, H. L., Weber, F. R., Forbes, R. B., and Brabb, E. E., 1973, Regional Geology of Yukon-Tanana Uplift, Alaska. In: Pitcher, M. G. (Ed.), Arctic Geology: American Association of Petroleum Geologists Memoir 19, p. 388-395.

Henstridge, D. A., and Missen, D. D., 1982, Geology of Oil-Shale Deposits within the Narrows Graben, Queensland, Australia: American Association of Petroleum Geologists Bulletin Vol. 66, pp. 719-731.

Holm, B., 1973, Bedrock Geology and Mineralization of the Mount Prindle Area, Yukon-Tanana Upland, Alaska: Unpub. M.S. Thesis, University of Alaska, Fairbanks, 55 pp.

Lalechos, N., and Savoyate, E., 1977, La Sédimentation Néogène Dans Le Fossé Nord Egéen: The Sixth Colloquium of the Geology of the Aegean Region, Athens, Vol. 2, pp.591-603.

Martin, G. C., 1919, the Nenana Coal Field, Alaska: United States Geological Survey Bulletin 664, 54 p.

Martin, G. C., 1921, The Supposed Petroleum Seepage in the Nenana Coal Field. In: Brooks, A. H. (Ed.), Mineral Resources of Alaska: United States Geological Survey Bulletin 739, pp. 137-148.

Mertie, J. B., Jr., 1937, The Yukon-Tanana Region, Alaska: United States Geological Survey Bulletin 872, 276 p.

Péwé, T. L., 1955, Evidence for Possible Marine Teritary Sediments in Central Alaska: United States Geological Survey Geological Notes for 1955, pp. 2222-2225.

Péwé, T. L., 1958, Geology of the Fairbanks (D-2) Quadrangle, Alaska: United States Geological Survey Geological Quadrangle Map D-2.

Péwé, T. L., and Rivard, N. R., 1961, Geology Map and Section of the Fairbanks (D-3) Quadrangle, Alaska: United States Geological Survey, Miscellaneous Geologic Investigations Map I-340.

Péwé, T. L., Wahrhaftig, C., and Weber, F., 1966, Geology Map of the Fairbanks Quadrangle, Alaska: United States Geological Survey Miscellaneous Geological Investigations Map I-455.

Stevens, C. C., 1971, A Provenance Study of the Tertiary in Healy Creek and Lignite Creek Coal Basin, Nenana Coal Field, Alaska: Unpub. M.S. Thesis, University of Alaska, College, Alaska, 122 p.

Sloan, E. G., Shearer, G. B., Eason, J. E., and Almquist C. L., 1979, Reconnaissance Survey for Coal near Farewell, Alaska: United States Geological Survey Open-File Report 79-410, 18 p.

Wahrhaftig, C., 1970, Geologic Map of the Fairbanks A-2 Quadrangle, Alaska: United States Geological Survey Map GQ-808, 1 p.

Wahrhaftig, C., 1970, Geological Map of the Fairbanks A-3 Quadrangle, Alaska: United States Geological Survey Map GQ809, 1 p.

Wahrhaftig, C., 1970, Geological Map of the Fairbanks A-4 Quadrangle, Alaska: United States Geological Survey Map GQ-810, 1 p.

Wahrhaftig, C., 1970, Geological Map of the Fairbanks A-5 Quadrangle, Alaska: United States Geological Survey Map GQ-811.

Wahrhaftig, C., 1970, Geological Map of the Healy D-2 Quadrangle, Alaska: United States Geological Survey Map GQ-804.

Wahrhaftig, C., 1970, Geological Map of the Healy D-3 Quadrangle, Alaska: United States Geological Survey Map GQ-805.

Wahrhaftig, C., 1970, Geological Map of the Healy D-4 Quadrangle, Alaska: United States Geological Survey Map GQ-806.

Wahrhaftig, C., 1970, Geological Map of the Healy D-5 Quadrangle, Alaska: United States Geological Survey Map GQ-807.

Wahrhaftig, C., and Birman, J. H., 1954, Stripping-Coal Deposits on Lower Lignite Creek, Nenana Coal Field, Alaska: United States Geological Survey Circular 310, 11 p.

Wahrhaftig, C., and Hickcox, C. A., 1955, Geology and Coal Deposits, Jarvis Creek Coak Field, Alaska: United States Geological Survey Bulletin 989-G, pp. 353-367.

Wahrhaftig, C., and Hickcox, C. A., and Freedman, J., 1951, Coal Deposits on Healy and Lignite Creek, Nenana Coal Field, Alaska: In: Barnes, F. F. and Others, Coal Investigations in South Central Alaska, 1944-46: United States Geological Survey Bulletin 963-E, pp. 141-165.

Wahrhaftig, C., Wolfe, J. A., Leopold, E. B., and Lanphere, M. A., 1969, The Coal-Bearing Group in the Nenana Coal Field, Alaska: United States Geological Survey Bulletin 1274-D, 30 p.

Williams, J. R., Péwé, T. L., and Paige, R. A., 1959, Geology of the Fairbanks (D-1) Quadrangle, Alaska: United States Geological Survey Map GQ-124.

Wolfe, J. A., 1972, An Interpretation of Alaskan Tertiary Floras: In: Floristics and Paleofloristics of Asia and Eastern North America, United States Geological Survey, pp.201-233.

Tang Zhi, 1982, Tectonic Features of Oil and Gas Basins in Eastern Part of China: American Association of Petroleum Geologists Bulletin Vol. 66, pp. 509-521.

ENCLOSURES

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Appendix I: Basin Analogs (Waller)
Appendix II: Subsidence Program for the Tanana Basin (Waller)
Appendix III: State Lease Terms of the Sale

Appendix IV: The Petrology of Selected Tertiary and Cretaceous Outcrop Samples of the Minchumina and Middle Tanana Basins, Alaska (Bill Dunn, 1981)

Appendix V: Source Rock Evaluation of the Middle Tanana and Minchumina Basin Outcrops, Alaska (Bob Harwood, 1981)

Appendix VI: Palynological Analysis of Outcrop Samples from the 1981 Alaska Basins Interior Basins Field Program (Bill Baxendale, 1981)

Appendix VII: Source Rock Evaluation of the Sanctuary Formation, Alaska (Bob Harwood, 1982)

TABLES

Table 1: Resumé of Prominent Characteristics of the "Tertiary Coal-Bearing Group" Strata.

Table 2: Resumé of the Interpretations for the "Tertiary Coal-Bearing Group" Strata.

LAND

On August 24, 1982 the Department of Natural Resources for the State of Alaska offered for lease approximately 860,000 acres of land comprising 217 tracts. The size of the tracts varied from 5,760 acres to 640 acres, with an average size of 3,960 acres.

Leases were awarded based upon the highest cash bonus offered for each lease. The terms of the lease include a 12.5% fixed royalty, 30% net fixed profit share, seven (7) year primary term, escalating rentals from $1.00 per acre in the first year, to $3.00 per acre in the fifth and subsequent wells, and an exploration incentive. Credit is in an amount of $250 per foot drilled for the first well on a lease, which will be limited to 30% of well costs and can be transfered to other obligations due the state.

GEOLOGY

The Tanana Basin is a Tertiary intermontane structural and topographic basin that developed between the Yukon-Tanana upland and the Kuskokwim Mountains to the north, and the Alaska Range to the south. The basin is approximately 180 miles long by 72 miles wide at its widest point. The main feature is the northeast to southwest trending Minto Flats Graben, which may be seen on gravity, seismic, and magnetic data. The graben is expressed at the surface as a broad, flat, regional lowlands area directly adjoining the Tanana upland. The basin has one dry hole, the Union Nenana #1, which drilled to 3,027 feet. There were no shows in this well. However, the well only penetrated the uppermost 977 feet of the Tertiary section and entered the section at a depth of 2150 feet.

Stratigraphy

Basement (Pre-Cambrian - Mississippian):

The basement of the Tanana Basin appears to be schist: the Pre-Cambrian Birch Creek Schist outcrops to the north of the basin, and the Mississippian Totatlanika Schist outcrops in the hills south of the basin. The Birch Creek Schist formed the basement in the Union Nenana #1.

The Birch Creek Schist is a light to dark gray, quartz-sericite schist and micaceous quartzite, which weathers reddish brown to tan. The Birch Creek Schist includes chloritic and graphitic schists, anphibolite, impure marbles, and gneisses that have been affected by retrograde metamorphism. The thickness of the Birch Creek Schist is not known.

The Totatlanika Schist is a 4,000 feet thick quartz-microcline-sericite schist. The schist is believed to be Mississippian in age, on the basis of a single Syringopora (Wahrhaftig, 1958, p. 12).

The two schists are very difficult to separate in the field (B. Kemp, 1982, pers. comm.). Schists probably form the cores of almost all of the uplifts or gravity highs in the Tanana Basin.

The Nilkoka Group (Ordovician to Cambrian), and the Tolovana Limestone (Devonian) are present to the north of the basin. These two units appear to have been brought in by a thrust fault, and are not exposed to the south. These units were probably thrust onto the southern Tanana Upland from the north, which may be a result of compression during obduction of the Talkeetna Superterrane. The Nilkoka Group is composed of chert, siliceous shale, grit, and argillite; the Tolovana Limestone is a massive, crystalline, bluish-gray limestone with many calcite veins. Both units appear to be devoid of porosity, and both have gone through too high a state of thermal maturity to be prospective as source rocks.

Coal-Bearing Group (Eocene - Miocene):

The Tertiary Coal-bearing Group unconformably overlies the basement rocks. The Coal-bearing Group is only exposed to the south of the basin and may be divided into 5 different formations. Most of our information comes from the Usibelli Mine area, where the unit is well exposed. The formations were named and described by Wahrhaftig (1969) and they may or may not be exactly correlative to units in the basin. However, the general stratigraphic/sedimentologic sequence should be fairly closely related to what we see in the basin; this conclusion is somewhat reinforced by the good correlation between the only well and the outcrops.

Healy Creek Formation

The basal-most formation is the Healy Creek formation. The Healy Creek formation ranges from 800 to 2,200 feet thick; it appears to thicken and thin as a result of deposition on the topographic highs and lows that were present on the Birch Creek Schist. The Healy Creek formation is a classic basal fill of immature sandstones, claystones and coals. These sediments were deposited in interfingering lenses, and they are poorly sorted and clay rich. The Healy Creek formation is further characterized by rapid lateral facies changes and thickness variations. It was probably deposited as alluvial fan, fluviatile, marsh, and basal lag conglomerate deposits. The porosity is only fair to poor. The Healy Creek formation

is not expected to be prospective, because of the poor sorting and high percentage of clay.

Sanctuary Formation

Overlying the Healy Creek formation is the Sanctuary formation. The Sanctuary formation consists of gray, varved mudstone, claystone and shale, and probably represents a relatively extensive lacustrine deposit. The Sanctuary formation ranges up to 150 feet thick where it is exposed in the south part of the Tanana Basin, and may be correlated over a greater area than can any of the other coal-bearing units.

The percent of organic carbon in the Sanctuary varies randomly from approximately 1.7 (very good) down to 0.9 (fair) (R. Harwood, pers. comm.). However, this organic carbon percent is probably lower than it should be, because the Sanctuary formation was definitely weathered in the samples that were analyzed by Amoco.

The Sanctuary formation is primarily a gas source, with some parts appearing to be a condensate source. However, these results may not be conclusive. The Sanctuary formation is lithologically very similar and has identical source analysis results to lacustrine deposits that Amoco has sampled in outcrop in the Tertiary basins of Montana (Rich Klecker, pers. comm.). These latter source rocks were found by the lab to be condensate and gas sources. However, when Amoco drilled in the center of the Montana basins, these same beds were found to be oil sources. A similar situation may occur in the Tanana Basin.

Suntrana Formation

The Suntrana formation overlies the Sanctuary formation. The Suntrana formation ranges from 1,290 to 500 feet thick, and is predominantly composed of sandstone and coal, with some interbedded claystone (Péwé et al., 1966). The sandstones are moderate to coarse, with gravels at the base. The pebble and heavy mineral assemblages are quite complex, and show a low to medium grade metamorphic source with some granites. The sedimentary source was probably in the Yukon-Tanana Upland (Foster et al., 1973; Stevens, 1971, p. 71). Porosity in the Suntrana formation is very good to excellent, with very high permeability.

The Suntrana sandstones are laterally extensive beds, and were thought by Wahrhaftig to pinch out to the north. However, Wahrhaftig gives no reason for this speculation, and I believe he proposes a pinchout only because the outcrops are absent to the north, where they are covered by the Nenana Gravel and Recent alluvium. A laterally extensive coalbed, which should make a good marker horizon, is present at the top of the section. The Suntrana formation represents fluviatial, flood plain, and marsh deposits. The source of the sands were probably from the north, as the grand vector mean of the paleocurrent (crossbed) measurements is S 18 W. The standard deviation from the grand mean (69°) of the cross-beds suggests a low gradient with some channel meandering (Stevens, 1971, p. 71).

Lignite Creek Formation

Overlying the Suntrana formation is the very similar Lignite Creek formation. The Lignite Creek is 800 to 500 feet thick, and is composed of well-sorted, sub-arkosic sandstone, with some mudshale and coal. The sandstone is buff, contains up to 10% heavy minerals and complex SRF's and MRF's, and is

medium grained to a gravel. Most of the Lignite Creek formation is cross-bedded and is very clean. The fact that the sand is so clean is probably because the source was paleogeographically removed from the locus of sedimentation; the mineralogical immaturity is probably due to a change in source area or rapid transport and deposition of the sediments (Stevens, 1971, p. 75).

A 100 to 200 foot thick mudshale sequence is present at the top of the Lignite Creek formation. This mudshale sequence could serve as a seal, but it's lateral persistence is not well documented.

The Lignite Creek sands are also laterally extensive sands which thicken, and contain less coal, to the north. The Lignite Creek sands represent braided fluviatial, flood plain, and marsh deposits. A grand vector mean of S 09 E indicates a northerly source related to the rejuvenation of the Yukon-Tanana Upland. The Lignite Creek sands appear to be even more prospective than the Suntrana formation sands, because of their excellent porosity, permeability, and lack of argillaceous material throughout the sand interval.

Grubstake Formation

The Grubstake formation overlies the Lignite Creek formation. The Grubstake formation is 1,500 to 600 feet thick. The Grubstake is a "dirty" formation of conglomerate, shale, mudshale, siltstone, sandstone and maybe some coals. The porosity is moderate to poor. The Grubstake is dark gray to green gray and tan, it is carbonaceous, and it is very thinly bedded. There are some extensive shale beds up to 90 feet thick, and a 30 foot thick vitric ash bed at the base. The latter could be a very good marker horizon. The thicker shale sections in the Grubstake formation may serve as a seal to the underlying clean sands.

The Grubstake formation appears to have been deposited in a somewhat restricted basin, and is probably absent from topographic highs to the south. It was deposited in lacustrine and fluviatial environments by north flowing streams.

The Grubstake formation was the only formation penetrated by the Union Nenana #1 well, hence it is not surprising, considering the porosity present, that there were no oil shows in the well. Oil would probably have been kept out of the upper Grubstake section by the lower shale beds sealing off the underlying sands.

Nenana Gravel (Pliocene - Pleistocene):

Unconformably overlying the coal-bearing group is the Nenana Gravel. The gravel is up to 2,000 feet thick in outcrop and may be a bit thicker in the center of the basin. Seismic data appears to indicate that the thickest section of gravel is no more than 3,000 feet thick. The Nenana Gravel is an immature, open-work boulder to a pebble conglomerate with very coarse sandstone; the sediments are buff to red brown, are interbedded with mud flows, and have many clay and lignite lenses. Cross-bedding is present but is difficult to measure or discern in the field, because the unit is so porous and uncompacted. The unit thickens and the pebble size reduces to the north, which indicates a source in the Alaska Range to the south. The Nenana Gravel is comprised of alluvial fan, fluviatial, and flood plain deposits. The porosity is excellent, but the gravel is not prospective, as there are no overlying seals.

Sedimentology of the Coal-Bearing Group

The sedimentologic sequence in faulted Tertiary continental basins has been fairly well established by examining analogs throughout the world (See Appendix I). Analogs to the Minto Flats Graben/Tanana Basin include the Narrows graben in Queensland, Australia, the Gabon Basin in West Africa, the Cabinda Basin in Africa, the Bohai Bay and Subei Bay in China and, to some extent, Cook Inlet in Alaska. All these basins are producers of gas, condensate, and oil, they are all fault-block basins with horst and graben structures, and they are all predominantly Tertiary. Drawing on the knowledge we have of these analogs, combined with our stratigraphic knowledge of the coal-bearing group, we can reasonably predict a sedimentologic sequence in the Minto Flats Graben.

The Minto Flats Graben probably initially formed in the Eocene or earlier, commensurate with the uplift of the Alaska Range. The initial uplift of the Alaska Range appears to have been due to the obduction of the Talkeetna Superterrane to the south-southeast. As this obduction progressed, southern Alaska experienced oroclinal bending (Price, 1982, pers. comm.) and concomitant faulting. This faulting defined the graben structure. After the graben opened, a basal lag conglomerate probably formed (the Healy Creek formation). This basal lag conglomerate probably has a very high fraction of metamorphic and sedimentary rock fragments, and should be very immature from a sedimentological standpoint.

Above the basal lag conglomerates there are probably extensive (Eocene?) lacustrine deposits, such as the Sanctuary formation, that developed in the topographic lows. An example of the latter is the Minto Flats Graben. Coarse fan sediments, coming off the sides of the topographic highs, probably extend into these lacustrine sediments.

There is no Oligocene present to the south of the basin, which may be the result of two different events. One possiblility is that there was a period of slow or no deposition during the Oligocene. Thin Oligocene strata may even be present to the south of the basin, but it may not have been identified due to incomplete sampling. The other explanation of the lack of Oligocene strata may be that it was deposited, then uplifted and eroded off. There is no mention in the literature of an old erosional surface on the Eocene which would mark this event, but that may have been missed by field crews as well.

Sometime in the late Oligocene or early Miocene, a gradient started building up, due to the interlayering of coarse fan sediments and fluvial sediments. Tectonic stress was still being applied from the south, so a number of the horst and graben structures in the basin experienced further block faulting; basement faults were active concomitant with sedimentation. Strike-slip movement of 10 kilometers or less occurred along major fault systems during the early Miocene. The sediment sources were broader than the localized Eocene sources; the sources came from the Yukon-Tanana uplands and from the Alaska Range, as well as local sources. This rapid influx of sediment, due to the extreme topographic relief of major areas, resulted in a very thick section of high energy, relatively clean, coarse fluvial sandstones in a short amount of time. These sands are the Suntrana and Lignite Creek formations. As more sands were deposited, and the local relief was eroded down or filled in, the alluvial plain approached grade.

Once grade was approximately reached, extensive floodplain development took place. The floodplains were interspersed with muddy, braided streams. Sands were no longer "cleaned up" by the gradient, and perhaps more clays were contributed due to the relative maturity of diagenesis of the feldspars in the sediment sources. These deposits are seen in the Grubstake formation.

There appears to have been a final uplift of the Alaska range during Pliocene or Pleistocene time. Clean gravels and sands were again deposited because this tectonic event made the gradient higher.

Seismic Stratigraphy

While seismic coverage in the Tanana Basin is sparse, and data quality is relatively poor, some generalized ideas may be supported by the seismic data. The seismic lines do appear to have a few different packages which correlate to what we would expect to see, judging from the sections exposed to the south of the basin.

The Minto Flats Graben and the western Tanana Basin appears to contain some buried topography; this may be Eocene strata buried under the later Teritary sediments (See Seismic Line TA-5). The top of this topography may represent the Oligocene unconformity, and the buried hills may be composed of the Healy Creek and Sanctuary formation analogs. Above the buried hills there is a thick sedimentary package with a different set of reflectors. This probably correlates to the clean sands of the Suntrana and Lignite Creek formations. These are overlain by another very different set of reflectors which may represent the Grubstake formation. The Nenana gravel is too shallow to readily discern at the top of the section. However, one would not expect to get reflectors from the unconsolidated gravel. The seismic sections start showing reflectors at about 2,000 feet down, so the gravels are probably only about 2,000 feet thick.

The "seismic stratigraphy" is outlined for line TA-5 in Enclosure 4.

STRUCTURE

Prior to actual structural mapping, the faulting and folding development that one should see throughout the Tanana Basin area was predicted (See Enclosure 8). Faults and folds north of the Alaska Range were predicted by projection of structural trends, given the large folds paralleling the Alaska Range and the presence of major right lateral strike-slip faults. As it turned out, the actual structural trends observed around the basin matched the trends hypothesized in the predictive model quite well.

One beginning assumption was that the oroclinal bend that one sees in southern Alaska, the bend that resulted in the Alaska Range, was related to the obduction of the Talkeetna Superterrane. Obduction occurred in late Cretaceous to early Tertiary time. The northward obduction of the Talkeetna Terrane onto the Alaska plate provided very strong compressional forces from the north and south. The resultant extensional vectors would then be oriented east and west. Considering the compression from north and south, one would expect folding paralleling the Alaska Range around the oroclinal bend, with normal (extensional) faults radiating out from this bend. In the western Tanana Basin, one would then expect extensional forces

pulling to the northeast and southwest and compressional forces pinching in from the northwest and southeast. Folds would be oriented northeast to southwest and the regular faults would be oriented northwest to southeast. This is indeed what one sees on the map of fold and fault lineations in the Tanana Basin (See Enclosure 7). Because of this fact, one can predict what lineations on the gravity are faults, and what are folds.

One would also expect to see a number of strike-slip faults trending northeast-southwest; these would parallel the Farewell fault extensions and the Minto Flats bounding fault. The Minto Flats bounding fault is probably in itself a strike-slip fault, with right lateral movement. This latter fact is shown by the Precambrian Birch Creek Schist being brought southwestward down into the basin proper, where it adjoins the Tertiary sediments.

There are at least two ways in which the Minto Flats Graben may have originated. One hypothesis is that the graben is due to progressive development of southwest and northeast "pull apart" structures. The southwest to northeast faults that are seen in the basin and on gravity may be due to right lateral sheer along northeast-southwest strike-slip faults. This shear caused a series of normal(?) faults that were obtuse to, and in between, the strike-slip faults. Normal block(?) faulting progressed between the strike-slip faults, and the Minto Flats Sub-basin formed. The presence of block faulted, or horst and graben, structures within the Minto Flats sub-basin may be indicated by the gravity highs, such as the high separating the main graben from a localized low to the south. The graben and horst development in the western Tanana Basin was probably concomitent with the late Cretaceous(?) to early Tertiary oroclinal bending.

On the other hand, the Minto Flats Graben may be an extensional graben. An extensional graben might have formed along the sides of the Alaska range as a result of anticlastic bending along the oroclinal bend. This bending would have caused a volume problem because of the flexural flow/strain. In this scenario, extension paralleling the oroclinal bend would occur on the northwest and northeast sides of the Alaska Range. The graben, of course, is located on the northwest side of the bend. The problem with this alternative hypothesis is that a similar graben is not present on the northeast side of the bend, where flexural strain would also occur. Then again, Amoco does not have the extensive gravity or seismic coverage on the northeast side to prove or disprove the presence of a minor graben in the eastern Tanana Basin.

In summary, the Tanana Basin displays excellent porosity with good lithologies, it has effective source beds probably with favorable thermal histories, and it has one clear migration path for oil and gas, with a favorable timing of events. There are possible seals and traps, and there is definate structural development. Unfortunately, the structural development in the basin appears to be mainly faulting with little folding, and the structures that are present appear to be too small to be presently economic.

GEOPHYSICAL DATA AND INTERPRETATION

The geophysical data base consists of a gravity survey with stations on a 1 x 3 mile grid and 4 seismic reflection profiles, three transecting the graben and one profile longitudinally crossing the deepest flank of the graben along its bounding fault. A terrain corrected Bouguer gravity map with a one milligal contour interval, which shows the location of the

4 seismic profiles, is included at the back of this report. The seismic profiles are included as enclosures 10, 11, 12 and 13, respectively.

The four reconnaissance seismic lines were shot using the Poulter technique, suspending an array of charges on wooden stakes above the ground surface. These lines constitute only 126 miles of coverage with which to evaluate the prospectiveness of the Tanana Basin. Hence, the primary value of the limited seismic data has been to correlate the undulations and gradients of the contoured gravity surface to geologic structure.

In comparing the Bouguer gravity surface to the seismic profiles, it is evident that the measured gravity differences are caused primarily by geologic structure, i.e., changes in depth to crystalline basement, rather than lithologic changes in either the basement or overlying sediment. This correlation between gravity and geologic structure is fairly typical of Alaska's interior basins.

Incorporating the gravity/seismic correlation into an interpretation of the gravity data, the results are disappointing in that the basin complex appears to be relatively simple and featureless. The prospective sedimentary material has filled simple half grabens with virtually no internal folding from which to develop a prospect. See seismic lines APT 002 and APT 005, enclosures 11 and 13, respectively.

In the southern part of the sale area the gravity indicates slightly more complexity with one large apparent 4-way closure. Seismic line APT 004, enclosure 12, crosses this portion of the sale area and despite poor data quality, suggests that this gravity anomoly is a basement horst which lacks sedimentary drape or other prospective sedimentary deformation.

The evaluation of this geophysical data has led to the conclusion that the sedimentary section is relatively featureless throughout the sale area, and that the geophysical data has not identified an economically viable prospect worthy of recommendation within the Tanana Basin.

APPENDIX I: BASIN ANALOGS

The following is a brief summary of the geology from each basin that has been used as an analog to the Tanana Basin. Not all the geological data that we have from each basin was used in reconstructing the sedimentology and source rock subsidence profile of the Tanana Basin. Pertinent facts were selected as was deemed appropriate. This method has no proven statistical basis, and the facts that have been considered analagous to the Tanana Basin have certainly been used in a qualitative and not a quantative sense.

One of the best analogies to the Tanana Basin is the Narrows Graben in Queensland, Australia. The Narrows Graben is approximately the same size as the Tanana Basin, 24 miles by 3 miles, and it also contains important lacustrine sediments. These lacustrine sediments, like in the Tanana Basin, are found near the base of the section. The lacustrine sediments range up to 3,280 feet thick in the graben and contain an estimated 5.1 billion barrels of oil, which are contained in the Rundle and Stewart formation oil shales. The Narrows Graben was also discovered by gravity, and also has a major bounding fault on one side of the graben. The only thing that is different about the Narrows Graben Basin is that the sedimentary sequence is not quite as thick, nor is the basin quite

as large as the Minto Flats Graben in the Tanana Basin. It is because of this lack of a thick sedimentary section, and the resulting lack of overburden pressure, that the oil shales have not expelled hydrocarbons.

The Gabon Basin in west Africa is also primarily a half-graben structure like the Minto Flats Graben. The Gabon Basin, is a fault-block basin filled with Tertiary sediments. The lowermost section in the Gabon Basin consists of interbedded sand, shale, and coal which appears to be very similar to the Healy Creek formation sediments. This lowermost section of the Gabon Basin is overlain by coarse sandstones with some interbedded shales, which sounds remarkably similar to the Lignite Creek and Suntrana formations. The uppermost section of the Gabon, the Curlew formation, is similar to the silty, shaly Grubstake formation of the Tanana Basin. There are oil shows throughout the Gabon. The Gabon Basin is a remarkably similar analog to the Tanana Basin. The major difference between the Gabon and the Tanana, is that the sedimentation in the Gabon started during late Jurassic or early Cretaceous, rather than early Tertiary. The sequence that I have described above, known as the Cocobeach group, is overlain by a thick salt sequence. The rest of the basin is not analagous to the Tanana.

The Cabinda Basin in offshore Angola, is another rift basin which is similar to the Tanana. This basin is a prolific oil producer, and contains approximately 8,000 feet of sediment. The Cabinda Basin is filled with nonmarine Tertiary sediments similar to those in the Tanana. Lacustrine development occurs at the base of the graben in the Cabinda. The difference between the Cabinda Basin and the Minto Flats Graben is that the Cabinda had much more of a marine influence and has a number of carbonate intervals throughout.

The Bohai Bay and Subei Bay Basins in China are also similar to the Tanana Basin. These basins are approximately 20,000 feet thick, like the Tanana Basin, and were also subject to rapid sedimentation. Basement faulting bounds these basins with fault blocks throughout, so migration has occurred over a short distance. The basin is larger than the Tanana Basin, being approximately 480 kilometers by 240 kilometers. The section is early Tertiary through mid-Tertiary, just like the Tanana, and once again there is lacustrine development at the base of the section, along with a slight marine influence. The maximum estimated thickness of the lacustrine source rock is 5,000 to 6,500 feet thick. I don't think that the Tanana Basin source rock could be quite this thick, however it does show how massive lacustrine deposits can form in Tertiary fault block basins. The plays in the Bohai Bay and Subei Bay Basins are predominantly paleogeomorphic; the basins contain buried hill reservoirs (carbonates) and alluvial fans interfingering with lake sediments. These alluvial fans are also associated with slump deposits (turbidites?) which are contained in the main body of the lake sediments. There is, of course, a possibility of similar types of clastic buried foothills and slump deposit plays occurring in the Tanana Basin. The many fault blocks that are present in the mainland China basins are similar to the fault blocks that are present bounding the west side of the Minto Flats Graben. The fault block contains the major hydrocarbon accumulations in the Bohai Bay and Subei Bay Basins.

One of the major pitfalls of the Tanana Basin has always been its size. Few would believe that a basin this small could be a producer. However, there is a precedent of a very small

offshore Tertiary basin in Greece being a very good producer. This is the Kavala Basin, in the Aegean Basin offshore Greece. The Kavala Basin is filled with a very thick Tertiary nonmarine sequence, which is very similar to the Tanana's. However, the Kavala Basin is only a little over 10,000 feet deep. The Kavala is also a nonmarine Tertiary fault-block basin where significant lacustrine development has taken place at or near the base. In the Kavala Basin, lacustrine beds are overlain by conglomerates and sands, which seems analagous to the Lignite Creek and Suntrana formations of the Tanana Basin. The sands and conglomerates of the Kavala Basin are overlain by shales and coals which are very similar to the Grubstake formation of the Tanana Basin.

The last analogies to the Tanana Basin are the Tertiary Basins of Montana. These are Tertiary fault block basins with a thick, localized, nonmarine sedimentary fill which is remarkably similar to the Tanana Basin. Fortunately, the Tertiary basins of Montana have had some drilling activity, so one has a better understanding of what the center of the basin looks like. The sedimentary sequence in the Tertiary basins of Montana is nearly identical to the Tanana Basin: The lower most part of the section consists of lacustrine sediments with basal gravels; these are overlain by thick relatively clean sands, which are in turn overlain by shaly sands and shales. It is interesting to note that the lacustrine sediments were found to be oil source rocks when the cuttings were analyzed from the deeper wells in the center of the basin. These same lacustrine beds had been analyzed to be gas or condensate sources when the outcrop samples were analyzed by the lab. This discrepancy is probably due to weathering of the outcrop samples.

APPENDIX II: SUBSIDENCE PROGRAM FOR THE TANANA BASIN, STATE SALE 37

The subside-X program was run with Bob Brigham's help in June 1982. Many assumptions had to be made to run this program, and without any wells in the basin, one can not be sure that all the correct parameters were assumed. Assumptions were based on some sort of educated scientific basis, these bases will be given where appropriate. A high and low case were generated, as well as a most likely case. First of all, it was assumed that the main source interval would be considered the only source interval. This was the Sanctuary formation, which is the lacustrine sequence near the base of the Tanana Basin. Thicknesses were derived by analogy to other Tertiary fault block basins, by gravity and seismic data, and by the outcrop thickness. It was also assumed that the Sanctuary formation was an oil source. This was because it had been tested as a condensate source in outcrop, and because of the experience of Rich Klecker in having the source rocks of the Tertiary Basins in Montana analyzed. In Montana, the source rocks tested out as condensate sources in outcrop and oil sources when they were drilled in the center of the basin.

First of all, one has to assume a geological temperature gradient. The average gradient for the north slope is 15° per 1,000 feet. Using this gradient, 1,500 feet of section and deeper were generated by 10 million years ago. Ten million years ago, which would be approximately the top of Miocene, and certainly older than Pliocene. Hence, the Grubstake formation, the seal to the entire sequence, would have just barely been in place by the time generation would have started taking place. However, a gradient of 20° per 1,000 feet is more reasonable, because the Tanana Basin contains localized igneous activity which would heat up the temperature gradient. Assuming this later gradient, our results showed that 15,000 feet and

deeper would have generated 18 million years ago. Fourteen to 15,000 feet would have generated 8 million years ago and 12,000 to 14,000 would have generated 5 million years ago. Therefore the entire section would most likely have generated by the time Miocene deposition was over. Considering this, the Sanctuary formation lacustine beds should have generated prior to recent times; this generation would also allow for the Upper Miocene to Pliocene Grubstake formation cap rocks to have been implaced prior to generation.

To find the volume of oil generated, we must work with the following formula:

> Barrels of oil/acre foot of organic carbon x thickness of the source bed x 640 acres x 36 sections x number of townships x 10% expulsion efficiency = barrels of oil generated.

The following is a discussion of the variables used in this equation.

The percent of organic carbon in the Tertiary Coalbearing group ranges from 55.1 to .7% in the various source rocks analyzed throughout. The percent of organic carbon in the Eocene Sanctuary formation ranges up to 1.7%, where it was tested in outcrop. However, the samples were badly weathered, which reduces the total measured organic carbon percentage.

Thickness of the source bed: The Sanctuary formation is 150 feet thick to the south of the basin, and is probably thicker in the Minto Flats Graben. This is because at the time of deposition there was a larger topographic low in the Minto Flats Graben than in the south, where one sees the Sanctuary formation today. Thickness estimations were judged to range from 100 to 300 feet, with an average of 250 feet. The reason the average was judged to be so high is that the steep-sided, fault-bounded graben makes for a very high isopach gradient. It is possible, of course, that the Sanctuary formation was very much thinner in the graben, or that it was several hundred feet thicker. The number of townships covered by the Sanctuary formation was estimated by counting the sections on an overlay of the gravity-resolved graben on a physiographic base. The graben was extrapolated to the north where we did not have gravity data based on the topography. In this very small section to the north, we assumed the gravity contour spacing as seen in the south.

Expulsion efficiency was approximated as 10% based on the Williston and Permian Basin analogs. This 10% expulsion efficiency gives us what was actually expelled from the Sanctuary formation. One may also use a 5% expulsion efficiency figure which is based on a 50% trapping efficiency. However, the trapping efficiency in the Tanana Basin was probably greater due to the fact that there were very few clear migrations paths present in the Tanana Basin. The graben was probably quite restricted unlike the Willistion and Permian Basins, where the hydrocarbons had free paths throughout a large basinal area.

The barrels of oil, or the convertibility ratio which is in the first part of the equation, ranges from 3 to 5. This convertibility ratio is derived from Prudhoe Bay, Alaska, and the convertibility ratio was assumed to be 4 throughout the cases.

HIGH EXPULSION CASE:

Assume: 20°+/1,000 feet gradient

5 barrels of oil/acre feet per/0.1%

2.5% organic carbon.

400 foot source bed

13.5 townships

10% expulsion efficiency

5 BO/acre feet x 25 (0.1%) organic carbon x 400 feet x 640 acres x 36 sections x 13.5 townships x 10% = 1,555,200,000 barrels of oil generated and trapped

LOW EXPULSION CASE:

Assume: 15°/1,000 feet gradient

4 barrels of oil/acre feet/0.1%

1.7% organic carbon

200 foot source bed

7 townships

10% expulsion efficiency

4 BO/acre feet x 17 (0.1% organic carbon x 200 feet x 640 acres x 36 sections x 7 townships x 10% = 219,340,800 barrels of oil generated and 109,670,400 barrels of oil trapped.

MOST LIKELY EXPULSION CASE:

Assume: 20°/per acre feet gradient (Deer Lodge Basin, Montana, USA, has 11 to 14° gradient in upper 7,500 feet (Neogene), 23 to 28°/1,000 feet from 7,500 to 10,000 feet, increases below that.)

4.0 barrels of oil/acre-feet/0.1%

2.0% organic carbon.

Assume: A thickness range of 100 to 300 feet; with an average gradient which results in the following:

30 sections at 0 to 100 feet (50 foot average)
130 sections at 100 to 200 feet (150 foot average)
137 sections at 200 to 300 feet (250 foot average)
151 sections at 300 to 400 feet (350 foot average)
10 sections at 400 feet+ (420 foot average)
(These thickness variations were postulated from a combination of gravity and seismic data.)

Assume a 10% expulsion efficiency

4 BO/acre feet x 20 (0.1%) organic carbon x [(50 Feet x 30 sections) + (150 feet x 138 sections) + (250 feet x 137 sections) + (350 feet x 151 sections) + (420 feet x 10 sections)] x 640 acres x 10% expulsion efficiency = 581,120,000 barrels of oil generated and, assuming a 70% trapping efficiency: 406,784,000 barrels of oil trapped

This figure is not unreasonable, as the Kavala basin in the Aegean of Greece, a basin half the size of the Minto Flats Graben, with a continental Tertiary fill 23,000 feet thick, has estimated reserves of 1 billion barrels of oil.

The Oligocene is not present to the south of the basin, so it was deemed necessary to run a program assuming the Oligocene was deposited, and that the area was subsequently uplifted, Oligocene eroded, and then downdropped again. This scenario would have subjected the underlying Sanctuary formation sediments to a greater thickness of strata over a longer period of time. The assumption was made that deposition started approximately 40 million years ago, and that it continued relatively uninterrupted from the Eocene through the Oligocene. Maximum thickness was assumed to be 8,000 feet, 30 million years ago. The Oligocene was then uplifted, and the Sanctuary came within 2,000 feet of the surface 28 million years ago (upper Oligocene). Deposition then continued, up to 20,000 feet thick, until the present day. This, of course, is a purely ficticious scenario, but it does give one an idea of whether the Sanctuary formation would have generated had the Oligocene been there. Assuming a 20° per 1,000 foot gradient, we found that generation would have taken place at the 20,000 foot mark 14 million years ago. All the basin out to 12,000 feet would have generated before 3 million years ago. The danger here is that if there was a thick Oligocene section, that it might have caused the Sanctuary formation to have expelled oil before deposition of the overlying Grubstake formation.

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APPENDIX III

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

MINERALS AND ENERGY MANAGEMENT

JAY S. HAMMOND, GOVERNOR

555 CORDOVA STREET
POUCH 7-005
ANCHORAGE, ALASKA 99510
(907) 276-2653

Phone: (907)276-2653

June 24, 1982

Sale 37
Information to Bidders

A. Acceptance and Rejection of Bids

The state hereby expressly reserves the right to reject any bid on any tract. No bid for any tract will be accepted and no lease for any tract will be awarded to any bidder unless the following conditions have been met:

1. The bidder has complied with this notice and applicable state regulations and statutes unless the Commissioner determines that an omission was immaterial or due to excusable inadvertance and if the omission is corrected within one week after receipt of a notice of deficiency.

2. The bid is the highest valid cash bonus bid.

3. The amount of the bid has been determined to be adequate by the Commissioner of Natural Resources.

4. No bid containing or accompanied by any condition, qualification, or material alteration will be considered.

B. Pre-Qualification of Bidders

In order to submit bids for this sale, bidders must be qualified to bid prior to the sale date of August 24, 1982. Qualification procedures are as follows:

1. Individuals - An individual bidder must have a Statement of Qualifications on file at DMEM certifying that he or she is at least 18 years old and a citizen of the United States or is eligible for and has filed for citizenship, or is an alien person entitled to a similar lease by virtue of a treaty between the United States and the nation of which the alien person is a citizen. The statement must include the bidder's name, address, and telephone number and must be signed and dated. If an agent is signing the bid form on behalf of an individual, a notarized power-of-attorney document evidencing the authority of the agent to act on behalf of the individual must be on

In order to receive a Certificate of Authority, foreign corporations must submit a packet of completed forms entitled "instructions for qualifying a foreign corporation to do business in the State of Alaska" to the Department of Commerce and Economic Development, Corporation Section, Pouch D, Juneau, Alaska 99811. In order to receive a Certificate of Incorporation, domestic Corporations must submit Articles of Incorporation to the Department of Commerce and Economic Development. These forms can be obtained by writing or telephoning DMEM, Pouch 7-005, Anchorage, Alaska, 99510 (276-2653). Upon proper application, the Department of Commerce and Economic Development will issue a Certificate of Authority or Certificate of Incorporation. Please allow two to three weeks for the processing of these Certificates.

4. Partnerships or Other Unincorporated Associations - A partnership or unincorporated association must submit the following documents to DMEM prior to the lease sale:

    a. A statement describing the business relationships between members or partners.

    b. A statement of qualifications for each member stating that each member is at least 18 years of age and a citizen of the United States, or is eligible for and has filed for citizenship, or is an alien person entitled to a similar lease by virtue of a treaty between the United States and the nation of which the alien person is a citizen.

    c. If an agent is signing the bid form on behalf of the partnership or association, a notarized power-of-attorney defining the agent's authority to sign the bid on behalf of the partnership or association.

C. Bid Submission

All bids will be accepted by the Director of the Division of Minerals and Energy Management or her authorized agent in Room 31 (3rd Floor), 555 Cordova Street, Anchorage, Alaska, between the hours of 9 a.m. and 3 p.m. on August 23, 1982. Bids that are mailed to the Director, DMEM Pouch 7-005, Anchorage, Alaska 99510 must be received no later than August 23, 1982. Bids will also be accepted at the Division's temporary office at the Travelers Inn in Fairbanks between 8 a.m. and 9 a.m. on August 24, 1982. No bids tendered after 9 a.m. on the day of the sale, August 24, 1982, will be accepted.

Bids will be received and processed on August 24 in the following manner:

1. 8:00 a.m. - 9:00 a.m. - bids will be received in the "Gold Room".

2. 9:00 a.m. - closing of bid submission.

3. A bidder whose bid deposit for an apparent high bid is tendered by cashier's check or certified check drawn on a bank other than the Alaska National Bank of the North in Fairbanks, must wire transfer funds in the amount of such bid deposit (if more than $50,000) on August 25, 1982, no later than noon E.S.T. (7 a.m. A.S.T), to the credit of the State of Alaska Investment Account, Bank of America, N.T.& S.A., San Francisco, California, to the attention of: Elizabeth Stephens, Securities Clearance Department, #3298. It is not necessary that separate wire transfers be made if more than one bid deposit is being transferred to the account; however, each apparent high bidder making a wire tranfer to this account must Telex the following information to Bank of America (Telex No. 9-34-0534) with a copy to the Alaska Department of Revenue, Treasury Division (Telex No. 099-45-333): the amount of each bid deposit comprising the wire transfer, the tract number to which each bid deposit applies, the originating bank of the wire transfer, and the name(s) of the bidder's partner(s), if any, on whose behalf a bid deposit is being wire transferred. Upon notification of receipt of a wire transfer, the cashier's check(s) and certified check(s) for the bid deposit(s) corresponding to that wire transfer will be returned from 1 p.m. to 3 p.m., August 25, 1982, and from 8:30 a.m. to 3 p.m., August 26, 1982 in Room 31 (3rd Floor), 555 Cordova Street, Anchorage, Alaska.

4. If a bid deposit for an apparent high bid is tendered in cash, by money order, or is a certified or cashier's check drawn on the Alaska National Bank of the North in Fairbanks, the bidder will not be required to wire transfer federal funds for that bid deposit. Such checks will be presented August 24, 1982, for payment in federal funds at the Alaska National Bank of the North in Fairbanks.

5. Upon rejection by the State of Alaska of any apparent high bid, the amount of the bid deposit for that bid will be returned by wire transfer to a bank designated by the bidder. A bidder who is unable to pick up a bid deposit in the manner described in E(2) and E(3) above may submit with the bid written instructions for return of the bid deposit.

6. Upon acceptance of a bid by the Commissioner of Natural Resources, the successful bidder will be notified by certified mail of the lease award and will be sent two copies of the lease for signature. Within 30 days of the date that the bidder receives notification of the lease award, the bidder must: 1) sign both copies of the lease; 2) return them to the Division of Minerals and Energy Management for execution; 3) pay the balance of the cash bonus and accrued interest; and 4) pay for the first year annual rental. Interest of 12.248% per annum (which is the market interest rate for 90-day U.S. Treasury bills prevailing during the week of June 14 -18) will be charged on the balance of the cash bonus accruing from the date of the successful bidder's receipt of the notification of the lease award to the date of payment. The successful bidder owes interest from the day that he receives the bid acceptance letter until the day <u>before</u> the money is paid. Interest should be paid on the cash bonus only and not on the

MITIGATING MEASURES

AS 38.05.035(a)(14) and the departmental delegation of authority give the Director, Division of Minerals and Energy Management, hereafter the Director, the authority to impose conditions or limitations, in addition to those imposed by law, to ensure that a disposal is in the state's best interest. The following stipulations and terms of sale have been developed considering the Social, Economic, and Environmental Analysis for Sale 37, the Preliminary Analysis of the Director Regarding Oil and Gas Lease Sale 37, interagency discussion, and public comment. Lease stipulations will be enforced throughout the lease term. Measures listed under "Plans of operations and other terms of sale" will be imposed through Plans of Operations and other permits as needed to mitigate the social and environmental effects of lease-related activities.

Lease Stipulations

1. Spill Prevention, Control, and Countermeasure (SPCC) Plan:

   A Spill Prevention, Control, and Countermeasure Plan must be approved by the Department of Environmental Conservaton prior to drilling operations and construction of facilities for oil and gas storage (of greater than 660 gallons capacity), transfer, and transportation. The SPCC Plan must delineate how the lessee will prevent, detect, clean-up, and control blow-outs and other accidental releases of oil. The Plan must also describe the location of spill clean-up equipment, identify suitable alternative drilling rigs and their location, and specify the time required to commmence and complete drilling of a relief well.

2. Discovery of historic or archeologic objects:

   If the lessee discovers any site, structure, or object of historic or archeologic significance during conduct of operations on the leased area, the lessee must immediately report such findings to the Director and make every reasonable effort to preserve such site, structure or object until the Director, after consultation with the State Historic Preservation Officer, makes provisions for its protection.

3. Slide Mountain Flats Moose Wintering Area:

   The Department of Fish and Game must approve siting, design, and timing of gravel road construction and existing trail improvement within Tracts 179-190 and 205-210. Lessees may be required to restrict public access to gravel roads and improved trails if the Department of Fish and Game determines that such restrictions are necessary.

Plans of Operations and Other Terms of Sale

Bidders are advised that if the state owns the surface of the lease area, if the lease reserves a net profit share to the state, or if a surface owner other than the state so requests, the lessee must submit a detailed plan of operations to the Division of Minerals and Energy Management prior to

buildings, and other related structures. The location of restricted areas must be identified in the plan of operations. Lease facilities and operations must not block public access to or along navigable or public waters as defined in AS 38.05.365(22) and (23). If facilities are proposed in the vicinity of navigable or public waters, an easement will be reserved under AS 38.05.127 and 11 AAC 53.330.

7. The lessee is required to conduct an environmental training program for all personnel involved in exploration and development of the lease sale area, including the personnel of the lessee's contractors and subcontractors. The lessee's personnel must be informed of the environmental, social, and cultural concerns specific to the sale area and of the techniques necessary to preserve archeological, geological, and biological resources. The program must be formulated and implemented by instructors experienced in each field, and a plan describing the program must be submitted to the Director.

8. Surface entry, fixed-wing aircraft flights below 500 vertical feet, and helicopter flights below 1500 vertical feet will be prohibited within one-quarter mile of Trumpeter Swan nests between 1 May and 10 September. Powerlines, roads, pipelines, and other facilities will be prohibited within one-quarter mile of Trumpeter Swan nests. In the Tanana sale area, concentrations of nesting Trumpeter Swans are found in Tracts 10-12, 20-23, and 81-84. In the Copper River sale area, Trumpeter Swans nest in Tracts 157-174 and 179-184. The Department of Fish and Game will make maps identifying documented Trumpeter Swan nest site locations available to the Director and lessees within 60 days of the date a request for approval of a plans of operations is received.

9. Peregrine Falcons have historically nested on the banks of the Tanana River near Nenana. If Peregrine Falcons re-use these nest sites, lessees of Tracts 13-19 could be required to modify their plans of operations. If the lessee discovers previously unreported active or inactive Peregrine Falcon nest sites, the lessee must immediately report the nest locations to the Director. Mitigating measures, including seasonal restriction of surface entry and aircraft overflights and prohibition of most permanent facilities construction within two miles, will be required to comply with state and federal Endangered and Protected Species Acts.

10. If the lessee discovers previously unreported active or inactive Bald Eagle nest sites, the lessee must immediately report the nest locations to the Director. Permanent facilities may be prohibited within one-quarter mile (0.4 km) and will be prohibited within 500 feet of Bald Eagle nests, whether currently active or inactive. Surface entry within 500 feet of all active Bald Eagle nests will be prohibited between 1 April and 31 August. Temporary activities within 500 feet of Bald Eagle nest sites may be allowed between 1 September and 31 March if they will not alter Bald Eagle habitat. The Department of Fish and Game will make maps identifying documented Bald Eagle nest site locations available to the Director and lessees within 60 days of the date a request for approval of a plans of operations is received.

be by subsurface techniques. The Commissioner, Department of Environmental Conservation, may approve use of alternative disposal methods if the lessee can demonstrate that subsurface disposal is not feasible or prudent.

b. Discharge of drilling muds and cuttings into freshwater bodies, including wetlands, is prohibited, and plans for their disposal must be approved by the Department of Environmental Conservation. Mud Sumps and reserve pits must be rendered impermeable and otherwise fully contained through diking or other means.

16. Fish-bearing Stream Protection:

a. Riverbank alterations and equipment operation within riparian habitat must be approved by the Department of Fish and Game.

b. The location, design, and construction of all road and pipeline crossings of fish-bearing streams must be approved by the Department of Fish and Game. Bridges, rather than culverts, will be the preferred method of watercrossing. Culverts may be used if they will not block fish passage; bottomless arch culverts will be preferred over either round or elliptical culverts, which must be buried one-fifth of the culvert's diameter into the stream's thaw leg.

c. In winter, from the time of ice formation on streams until breakup, the following activities will be prohibited in fish-bearing streams unless approved by the Department of Fish and Game:

(1) equipment operation in open water areas and where under-ice water is present.

(2) removal of water or snow cover.

(3) compaction of snow cover.

d. Intake pipes for summer water removal must be surrounded by a screened enclosure. Maximum water velocity at the surface of this enclosure must not exceed 0.1 foot per second; screen mesh size must not exceed 0.04 inch, unless approved by the Department of Fish and Game.

e. Unless drilling immediately prior to the proposed explosions shows that the stream and its substrate are solidly frozen, the minimum distance between fish-bearing streams and charge location will be:

Charge (lbs)	Distance from stream (ft.)
1	50
2	75
5	125
10	150
25	250
100	500

b. describe their current condition based on site visits.

c. document their historic and prehistoric use.

d. discuss the potential effects of lessee activities on these sites.

Lessees must consult the Alaska Heritage Resources Survey and the National Register of Historic Places; oral accounts of local residents must also be considered. If an identified site could be adversely affected by lessee activities, the Director, after consultation with the Director, Division of Parks, will determine what measures must be used to mitigate such effects, before construction begins.

24. Tracts 27-29, 33-38, 41-55, 57, 58, 60-62, 64-71, 92-94, 98, 99, 102 and 103 are in an area proposed by the state for agricultural disposal, and some restrictions on surface entry and facilities siting on these tracts may be required. Plans of Operations involving activities on these tracts will be reviewed by the Division of Agriculture. Whenever feasible and prudent, drill pads and other oil and gas facilities will not be located on Class II or III soils, as defined by the Division of Agriculture.

25. In approving water appropriations and freshwater wells within the Toklat River drainage, the Director, Division of Land and Water Management, will consult with the Department of Fish and Game.

STATE OF ALASKA
Oil and Gas Lease Sale 37
Third-Party Interests
June 24, 1982

Tract 37-006	T2S, R7W, FM Alaska Railroad 200' R/W
Tract 37-007	T2S, R7W, FM Timber Sale 403834 Alaska Railroad 200' R/W
Tract 37-012	T3S, R5W, FM Bombing & Gunnery Range F-08847 north of Wood River
Tract 37-013	T3S, R7W, FM 50' C/L R/W Permit 29238 R/W Permit 32150 R/W Material Site F-025774 R/W Material Site F-025720 Power Transmission Line F-034779 Timber Sale 403834 Fairbanks-Nenana Highway and Alaska RR Reservation for R/W
Tract 37-014	T3S, R7W, FM Alaska Railroad
Tract 37-015	T3S, R7W, FM Alaska Railroad R/W for Richardson Highway Power Transmission Line F-034779 R/W Material Site F-025717 R/W Material Site F-025721
Tract 37-017	T3S, R7W, FM R/W for Richardson Highway
Tract 37-019	T4S, R8W, FM Native Allotment Application F-14138 Village Selection F-14903
Tract 37-163	T6N, R6W, CRM Unnamed Trail R/W (A-060852)
Tract 37-166	T6N, R6W, CRM Unnamed Trail R/W (A-060852)
Tract 37-167	T6N, R6W, CRM Unnamed Trail R/W (A-060852)
Tract 37-169	T5N, R6W, CRM Unnamed Trail R/W (A-060857)

Tract 37-172	T6N, R6W, CRM Unnamed Trail R/W (A-060857)
Tract 37-173	T6N, R6W, CRM Unnamed Trail R/W (A-080657)
Tract 37-175	T5N, R7W, CRM R/W AA2709 R/W Material Site AA287
Tract 37-176	T5N, R7W, CRM R/W AA2709 for Lake Louise Rd. R/W AA857 R/W AA287 R/W AA258
Tract 37-177	T5N, R7W, CRM Letter Permit 55347 R/W Material Site AA365 R/W AA6324 Triangulation Station
Tract 37-178	T5N, R7W, CRM R/W AA2709 for Lake Louise Rd.
Tract 37-192	T4N, R7W, CRM 200'R/W AA2709 for Lake Louise Rd. Letter Permit 55224 R/W AA366 R/W AA6323 Letter Permit 47820
Tract 37-193	T4N, R7W, CRM Letter Permit 47820
Tract 37-194	T4N, R7W, CRM 200' R/W AA2709 for Lake Louise Rd. R/W AA361 R/W AA856 Unnamed Trail R/W A-060855 Unnamed Trail R/W A-067485
Tract 37-195	T2N, R7W, CRM 200'R/W AA2709 for Lake Louise Rd. Unnamed Trail R/W A-060855 Unnamed Trail R/W A-067485 Land Lease Application 212809
Tract 37-198	T2N, R7W, CRM AA6188 25' C/L Easement Deed Land Lease Application 213119
Tract 37-199	T2N, R8W, CRM Land Lease Application 212802

Tract 37-211	T2N, R9W, CRM R/W AA6022 150' C/L PL01613, ADL 73304 R/W AA9459 R/W A060848 R/W A064401 Remote Lease Application 213119 R/W Application A062297 R/W A062218 Easement Deed to RCA 25' C/L AA6188
Tract 37-212	T2N, R9W, CRM R/W AA6022 150' C/L PL01613, ADL 73304 Material Site A062218 Material Site A062296 Easement Deed to RCA 25' C/L AA6188
Tract 37-214	T2N, R9W, CRM Land Lease Application 213150 Land Lease Application 212699 Land Lease Application 212700 Land Lease Application 212792 Land Lease Application 212983 Land Lease Application 212984 Land Lease Application 213067
Tract 37-215	T2N, R9W, CRM Land Lease Application 212802
Tract 37-217	T2N, R9W, CRM Land Lease Application 212543 Land Lease Application 212694 Land Lease Application 212429 Land Lease Application 212696 Land Lease Application 212544 Land Lease Application 212723 Land Lease Application 212937 Land Lease Application 213111 Land Lease Application 212693

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

MINERALS AND ENERGY MANAGEMENT

JAY S. HAMMOND, GOVERNOR

555 CORDOVA STREET
POUCH 7-005
ANCHORAGE, ALASKA 99510
(907) 276-2653

June 24, 1982

-NOTICE-

COMPETITIVE OIL AND GAS LEASE SALE 37
(Middle Tanana Basin and Copper River Basin)

The Department of Natural Resources, Division of Minerals and Energy Management (DMEM) gives formal notice under AS 38.05.345(a)(4) of its intention to offer lands for competitive oil and gas lease. Sale 37 includes about 860,000 acres of land within two areas: the Middle Tanana Basin, including about 632,000 acres in the Nenana area; and the Copper River Basin, including about 228,000 acres west of Glennallen in the Lake Louise area.

The sale will be conducted by the Department of Natural Resources under the authority of Alaska Statute 38.05.180. Bidders awarded leases at this sale will acquire the right to explore for, develop and produce the oil and gas that may be discovered within the leased area. In order to bid at the sale bidders must prequalify prior to the sale date. Potential bidders should consult DMEM for prequalification procedures. Under 11 AAC 82.445, a bid will not be considered unless supported by the bid deposit and the information required, unless any omission is determined by the Commissioner to be immaterial or due to excusable inadvertence and the omission is corrected within one week after receipt of a notice of deficiency.

Sale 37 is scheduled to be held on August 24, 1982 at the Travelers Inn, 620 Noble, Fairbanks, Alaska. Bids will be received and processed on August 24 in the following manner:

1. 8:00 - 9:00 a.m. - bids will be received in the "Gold Room".
2. 9:00 a.m. - closing of bid submission.
3. 9:00 - 10:30 a.m. - bids will be opened.
4. 10:30 a.m. - a public reading of the bids will begin in the "Gold Room".

Bids also will be accepted from 9 a.m. to 3 p.m. on August 23, 1982 in Room 31 (3rd floor), 555 Cordova Street, Anchorage, Alaska. Bids that are sent by mail must be sent to: Director, DMEM, Pouch 7-005, Anchorage, Alaska 99510, and must be received by August 23, 1982.

Any lease issued as a result of this sale will be executed on Form No. DMEM-1-82 (NET PROFIT SHARE) which was revised April 7, 1982.

The bidding method will be cash bonus bidding with a fixed royalty of 12.5% and a fixed net profit share of 30%.

tracts leased in Sale 37. Lease stipulations will be enforced throughout the term of the lease. Measures will also be imposed through approval of plans of operations and other permits as needed to mitigate undesirable social and environmental effects of lease related activities.

The stipulations and terms describe standards that must be met by the operators with regard to water quality and appropriation, gravel extraction, oil spill prevention and cleanup, construction of roads, pipelines and other lease related structures and facilities, public access, disposal of waste, drilling muds and cuttings and produced waters, timing and routing of exploration and development activities, rehabilitation of abandoned sites, and additional permits and approvals. These stipulations and terms are necessary to protect the unique biological, archeological, and social aspects of the sale area.

In support of the lease sale, the Director of the Division of Minerals and Energy Management has prepared a final written finding under AS 38.05.035(a)(14) which sets forth the facts and applicable law upon which she has determined that the proposed action will best serve the interests of the state. The Director's written finding and decision will be available to the public within one week at the Division of Minerals and Energy Management, 555 Cordova Street in Anchorage or by writing DMEM at Pouch 7-005, Anchorage, Alaska 99510. Additional information on the proposed sale is available to prospective bidders and members of the public at DMEM.

Kay Brown
Director

STATE OF ALASKA

SALE 37

Middle Tanana and
Copper River Basins

TRACT LEGAL DESCRIPTIONS

June 24, 1982

TRACT 37-001

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 1, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 652.00 acres;
Section 2, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 646.00 acres;
Section 11, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 12, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 644.00 acres.

This Tract contains 2582.00 acres more or less.

TRACT 37-002

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 3, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 645.00 acres;
Section 4, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 643.00 acres;
Section 9, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 10, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres.

This Tract contains 2568.00 acres more or less.

TRACT 37-003

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 5, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 642.00 acres;
Section 6, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 605.00 acres;
Section 7, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 606.00 acres;
Section 8, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres.

This Tract contains 2493.00 acres more or less.

TRACT 37-004

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 17, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 18, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 608.00 acres;
Section 19, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 612.00 acres;
Section 20, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres.

This Tract contains 2500.00 acres more or less.

TRACT 37-005

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 15, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 16, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 21, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 22, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres.

This Tract contains 2560.00 acres more or less.

TRACT 37-006

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 13, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 643.00 acres;
Section 14, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 23, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 24, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 642.00 acres.

This Tract contains 2565.00 acres more or less.

TRACT 37-007

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 25, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 641.00 acres;
Section 26, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 35, All, 640.00 acres;
Section 36, All, 640.00 acres.

This Tract contains 2561.00 acres more or less.

TRACT 37-008

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 27, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 28, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 33, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 34, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres.

This Tract contains 2560.00 acres more or less.

TRACT 37-009

T. 2 S., R. 7 W., FAIRBANKS MERIDIAN

Section 29, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres;
Section 30, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 615.00 acres;
Section 31, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 619.00 acres;
Section 32, All, as shown on State of Alaska Supplemental Township plat of Tract "A" prepared April 1982, 640.00 acres.

This Tract contains 2514.00 acres more or less.

TRACT 37-010

T. 2 S., R. 8 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres.

This Tract contains 1920.00 acres more or less.

TRACT 37-011

T. 2 S., R. 8 W., FAIRBANKS MERIDIAN

Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This Tract contains 1920.00 acres more or less.

TRACT 37-012

T. 3 S., R. 5 W., FAIRBANKS MERIDIAN

Section 33, All, 640.00 acres.

This Tract contains 640.00 acres more or less.

TRACT 37-013

T. 3 S., R. 7 W., FAIRBANKS MERIDIAN

Section 1, All, 639.92 acres;
Section 2, All, 639.96 acres;
Section 3, All, 640.04 acres;
Section 10, N1/2, E1/2SE1/4, SW1/4SE1/4, S1/2NW1/4SE1/4, NE1/4NW1/4SE1/4, S1/2NW1/4NW1/4SE1/4, 475.00 acres;
Section 11, All, 640.00 acres;
Section 12, All, 640.00 acres.

This tract contains 3674.92 acres more or less.

TRACT 37-014

T. 3 S., R. 7 W., FAIRBANKS MERIDIAN

Section 4,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 639.00 acres;
Section 5,	All, as shown on Supplemental Cadastral Survey plat 82-1 Nenana Recording District, 640.82 acres;
Section 6,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 621.00 acres;
Section 7,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 621.00 acres;
Section 8,	All, as shown on Supplemental Cadastral Survey plat 82-1 Nenana Recording District, 641.36 acres;
Section 9,	N1/2, 320.00 acres.

This tract contains 3463.18 acres more or less.

TRACT 37-015

T. 3 S., R. 7 W., FAIRBANKS MERIDIAN

Section 16,	All, 640.00 acres;
Section 17,	N1/2, N1/2 S1/2, SE1/4SE1/4, 520.00 acres;
Section 18,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 622.00 acres;
Section 20,	SE1/4, S1/2NE1/4, NE1/4NE1/4, SW1/4SW1/4NW1/4, SE1/4SE1/4NW1/4, NW1/4NW1/4SW1/4, S1/2NW1/4SW1/4, E1/2SW1/4SW1/4, SW1/4SW1/4SW1/4, SE1/4SW1/4, S1/2NE1/4SW1/4, NE1/4NE1/4SW1/4, 430.00 acres;
Section 21,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres.

This tract contained 2852.00 acres more or less.

TRACT 37-016

T. 3 S., R. 7 W., FAIRBANKS MERIDIAN

Section 13,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 14,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 15,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 22,	All, as shown on State of Alaska Supplemental Townsnip plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 23,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 24,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-017

T. 3 S., R. 7 W., FAIRBANKS MERIDIAN

Section 25,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 26,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 27,	All, as shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 34,	All, as shown on State of Alaska Supplemental Townsnip plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 35,	All, as shown on State of Alaska Supplemental Townsnip plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 36,	All, as shown on State of Alaska Supplemental Townsnip plat of Tracts "A & B" prepared April 1982, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-018

T. 3 S., R. 7 W., FAIRBANKS MERIDIAN

Section 28,	As shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 29,	As shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 30,	As shown on Supplemental Cadastral Survey plat 82-1 Nenana Recording District, 623.15 acres;
Section 31,	As shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 626.00 acres;
Section 32,	As shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres;
Section 33,	As shown on State of Alaska Supplemental Township plat of Tracts "A & B" prepared April 1982, 640.00 acres.

This tract contains 3809.15 acres more or less.

TRACT 37-019

T. 4 S., R. 8 W., FAIRBANKS MERIDIAN

Section 33, All, 640.00 acres.

This tract contains 640.00 acres more or less.

TRACT 37-020

T. 1 S., R. 9 W., FAIRBANKS MERIDIAN

Section 22,	Protracted, All, 640.00 acres;
Section 23,	Protracted, All, 640.00 acres;
Section 24,	Protracted, All, 640.00 acres;
Section 25,	Protracted, All, 640.00 acres;
Section 26,	Protracted, All, excluding the unnamed lake contiguous with U.S. Survey 4442C, 635.00 acres;
Section 27,	Protracted, All, excluding U.S. Survey 4442 C and the unnamed lake contiguous with U.S. 4442C, 588.88 acres;
Section 35,	Protracted, All, excluding the unnamed lake contiguous with U.S. Survey 4442C, 545.00 acres;
Section 36,	Protracted, All, 640.00 acres.

This tract contains 4968.88 acres more or less.

TRACT 37-021

T. 1 S., R. 9 W., FAIRBANKS MERIDIAN

Section 19,	Protracted, All, 598.00 acres;
Section 20,	Protracted, All, 640.00 acres;
Section 21,	Protracted, All, 640.00 acres;
Section 28,	Protracted, All, 640.00 acres;
Section 29,	Protracted, All, 640.00 acres;
Section 30,	Protracted, All, 600.00 acres;
Section 31,	Protracted, All, 602.00 acres;
Section 32,	Protracted, All, 640.00 acres.

This tract contains 5000.00 acres more or less.

TRACT 37-022

T. 1 S., R. 10 W., FAIRBANKS MERIDIAN

Section 22,	Protracted, All, 640.00 acres;
Section 23,	Protracted, All, 640.00 acres;
Section 24,	Protracted, All, 640.00 acres;
Section 25,	Protracted, All, 640.00 acres;
Section 26,	Protracted, All, 640.00 acres;
Section 27,	Protracted, All, 640.00 acres;
Section 34,	Protracted, All, 640.00 acres;
Section 35,	Protracted, All, 640.00 acres;
Section 36,	Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-023

T. 1 S., R. 10 W., FAIRBANKS MERIDIAN

Section 19,	Protracted, All, 598.00 acres;
Section 20,	Protracted, All, 640.00 acres;
Section 21,	Protracted, All, 640.00 acres;
Section 28,	Protracted, All, 640.00 acres;
Section 29,	Protracted, All, 640.00 acres;
Section 30,	Protracted, All, 600.00 acres;
Section 31,	Protracted, All, 602.00 acres;
Section 32,	Protracted, All, 640.00 acres;
Section 33,	Protracted, All, 640.00 acres.

This tract contains 5640.00 acres more or less.

TRACT 37-024

T. 2 S., R. 9 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-025

T. 2 S., R. 9 W., FAIRBANKS MERIDIAN

Section 3, Protracted, All, 640.00 acres;
Section 4, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-026

T. 2 S., R. 9 W., FAIRBANKS MERIDIAN

Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 604.00 acres;
Section 7, Protracted, All, 607.00 acres;
Section 8, Protracted, All, 640.00 acres.

This tract contains 2491.00 acres more or less.

TRACT 37-027

T. 2 S., R. 9 W., FAIRBANKS MERIDIAN

Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 609.00 acres;
Section 19, Protracted, All, 611.00 acres;
Section 20, Protracted, All, 640.00 acres.

This tract contains 2500.00 acres or less.

TRACT 37-028

T. 2 S., R. 9 W., FAIRBANKS MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-029

T. 2 S., R. 9 W., FAIRBANKS MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-030

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-031

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 3, Protracted, All, 640.00 acres;
Section 4, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-032

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 5, Protracted, All 640.00 acres;
Section 6, Protracted, All 604.00 acres;
Section 7, Protracted, All 607.00 acres;
Section 8, Protracted, All 640.00 acres.

This tract contains 2491.00 acres more or less.

TRACT 37-033

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 609.00 acres;
Section 19, Protracted, All, 611.00 acres;
Section 20, Protracted, All, 640.00 acres.

This tract contains 2500.00 acres more or less.

TRACT 37-034

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-035

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-036

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-037

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 27, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-038

T. 2 S., R. 10 W., FAIRBANKS MERIDIAN

Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 613.00 acres;
Section 31, Protracted, All, 615.00 acres;
Section 32, Protracted, All, 640.00 acres.

This tract contains 2508.00 acres more or less.

TRACT 37-039

T. 2 S., R. 11 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-040

T. 2 S., R. 11 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 611.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres.

This tract contains 1891.00 acres more or less.

TRACT 37-041

T. 2 S., R. 11 W., FAIRBANKS MERIDIAN

Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 613.00 acres;
Section 31, Protracted, All, 615.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 3788.00 acres more or less.

TRACT 37-042

T. 2 S., R. 11 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-043

T. 3 S., R. 10 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-044

T. 3 S., R. 10 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 617.00 acres;
Section 7, Protracted, All, 619.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 621.00 acres.

This tract contains 5697.00 acres more or less.

TRACT 37-045

T. 3 S., R. 10 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 623.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 625.00 acres;
Section 31, Protracted, All, 627.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5715.00 acres more or less.

TRACT 37-046

T. 3 S., R. 10 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-047

T. 3 S., R. 11 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-048

T. 3 S., R. 11 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 617.00 acres;
Section 7, Protracted, All, 619.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres.

This tract contains 3796.00 acres more or less.

TRACT 37-049

T. 3 S., R. 11 W., FAIRBANKS MERIDIAN

Section 17, protracted, All, 640.00 acres;
Section 18, protracted, All, 621.00 acres;
Section 19, protracted, All, 623.00 acres;
Section 20, protracted, All, 640.00 acres.

This tract contains 2524.00 acres more or less.

TRACT 37-050

T. 3 S., R. 11 W., FAIRBANKS MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-051

T. 3 S., R. 11 W., FAIRBANKS MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-052

T. 3 S., R. 11 W., FAIRBANKS MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-053

T. 3 S., R. 11 W., FAIRBANKS MERIDIAN

Section 27, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-054

T. 3 S., R. 11 W., FAIRBANKS MERIDIAN

Section 29, Protracted, All 640.00 acres;
Section 30, Protracted, All 625.00 acres;
Section 31, Protracted, All 627.00 acres;
Section 32, Protracted, All 640.00 acres.

This tract contains 2532.00 acres more or less.

TRACT 37-055

T. 3 S., R. 12 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-056

T. 3 S., R. 12 W., FAIRBANKS MERIDIAN

Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-057

T. 3 S., R. 12 W., FAIRBANKS MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-058

T. 3 S., R. 12 W., FAIRBANKS MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

this tract contains 3840.00 acres more or less.

TRACT 37-059

T. 3 S., R. 12 W., FAIRBANKS MERIDIAN

Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 31, Protracted, All, 627.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 3187.00 acres more or less.

TRACT 37-060

T. 4 S., R. 9 W., FAIRBANKS MERIDIAN

Section 1, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 641.00 acres;
Section 2, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 3, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 10, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 11, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 12, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 641.00 acres;
Section 13, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 14, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 15, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres.

This tract contains 5762.00 acres more or less.

TRACT 37-061

T. 4 S., R. 9 W., FAIRBANKS MERIDIAN

Section 4, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 5, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 6, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 629.00 acres;
Section 7, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 631.00 acres;
Section 8, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 9, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 16, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 17, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 18, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 634.00 acres.

This tract contains 5734.00 acres more or less.

TRACT 37-062

T. 4 S., R. 9 W., FAIRBANKS MERIDIAN

Section 19, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 638.00 acres;
Section 20, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 21, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 28, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 29, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 30, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 641.00 acres;
Section 31, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 644.00 acres;
Section 32, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 33, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres.

This tract contains 5763.00 acres more or less.

TRACT 37-063

T. 4 S., R. 9 W., FAIRBANKS MERIDIAN

Section 22, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 23, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 24, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 25, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 26, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 27, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 34, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 35, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres;
Section 36, All, as shown on State of Alaska Supplemental Township plat, prepared April 1982, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-064

T. 4 S., R. 10 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-065

T. 4 S., R. 10 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 629.00 acres;
Section 7, Protracted, All, 631.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 633.00 acres.

This tract contains 5733.00 acres more or less.

TRACT 37-066

T. 4 S., R. 10 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5751.00 acres more or less.

TRACT 37-067

T. 4 S., R. 10 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-068

T. 4 S., R. 11 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-069

T. 4 S., R. 11 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 629.00 acres;
Section 7, Protracted, All, 631.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 633.00 acres.

This tract contains 5733.00 acres more or less.

TRACT 37-070

T. 4 S., R. 11 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5751.00 acres more or less.

TRACT 37-071

T. 4 S., R. 11 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-072

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-073

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 3, Protracted, All, 640.00 acres;
Section 4, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-074

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 629.00 acres;
Section 7, Protracted, All, 631.00 acres;
Section 8, Protracted, All, 640.00 acres.

This tract contains 2540.00 acres more or less.

TRACT 37-075

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 633.00 acres;
Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres.

This tract contains 2548.00 acres more or less.

TRACT 37-076

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-077

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-078

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-079

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 27, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-080

T. 4 S., R. 12 W., FAIRBANKS MERIDIAN

Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres.

This tract contains 2556.00 acres more or less.

TRACT 37-081

T. 4 S., R. 13 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 1280.00 acres more or less.

TRACT 37-082

T. 4 S., R. 13 W., FAIRBANKS MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This tract contains 1280.00 acres more or less.

TRACT 37-083

T. 4 S., R. 13 W., FAIRBANKS MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-084

T. 4 S., R. 13 W., FAIRBANKS MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-085

T. 5 S., R. 8 W., FAIRBANKS MERIDIAN

Section 33, All, 640.00 acres.

This tract contains 640.00 acres more or less.

TRACT 37-086

T. 5 S., R. 9 W., FAIRBANKS MERIDIAN

Section 1, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 645.00 acres;
Section 2, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 644.00 acres;
Section 3, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 643.00 acres;
Section 10, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 2572.00 acres more or less.

TRACT 37-087

T. 5 S., R. 9 W., FAIRBANKS MERIDIAN

Section 4, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 642.00 acres;
Section 5, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 641.00 acres;
Section 6, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 616.00 acres;
Section 7, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 618.00 acres;
Section 8, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 9, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 3797.00 acres more or less.

TRACT 37-088

T. 5 S., R. 9 W., FAIRBANKS MERIDIAN

Section 16, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 17, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 18, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 620.00 acres;
Section 19, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 622.00 acres;
Section 20, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 21, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 3802.00 acres more or less.

TRACT 37-089

T. 5 S., R. 9 W., FAIRBANKS MERIDIAN

Section 13, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 14, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 15, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 22, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 23, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 24, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-090

T. 5 S., R. 9 W., FAIRBANKS MERIDIAN

Section 25, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 26, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 27, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 34, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 35, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 36, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-091

T. 5 S., R. 9 W., FAIRBANKS MERIDIAN

Section 29, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 30, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 623.00 acres.

This tract contains 1263.00 acres more or less.

TRACT 37-092

T. 5 S., R. 10 W., FAIRBANKS MERIDIAN

Section 1, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 2, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 11, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 12, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 13, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 14, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-093

T. 5 S., R. 10 W., FAIRBANKS MERIDIAN

Section 3, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 4, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 9, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 10, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 15, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 16, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-094

T. 5 S., R. 10 W., FAIRBANKS MERIDIAN

Section 5, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 6, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 593.00 acres;
Section 7, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 595.00 acres;
Section 8, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 17, N1/2, as shown on Supplemental Cadastral Survey plat 81-12 Nenana Recording District, 320.00 acres;
Section 18, N1/2, as shown on Supplemental Cadastral Survey plat 81-12 Nenana Recording District, 298.00 acres.

This tract contains 3086.00 acres more or less.

TRACT 37-095

T. 5 S., R. 10 W., FAIRBANKS MERIDIAN

Section 17, S1/2, as shown on Supplemental Cadastral Survey plat 81-12 Nenana Recording District, 320.00 acres;
Section 18, S1/2, as shown on Supplemental Cadastral Survey plat 81-12 Nenana Recording District, 299.00 acres;
Section 19, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 599.00 acres;
Section 20, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 29, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 30, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 601.00 acres;
Section 31, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 603.00 acres;
Section 32, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 4342.00 acres more or less.

TRACT 37-096

T. 5 S., R. 10 W., FAIRBANKS MERIDIAN

Section 21, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 22, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 27, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 28, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 33, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 34, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-097

T. 5 S., R. 10 W., FAIRBANKS MERIDIAN

Section 23, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 24, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 25, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 26, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 35, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres;
Section 36, All, as shown on State of Alaska Supplemental Township plat prepared April, 1982, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-098

T. 5 S., R. 11 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-099

T. 5 S., R. 11 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 593.00 acres;
Section 7, Protracted, All, 595.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 597.00 acres.

This tract contains 5625.00 acres more or [illegible]

TRACT 37-100

T. 5 S., R. 11 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 599.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 601.00 acres;
Section 31, Protracted, All, 603.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This Tract contains 5643.00 acres more or less.

TRACT 37-101

T. 5 S., R. 11 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This Tract contains 5760.00 acres more or less.

TRACT 37-102

T. 5 S., R. 12 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This Tract contains 5760.00 acres more or less.

TRACT 37-103

T. 5 S., R. 12 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 593.00 acres;
Section 7, Protracted, All, 595.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 597.00 acres.

This Tract contains 5625.00 acres more or less.

TRACT 37-104

T. 5 S., R. 12 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 599.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 601.00 acres;
Section 31, Protracted, All, 603.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This Tract contains 5643.00 acres more or less.

TRACT 37-105

T. 5 S., R. 12 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This Tract contains 5760.00 acres more or less.

TRACT 37-106

T. 6 S., R. 10 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, excluding Native Allotment FO24288, 600.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This Tract contains 5680.00 acres more or less.

TRACT 37-107

T. 6 S., R. 10 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 605.00 acres;
Section 7, Protracted, All, 607.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 609.00 acres.

This Tract contains 5661.00 acres more or less.

TRACT 37-108

T. 6 S., R. 10 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 611.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 613.00 acres;
Section 31, Protracted, All, 615.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This Tract contains 5679.00 acres more or less.

TRACT 37-109

T. 6 S., R. 10 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This Tract contains 5760.00 acres more or less.

TRACT 37-110

T. 6 S., R. 11 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-111

T. 6 S., R. 11 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 605.00 acres;
Section 7, Protracted, All, 607.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 609.00 acres.

This tract contains 5661.00 acres more or less.

TRACT 37-112

T. 6 S., R. 11 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 611.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 613.00 acres;
Section 31, Protracted, All, 615.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5679.00 acres more or less.

TRACT 37-113

T. 6 S., R. 11 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-114

T. 6 S., R. 12 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, All, as shown on Supplemental Cadastral Survey plat 81-130 Fairbanks Recording District, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-115

T. 6 S., R. 12 W., FAIRBANKS MERIDIAN

Section 3, All, as shown on Supplemental Cadastral Survey plat 81-130 Fairbanks Recording District, 640.00 acres;
Section 4, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-116

T. 6 S., R. 12 W., FAIRBANKS MERIDIAN

Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 605.00 acres;
Section 7, Protracted, All, 607.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 609.00 acres.

This tract contains 3741.00 acres more or less.

TRACT 37-117

T. 6 S., R. 12 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 611.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, All, as shown on Supplemental Cadastral Survey plat 81-132 Fairbanks Recording District, 640.00 acres;
Section 30, Protracted, All, 613.00 acres;
Section 31, All, as shown on Supplemental Cadastral Survey plat 81-132 Fairbanks Recording District, 615.00 acres;
Section 32, All, as shown on Supplemental Cadastral Survey plat 81-132 Fairbanks Recording District, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5679.00 acres more or less.

TRACT 37-118

T. 6 S., R. 12 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-119

T. 7 S., R. 10 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-120

T. 7 S., R. 10 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 617.00 acres;
Section 7, Protracted, All, 619.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 621.00 acres.

This tract contains 5697.00 acres more or less.

TRACT 37-121

T. 7 S., R. 10 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 623.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 625.00 acres;
Section 31, Protracted, All, 627.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5715.00 acres more or less.

TRACT 37-122

T. 7 S., R. 10 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-123

T. 7 S., R. 11 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-124

T. 7 S., R. 11 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 617.00 acres;
Section 7, Protracted, All, 619.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 621.00 acres.

This tract contains 5697.00 acres more or less.

TRACT 37-125

T. 7 S., R. 11 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 623.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 625.00 acres;
Section 31, Protracted, All, 627.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5715.00 acres more or less.

TRACT 37-126

T. 7 S., R. 11 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-127

T. 7 S., R. 12 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-128

T. 7 S., R. 12 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 617.00 acres;
Section 7, Protracted, All, 619.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 621.00 acres.

This tract contains 5697.00 acres more or less.

TRACT 37-129

T. 7 S., R. 12 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 623.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 625.00 acres;
Section 31, Protracted, All, 627.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5715.00 acres more or less.

T. 7 S., R. 12 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-131

T. 8 S., R. 11 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-132

T. 8 S., R. 11 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 629.00 acres;
Section 7, Protracted, All, 631.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 633.00 acres.

This tract contains 5733.00 acres more or less.

TRACT 37-133

T. 8 S., R. 11 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5751.00 acres more or less.

TRACT 37-134

T. 8 S., R. 11 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-135

T. 8 S., R. 12 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-136

T. 8 S., R. 12 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 629.00 acres;
Section 7, Protracted, All, 631.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 633.00 acres.

This tract contains 5733.00 acres more or less.

TRACT 37-137

T. 8 S., R. 12 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5751.00 acres more or less.

TRACT 37-138

T. 8 S., R. 12 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-139

T. 5 S., R. 13 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-140

T. 5 S., R. 13 W., FAIRBANKS MERIDIAN

Section 3, Protracted, All, 640.00 acres;
Section 4, Protracted, E1/2, 320.00 acres;
Section 8, Protracted, SE1/4, 160.00 acres;
Section 9, Protracted, E1/2, SW1/4, 480.00 acres;
Section 10, Protracted, All, 640.00 acres.

This tract contains 2240.00 acres more or less.

TRACT 37-141

T. 5 S., R. 13 W., FAIRBANKS MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, E1/2, 320.00 acres;
Section 19, Protracted, S1/2, 300.00 acres;
Section 20, Protracted, E1/2, SW1/4, 480.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This tract contains 3660.00 acres more or less.

TRACT 37-142

T. 5 S., R. 13 W., FAIRBANKS MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-143

T. 5 S., R. 13 W., FAIRBANKS MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-144

T. 5 S., R. 13 W., FAIRBANKS MERIDIAN

Section 27, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-145

T. 5 S., R. 13 W., FAIRBANKS MERIDIAN

Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 601.00 acres;
Section 31, Protracted, All, 603.00 acres;
Section 32, Protracted, All, 640.00 acres.

This tract contains 2484.00 acres more or less.

TRACT 37-146

T. 6 S., R. 13 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-147

T. 6 S., R. 13 W., FAIRBANKS MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 605.00 acres;
Section 7, Protracted, All, 607.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 609.00 acres.

This tract contains 5661.00 acres more or less.

TRACT 37-148

T. 6 S., R. 13 W., FAIRBANKS MERIDIAN

Section 19, Protracted, All, 611.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 613.00 acres;
Section 31, Protracted, All, 615.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5679.00 acres more or less.

TRACT 37-149

T. 6 S., R. 13 W., FAIRBANKS MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-150

T. 7 S., R. 13 W., FAIRBANKS MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-151

T. 7 S., R. 13 W., FAIRBANKS MERIDIAN

Section 3, Protracted, All, 640.00 acres;
Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 617.00 acres;
Section 7, Protracted, All, 619.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres.

This tract contains 5076.00 acres more or less.

TRACT 37-152

T. 7 S., R. 13 W., FAIRBANKS MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 621.00 acres;
Section 19, Protracted, All, 623.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This tract contains 5084.00 acres more or less.

TRACT 37-153

T. 7 S., R. 13 W., FAIRBANKS MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-154

T. 7 S., R. 13 W., FAIRBANKS MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-155

T. 7 S., R. 13 W., FAIRBANKS MERIDIAN

Section 27, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 625.00 acres;
Section 31, Protracted, All, 627.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres.

This tract contains 5092.00 acres more or less.

TRACT 37-156

T. 9 S., R. 8 W., FAIRBANKS MERIDIAN

Section 33, Protracted, All, 640.00 acres.

This Tract contains 640.00 acres more or less.

TRACT 37-157

T. 7 N., R. 6 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This Tract contains 3840.00 acres more or less.

TRACT 37-158

T. 7 N., R. 6 W., COPPER RIVER MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 608.00 acres;
Section 7, Protracted, All, 610.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres.

This Tract contains 3778.00 acres more or less.

TRACT 37-159

T. 7 N., R. 6 W., COPPER RIVER MERIDIAN

Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 612.00 acres;
Section 19, Protracted, All, 613.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres.

This Tract contains 3785.00 acres more or less.

TRACT 37-160

T. 7 N., R. 6 W., COPPER RIVER MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This Tract contains 3840.00 acres more or less.

TRACT 37-161

T. 7 N., R. 6 W., COPPER RIVER MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This Tract contains 3840.00 acres more or less.

TRACT 37-162

T. 7 N., R. 6 W., COPPER RIVER MERIDIAN

Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 615.00 acres;
Section 31, Protracted, All, 617.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This Tract contains 3792.00 acres more or less.

TRACT 37-163

T. 6 N., R. 6 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This Tract contains 2560.00 acres more or less.

TRACT 37-164

T. 6 N., R. 6 W., COPPER RIVER MERIDIAN

Section 3, Protracted, All, 640.00 acres;
Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 619.00 acres;
Section 7, Protracted, All, 621.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres.

This Tract contains 5080.00 acres more or less.

TRACT 37-165

T. 6 N., R. 6 W., COPPER RIVER MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 623.00 acres;
Section 19, Protracted, All, 624.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This Tract contains 5087.00 acres more or less.

TRACT 37-166

T. 6 N., R. 6 W., COPPER RIVER MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This Tract contains 2560.00 acres more or less.

TRACT 37-167

T. 6 N., R. 6 W., COPPER RIVER MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This Tract contains 2560.00 acres more or less.

TRACT 37-168

T. 6 N., R. 6 W., COPPER RIVER MERIDIAN

Section 27, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 626.00 acres;
Section 31, Protracted, All, 628.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres.

This Tract contains 5094.00 acres more or less.

TRACT 37-169

T. 5 N., R. 6 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This Tract contains 3840.00 acres more or less.

TRACT 37-170

T. 5 N., R. 6 W., COPPER RIVER MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 630.00 acres;
Section 7, Protracted, All, 632.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres.

This Tract contains 3822.00 acres more or less.

TRACT 37-171

T. 5 N., R. 6 W., COPPER RIVER MERIDIAN

Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 634.00 acres;
Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres.

This Tract contains 3829.00 acres more or less.

TRACT 37-172

T. 5 N., R. 6 W., COPPER RIVER MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This Tract contains 3840.00 acres more or less.

TRACT 37-173

T. 5 N., R. 6 W., COPPER RIVER MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This Tract contains 3840.00 acres more or less.

TRACT 37-174

T. 5 N., R. 6 W., COPPER RIVER MERIDIAN

Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This Tract contains 3836.00 acres more or less.

TRACT 37-175

T. 5 N., R. 7 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres.

This Tract contains 5760.00 acres more or less.

TRACT 37-176

T. 5 N., R. 7 W., COPPER RIVER MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 630.00 acres;
Section 7, Protracted, All, 632.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 634.00 acres.

This Tract contains 5736.00 acres more or less.

TRACT 37-177

T. 5 N., R. 7 W., COPPER RIVER MERIDIAN

Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 5751.00 acres more or less.

TRACT 37-178

T. 5 N., R. 7 W., COPPER RIVER MERIDIAN

Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 5760.00 acres more or less.

TRACT 37-179

T. 5 N., R. 8 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres;
Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-180

T. 5 N., R. 8 W., COPPER RIVER MERIDIAN

Section 3, Protracted, All, 640.00 acres;
Section 4, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-181

T. 5 N., R. 8 W., COPPER RIVER MERIDIAN

Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 630.00 acres;
Section 7, Protracted, All, 632.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 634.00 acres.

This tract contains 3816.00 acres more or less.

TRACT 37-182

T. 5 N., R. 8 W., COPPER RIVER MERIDIAN

Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres.

This tract contains 3831.00 acres more or less.

TRACT 37-183

T. 5 N., R. 8 W., COPPER RIVER MERIDIAN

Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-184

T. 5 N., R. 8 W., COPPER RIVER MERIDIAN

Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-185

T. 5 N., R. 9 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-186

T. 5 N., R. 9 W., COPPER RIVER MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 630.00 acres;
Section 7, Protracted, All, 632.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres.

This tract contains 3822.00 acres more or less.

TRACT 37-187

T. 5 N., R. 9 W., COPPER RIVER MERIDIAN

Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 634.00 acres;
Section 19, Protracted, All, 635.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres.

This tract contains 3829.00 acres more or less.

TRACT 37-188

T. 5 N., R. 9 W., COPPER RIVER MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-189

T. 5 N., R. 9 W., COPPER RIVER MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-190

T. 5 N., R. 9 W., COPPER RIVER MERIDIAN

Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 637.00 acres;
Section 31, Protracted, All, 639.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 3836.00 acres more or less.

TRACT 37-191

T. 4 N., R. 7 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-192

T. 4 N., R. 7 W., COPPER RIVER MERIDIAN

Section 3, Protracted, All, 640.00 acres;
Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 598.00 acres;
Section 7, Protracted, All, 599.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres.

This tract contains 5037.00 acres more or less.

TRACT 37-193

T. 4 N., R. 7 W., COPPER RIVER MERIDIAN

Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 601.00 acres;
Section 19, Protracted, All, 603.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres.

This tract contains 3764.00 acres more or less.

TRACT 37-194

T. 4 N., R. 7 W., COPPER RIVER MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 601.00 acres;
Section 22, Protracted, All, 603.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-195

T. 4 N., R. 7 W., COPPER RIVER MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-196

T. 4 N., R. 7 W., COPPER RIVER MERIDIAN

Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 605.00 acres;
Section 31, Protracted, All, 607.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 3772.00 acres more or less.

TRACT 37-197

T. 2 N., R. 8 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-198

T. 2 N., R. 8 W., COPPER RIVER MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, excluding those portions of U.S.S. 3336, 3336A, 4824 and 5637 within Section 6, 585.58 acres;
Section 7, Protracted, All, 621.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres.

This tract contains 3766.58 acres more or less.

TRACT 37-199

T. 2 N., R. 8 W., COPPER RIVER MERIDIAN

Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 623.00 acres;
Section 19, Protracted, All, 625.00 acres;
Section 20, Protracted, All, 640.00 acres.

This tract contains 2528.00 acres more or less.

TRACT 37-200

T. 2 N., R. 8 W., COPPER RIVER MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-201

T. 2 N., R. 8 W., COPPER RIVER MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-202

T. 2 N., R. 8 W., COPPER RIVER MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-203

T. 2 N., R. 8 W., COPPER RIVER MERIDIAN

Section 27, Protracted, All, 640.00 acres;
Section 28, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres.

This tract contains 2560.00 acres more or less.

TRACT 37-204

T. 2 N., R. 8 W., COPPER RIVER MERIDIAN

Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 626.00 acres;
Section 31, Protracted, All, 628.00 acres;
Section 32, Protracted, All, 640.00 acres.

This tract contains 2534.00 acres more or less.

TRACT 37-205

T. 4 N., R. 9 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, 640.00 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-206

T. 4 N., R. 9 W., COPPER RIVER MERIDIAN

Section 4, Protracted, All, 640.00 acres;
Section 5, Protracted, All, 640.00 acres;
Section 6, Protracted, All, 598.00 acres;
Section 7, Protracted, All, 599.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres.

This tract contains 3757.00 acres more or less.

TRACT 37-207

T. 4 N., R. 9 W., COPPER RIVER MERIDIAN

Section 16, Protracted, All, 640.00 acres;
Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 601.00 acres;
Section 19, Protracted, All, 603.00 acres;
Section 20, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres.

This tract contains 3764.00 acres more or less.

TRACT 37-208

T. 4 N., R. 9 W., COPPER RIVER MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 15, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-209

T. 4 N., R. 9 W., COPPER RIVER MERIDIAN

Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres;
Section 27, Protracted, All, 640.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-210

T. 4 N., R. 9 W., COPPER RIVER MERIDIAN

Section 28, Protracted, All, 640.00 acres;
Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 605.00 acres;
Section 31, Protracted, All, 607.00 acres;
Section 32, Protracted, All, 640.00 acres;
Section 33, Protracted, All, 640.00 acres.

This tract contains 3772.00 acres more or less.

TRACT 37-211

T. 2 N., R. 9 W., COPPER RIVER MERIDIAN

Section 1, Protracted, All, excluding that portion of U.S.S. 5637 and 4824 within Section 1, 627.01 acres;
Section 2, Protracted, All, 640.00 acres;
Section 3, Protracted, All, 640.00 acres;
Section 10, Protracted, All, 640.00 acres;
Section 11, Protracted, All, 640.00 acres;
Section 12, Protracted, All, 640.00 acres.

This tract contains 3827.01 acres more or less.

TRACT 37-212

T. 2 N., R. 9 W., COPPER RIVER MERIDIAN

Section 4, Protracted, All, excluding U.S.S. 2915, 4862 Lots 1 and 3, and 3346, Lots 3, 4 and 5, and NW1/4NW1/4, 409.21 acres;
Section 5, Protracted, All, excluding E1/2NE1/4NE1/4, 620.00 acres;
Section 6, Protracted, All, excluding that portion of U.S.S. 3677 within Section 6, 605.15 acres;
Section 7, Protracted, All, 621.00 acres;
Section 8, Protracted, All, 640.00 acres;
Section 9, Protracted, All, 640.00 acres.

This tract contains 3535.36 acres more or less.

TRACT 37-213

T. 2 N., R. 9 W., COPPER RIVER MERIDIAN

Section 17, Protracted, All, 640.00 acres;
Section 18, Protracted, All, 623.00 acres;
Section 19, Protracted, All, 625.00 acres;
Section 20, Protracted, All, 640.00 acres.

This tract contains 2528.00 acres more or less.

TRACT 37-214

T. 2 N., R. 9 W., COPPER RIVER MERIDIAN

Section 15, Protracted, All, 640.00 acres;
Section 16, Protracted, All, 640.00 acres;
Section 21, Protracted, All, 640.00 acres;
Section 22, Protracted, All, 640.00 acres;
Section 27, Protracted, E1/2, 320.00 acres.

This tract contains 2880.00 acres more or less.

TRACT 37-215

T. 2 N., R. 9 W., COPPER RIVER MERIDIAN

Section 13, Protracted, All, 640.00 acres;
Section 14, Protracted, All, 640.00 acres;
Section 23, Protracted, All, 640.00 acres;
Section 24, Protracted, All, 640.00 acres;
Section 25, Protracted, All, 640.00 acres;
Section 26, Protracted, All, 640.00 acres.

This tract contains 3840.00 acres more or less.

TRACT 37-216

T. 2 N., R. 9 W., COPPER RIVER MERIDIAN

Section 33, Protracted, S1/2, 320.00 acres;
Section 34, Protracted, All, 640.00 acres;
Section 35, Protracted, All, 640.00 acres;
Section 36, Protracted, All, 640.00 acres.

This tract contains 2240.00 acres more or less.

TRACT 37-217

T. 2 N., R. 9 W., COPPER RIVER MERIDIAN

Section 29, Protracted, All, 640.00 acres;
Section 30, Protracted, All, 626.00 acres;
Section 31, Protracted, All, 628.00 acres.

This tract contains 1894.00 acres more or less.

APPENDIX IV

AMOCO PRODUCTION COMPANY
Tulsa, Oklahoma
May 11, 1982

82131ART0024

FILE: T.S. 825088SX

TO: David Versteeg, Denver

ATTN: S. F. Waller

SUBJECT: Petrology of Selected Tertiary and Cretaceous Outcrop Samples of the Minchumina and Middle Tanana Basins, Alaska

SUMMARY

Petrographic analyses were conducted on selected outcrop specimens of Tertiary and Cretaceous sandstones for the purpose of predicting reservoir quality of correlative units intercepted in the subsurface. Visual estimates of the porosity of samples 4, 10, 21, 26, 52, 54, and 56 are 20-30%. Samples 76, 77, 95, 107 and 113 were found to be well indurated with visual estimates of porosity to be 1-10%. In the first set of samples, the high porosities can be attributed to three factors:

1. Dilation, possibly, accompanying shallow fault related tectonics

2. The lack of substantial physical compaction

3. No significant amount of authigenic crystalline growth.

Compaction and further cementation will reduce the reservoir quality of correlative units intercepted in the subsurface. The effects due to the fault related, shallow burial cataclasis (dilation, grain size reduction and decrease in textural maturity) will be reduced in units found outside the tectonically altered zone. These units have good potential reservoir quality.

The poor reservoir quality of the second set of samples can be attributed to four factors:

1. Initial textural immaturity

2. Strong physical and chemical compaction

3. Abundant clay and quartz cementation

4. The lack of secondary porosity dissolution development.

Similar lithologic units intercepted in the subsurface are not likely to have maintained or generated economic reservoir quality.

[redacted]

DISCUSSION

These samples were collected as part of a reconnaissance field program conducted during the summer of 1981. Thirteen samples were forwarded to the author for petrographic analyses. Twelve (12) sandstones and one (1) sandy siltstone comprise the specimens examined. The sandstones are poorly to moderately sorted, medium grained to pebbly gritstone with compositions of litharenite and feldspathic litharenite. Samples 4, 10, 21, 26, 52, 54, and 56 are very porous and extremely friable. Samples 76, 77, 95, 107, and 113 are typically well indurated and contain little porosity. Sample 110 is a spotted sandy siltstone.

The friable sands contain small amounts of clay, quartz, and zeolite cements. Because the sandstone contains argillaceous grains, much of the clay reported in the Table of X-ray Diffraction Mineral Percentages is not of intergranular authigenic origin. Traces of authigenic clay were believed to have been observed associated with etched and crushed grains. Sparse pore linings and fillings of the zeolite heulandite were found in samples 4 and 54. Incipient quartz overgrowths were observed in all sandstones.

Samples 76 through 113 contain variable amounts of authigenic clay and quartz. Chlorite and illite dominate. Strong compaction of ductile argillaceous and metamorphic rock fragments reduced much of the original intergranular porosity. These sandstones are poorly sorted. No significant amount of grain and/or cement leaching has occurred. These units appear to have poor potential reservoir quality.

CATACLASIS & ROCK FABRIC - DISCUSSION

A few of the very friable sandstones (samples nos. 21, 26, 52 and 56) have textures which indicate the rocks have undergone cataclasis. The A.G.I. Glossary of Geology (Gary, et al., 1974) gives as a definition for cataclasis: "Rock deformation accomplished by fracture and rotation of mineral grains or aggregates without chemical reconstitution". These sands contain grains which are only partially fractured, aggregates of fragments whose shape suggests that they were originally one grain, and areas of pulverized grains. Only trace amounts of clay or other silicate cements have been detected. This pervasive chaotic fabric suggests that these rocks have undergone tectonic deformation possibly associated with faulting. Discussions with Amoco Denver geologist Bob Kemp revealed that these samples were collected in the area of the Denali and associated faults.

Recognition of this deformation is important in understanding how representative the reservoir quality of these samples are for correlative lithologies found outside the area of tectonic deformation. Specifically, how has this process affected the porosity and permeability of the collected samples? A couple of points require discussion:

The visual estimates of porosity of these samples are high: 20-30%. The cataclasis associated with faulting of shallowly buried sediments is likely to include dilation of the bulk rock effected by the faulting. Hence,

these very high porosities are in part a result of the tectonic disruption of the depositional fabric. Similar units intercepted at depth and/or away from the tectonic area will likely have somewhat reduced porosities.

As these sands occur today, the pore geometry, grain shape, size and sorting have been changed by deformation. Permeability is a function of these basic sandstone textures. The permeabilities of correlative lithologies found outside the zone of faulting may be higher or lower than that anticipated for these sands. The change will depend upon the dominance of opposing trends of the variation of permeability with changes in grain size and sorting (decreasing permeability with decreasing grain size and sorting) and that variation of permeability with changes in porosity (increasing permeability with increasing porosity).

X-RAY DIFFRACTOMETRY DATA

Thirteen samples were processed for major mineral analyses. Five grams of each sample were ground to pass through a 508 mesh screen (<28 microns), a portion of which was used for a random-mount whole rock analyses. <2 micron size fractions were prepared for the clay analyses. The <2 micron samples were run twice: prior to and after saturation with ethylene glycol.

The estimates of mineral percentages are of course semi-quantitative. These samples contain abundant both argillaceous and low to moderate grade metamorphic lithic fragments. Much of the reported clay listed in the Table of X-ray Diffraction Mineral Percentages represents clay <u>in</u> those fragments. Samples 4 through 56 are very porous and contain only small amounts of <u>in situ</u> authigenic clay. Samples 76 through 113 contain variable amounts of authigenic clay. Samples 76 and 107 contain appreciable amounts of clay pore fill.

LITHOLOGIC DESCRIPTIONS

I-81-4: Medium to fine grained feldspathic litharenite containing mostly monocrystalline quartz and microgranular rock fragments of sedimentary and metamorphic origin. Feldspar is common. Minor amounts of volcanic rock fragments and biotite are present. The zeolite heulandite occurs as microlaths in a sparse coating of grains and dissolution pores. Porosity is very high-visual estimates of 25 to 30%. Primary intergranular porosity is the dominant type. Traces of partial dissolution of feldspar, rock fragments, and hornblende have generated secondary porosity. Permeabilities are likely to be relatively low due to the many euhedral microlites lining pores and restricting pore throats. Water saturations could be expected to be higher than anticipated for a sandstone of this grain size and sorting.

Similar units at depth could possibly experience continued zeolitization and/or clay pore-filling. Compaction accompanying deep burial will be pronounced: increased ductile grain deformation resulting in loss of intergranular pore space.

I-81-10: Coarse to very coarse grained, poorly sorted litharenite composed of angular to subangular metamorphic quartzitic rock fragments and minor amounts of feldspar and sedimentary rock fragments. Only traces of cements and/or matrix is visible as sparse and discontinuous grain coatings. Porosity is very high-visual estimates of 25% to 30%. Permeability should be high due to the lack of any significant authigenic clays or other cements occupying the pore throats. Similar units intercepted at depth would likely contain some clay or other cement. Compaction is likely to be a major factor in porosity reduction at great depth.

I-81-21: Medium grained, moderately sorted litharenite composed of angular to subangular fine grained quartzitic metamorphic and sedimentary rock fragments, poly- and mono-crystalline quartz, mica, and traces of volcanic/metavolcanic rock fragments. The sample is very porous - 25% to 30%.

Permeability of this sand should be high. Only traces of authigenic clay coatings are apparent.

I-81-26: Medium to fine grained, poorly sorted feldspathic litharenite composed of angular quartz, feldspar, and metamorphic rock fragments. The original fabric of the sample has been disrupted by grain fracturing, rotation and pulverization. Very porous-visual estimates of 25-30%. No significant amount of clay or other authigenic phase present.

I-81-52: Medium grained, subangular to angular, moderately sorted feldspathic litharenite composed of quartz, feldspar, phyllitic and metasedimentary rock fragments. Less fractured and disrupted than I-81-26, however, shows some fracturing and crushing of grains. Very porous-visual estimates of 25%. No apparent clay. Incipient dissolution of feldspars and rock fragments has occurred along grain boundaries and fracture surfaces. Primary porosity is dominant.

I-81-54: Fine-grained, angular, moderately sorted feldspathic litharenite composed of quartz, feldspar, and metamorphic rock fragments. Hornblende, colorless amphibole, biotite, muscovite and garnet are present. Amphibole is an important accessory phase. Very porous-visual estimate of ~20%. No apparent disruption similar to that found in other samples. Incipient zeolite cementation occurs as lath and tabular shaped crystals attached to grain surfaces and filling small pores.

I-81-56: Medium to fine grained, poorly-sorted feldspathic litharenite composed of quartz, feldspar and metamorphic rock fragments. Very porous-visual estimate of 25%. Strongly fractured quartz and feldspar. Traces of dissolution (serrated fragment edges) and incipient clay linings occur with the crushed feldspars. This cataclasis has likely greatly disturbed original depositional fabric.

I-81-76: Medium grained, poorly sorted litharenite composed of strongly compacted metavolcanic/volcanic, microgranular rock fragments, altered feldspar and strained and polycrystalline quartz. This rock is tight due to the complete destruction of intergranular porosity by both clay and quartz cementation subsequent to ductile deformation of rock fragments. Chlorite (pennine) appears within the rock fragments as well as pore filling. Under plane light grain boundaries are in many case indistinguishable. No apparent sign of secondary porosity development. Very poor potential reservoir quality.

I-81-77A: Lithic pebble conglomerate with rounded to subangular clasts of silty mudstone, volcanic fragments, chert and metasedimentary rock fragments. The matrix is a medium grained lithic sand. The conglomerate is clast supported with 5-10% matrix. Crushed fragments possibly contribute to the matrix. Open fractures are present, held open by partial quartz cementation. 1-2% porosity by visual estimate. Microstylolites are common. Poor potential reservoir quality.

I-81-77B: Poorly sorted gritstone (lithic arenite) - companion sample to 77A. No porosity, minor cement. Much compaction and microstylolites.

I-81-95: Moderately sorted gritstone composed of subrounded chert, polycrystalline quartz, sandy siltstone fragments, metasedimentary rock fragments and minor feldspar and altered volcanic rock fragments. Only minor amounts of clay and quartz cementation. Porosity by visual estimate is 7-10%. Mostly intergranular porosity with traces of secondary porosity developed by the dissolution of volcanic and argillaceous rock fragments. Many grains have been fractured and show fracture porosity resulting from dilation of the bulk rock. Poor to fair potential reservoir quality.

I-81-107: A coarse grained sandstone to gritstone, poorly sorted, containing subangular grains of chert, polycrystalline quartz, and siltstone. Strongly compacted. Visual estimate of porosity is 1-2%. Mostly intergranular but includes minor partial dissolution of chert fragments. Ductile deformation of the fine grained rock fragments has aided the complete destruction of the intergranular porosity. Intergranular pore space is filled with clay and semi-opaques believed to be iron oxides, iron hydroxides and siderite. Very poor potential reservoir quality.

I-81-110: Spotted sandy siltstone. This specimen is undergoing incipient mineral segregation exemplified by the formation of the mica rich "spots". Mottled textures similar to this are found in volcanogenic deposits of the lower zeolite metamorphic facies.

I-81-113: Very coarse grained poorly sorted litharenite composed of subangular to angular grains of polycrytalline quartz, chert, siltstone, and metamorphic rock fragments. Minor amounts of feldspar, and volcanic rock fragments are present. Visual estimates of porosity are 3-5% with approximately 1-2% the result of dissolution of rock fragments of the sparse calcite cements. Clay and minor quartz cements are present. Strongly compacted. Poor potential reservoir quality.

Thomas L. Dunn

PRJ

TLD:tw

cc: L. C. Babcock
N. G. Higgs
R. A. Nelson

82131ART0024

Acknowledgments

Discussions with Ron Nelson and Nigel Higgs of the Tulsa Research Center's Structural Geology Group on the effects of cataclasis on porosity and permeability were very helpful.

TLD:tw

82131ART0024

References

Gary, M., McAfee, R., Jr., and Wolf, C. I., 1972, Glossary of Geology, American Geological Institute, Falls Church, Va., p. 110.

TLD:tw

CAUTION: THESE ESTIMATES ARE ONLY SEMI-QUANTITATIVE.

X-RAY DIFFRACTION MINERAL PERCENTAGES

LOCALITY: Alaska Interior Basins

T.S. NO.: 82-5088SX

FORMATION:

CHARGE: 5088

AGE:

SAMPLE ID. NUMBER	QRTZ	FELD	CALC	DOL	SIDR	ANHY	GYPS	PYRT	BARI	KAOL	ILLI	CHLR	MONT	MXLR	*HEUL	CELE
I-81-04	78	10								5	5	TRC			2	
I-81-10	81	8									4	7				
I-81-21	74	12								6	4	TRC	4			
I-81-26	78	8									4	6	4			
I-81-52	82	10									TRC	3	5			
I-81-54	79	11								7	3	TRC	TRC		TRC	
I-81-56	82	6								5	4	3				
I-81-76	65	20									TRC	15				
I-81-77	64	10	3								8	15				
I-81-95	84	TRC								8	8					
I-81-107	78	TRC			2					8	12					
I-81-110	67	5									10	18				
I-81-113	79	3	6							6	2	4				

* HEUL = HEULANDITE/CLINOPTILOLITE (A ZEOLITE)

TECHNICAL SERVICE NO. 82-50885X

SANDSTONE : THIN SECTION DESCRIPTION

NAME Outcrop

LOCATION Alaska Interior Basins : Minchumina : Middle Tanana

FORMATION _____

AGE _____

DATE 4/82

SAMPLE NUMBER	WHOLE ROCK (100%)				GRAINS (100%)														MATRIX (100%)							CEMENT (100%)							PRESSURE SOLUTION	POROSITY TYPES (100%)			GRAIN SIZE (mm) (100%)						SORTING	ROUNDNESS (based on detrital grain outlines)	DIAGENETIC SEQUENCE								MONOXTALLINE QTZ	POLYXTALLINE QTZ	PYROBITUMEN	ROCK TYPE	COMMENTS
	GRAINS	MATRIX	CEMENT	PORES	QTZ + QTZITE	CHERT	FELDSPAR				Amphibole & Hornbl.	OTHERS:	LITHIC FRAGMENTS	SHALE	SILT	PLUTONIC	VOLCANIC	METAMORPHIC	ARGILLACEOUS MAT'L	SHALE	ILLITE - SERICITE	KAOLINITE	MONTMORILLOMITE	CHLORITE	SILT & SAND	QUARTZ	CALCITE	DOLOMITE	SIDERITE	CLAY	CHLORITE	OTHER: Zeolite		INTERGRANULAR	DISSOLUTION	FRACTURE	VC > 1.0	C 0.5 - 1.0	M 0.25 - 0.5	F 0.13 - 0.25	VF 0.06 - 0.13	SILT < 0.06			OLDEST → YOUNGEST										FOLK, 1968	
I-81-4	70	-	5	25	X		X								X		TR	X										TR		X		X	TR				X				M	SA							X	X		F.L.	ZEOLITE (HEUL) LINING PORES
I-81-10	75	-	TR	25	X	X	X											X										TR				X			X	X					P	A							X	X		L.	
I-81-21	74	-	1	25	X		X								X		TR	X										TR				X					X				M	A							X	X		L.	INCIPIENT CLAY COATS
I-81-26	75	-	TR	25	X		X								X	TR		X										TR				X		X			X	X			P	A							X	X		F.L.	CATACLASTIC DEFORMATION
I-81-52	75	-	-	25	X		X								X	TR		X														X	TR	X			X				M	SA-A							X	X		F.L.	CATACLASIS LESS THAN 1/2 G
I-81-54	79	-	1	20	X		X				X					TR		X													X		X	TR				X				M	A							X	X		F.L.	TRACES OF HEUL LINING PORES
I-81-56	75	-	TR	25	X	X	X									TR		X										TR				X		X	TR	X			X	X		P	SA-A							X			F.L.	CATACLASIS
I-81-76	90	-	10	TR	X		X										X								TR				10					TR			X			P	SA-SR							X	X		L.	LITHICS STRONGLY COMPACTED.
I-81-77	83	10	5	2	X	X								X	X		X							X	X				X					TR	X						P	SA-SR							X			L.	PEBBLE CONG. & GRITSTONE OPEN FRACTURES
I-81-95	88	-	2	10	X	X									X		X	X								X			TR				X	TR	X	X					M	SA-SR							X	X		L.	GRITSTONE
I-81-107	84	-	15	1	X	X	TR							X	X			X								X			X	10				TR	TR						P	SA							X	X		L.	GRITSTONE
I-81-110																																																					SPOTTED SANDY SILTSTONE
I-81-113	87	-	10	3	X	X	TR								X		X	X								X	X	TR		X				X	X		X				P	SA								X		L	GRITSTONE

MINERALOGY : FE - Feldspar, SI - Quartz (Silica)
CA - Calcite, DO - Dolomite, SR - Siderite
IL - Illite/Sericite, KA - Kaolin
MO - Montmorillonite, CH - Chlorite
OT - Others, SO - Solution Porosity

[redacted] Atlantic Production Company

ABBREVIATIONS: Sorting: P - Poor, M - Moderate, W - Well, VW - Very Well
Roundness: A - Angular, SA - Subangular, SR - Subround, R - Round
F.L. - Feldspathic litharenite
L. - Litharenite
TR - Trace Amount Present.

INTERIOR BASINS, ALASKA 1981 FIELD PROGRAM

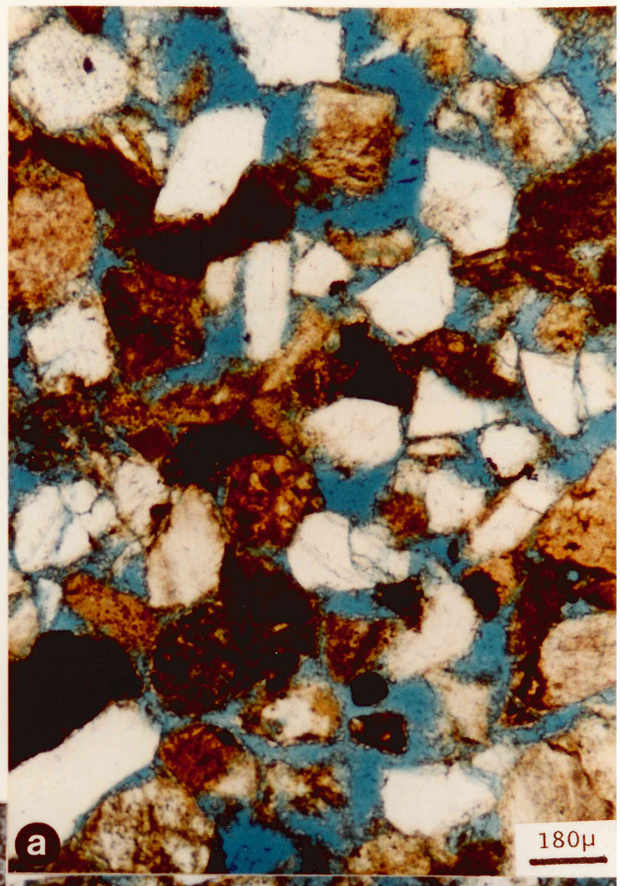
CLASTIC PETROLOGY SAMPLES Project

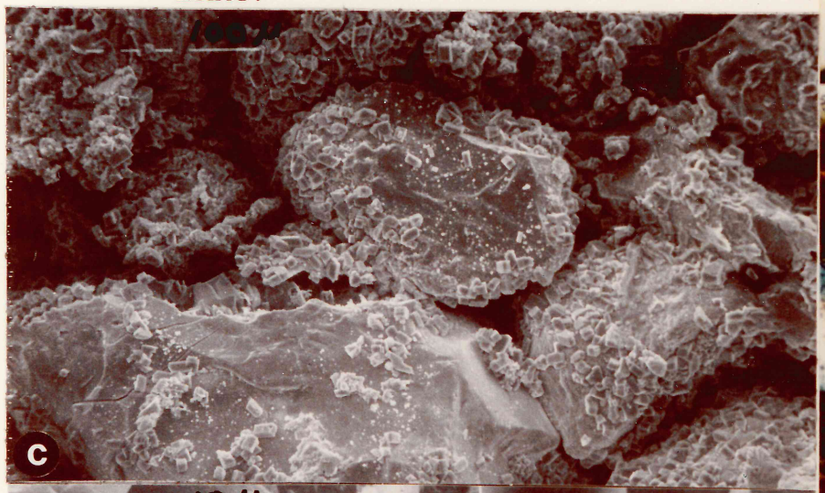
Sample	ID	Location				Quad	Latitude	Longitude	Formation	Lithology	Meridian	API Number			
		Spot	Sec	Twn	Rge										
I-81-4	3	NW ¼	20	10S	5E	Big Delta	64°11'	147°43'		Sandstone	Fairbanks Meridian	50	039	99800	00
I-81-10	5	NW ¼	1	11S	4E	Mt.Hayes	64°00'	146°53'		Sandstone	" "	50	173	99800	00
I-81-21	15	SE ¼	31	10S	1W	Fairbanks	64°00'30"	147°50'30"		Sandstone	" "	50	083	99800	05
I-81-26	18	NW ¼	3	12S	7W	Healy	63°57'30"	148°55'		Sandstone	" "	50	105	99800	01
I-81-52	37	NE¼	24	12S	7W	Healy	63°54'30"	148°51'		Sandstone	" "	50	105	99800	02
I-81-54	37	"	"	"	"	"	"	"		Sandstone	" "	"	"	"	"
I-81-56	37	"	"	"	"	"	"	"		Sandstone	" "	"	"	"	"
I-81-76	51	NW ¼	35	22S	22E	Medfra	63°32'30"	154°34'		Quartzite	Kateel River Meridian	50	165	99800	09
I-81-77	52	SW ¼	34	25N	22W	McGrath	62°12'45"	153°20'30"		Conglomerate	Seward Meridian	50	161	99800	00
I-81-95	63	SW ¼	19	27N	26W	McGrath	62°25'	154°10'		Conglomerate	" "	50	161	99800	04
I-81-107	70	NW ¼	27	18S	28E	Medfra	63°54'	153°21'30"		Sandstone	Kateel River Meridian	50	165	99800	22
I-81-110	72	NE ¼	9	25N	34W	McGrath	62016'15"	155°36'		?	Seward Meridian	50	161	99800	05
I-81-113	75	SW ¼	32	26N	28W	McGrath	62°18'	154°30'		Sandstone	Seward Meridian	50	161	99800	08

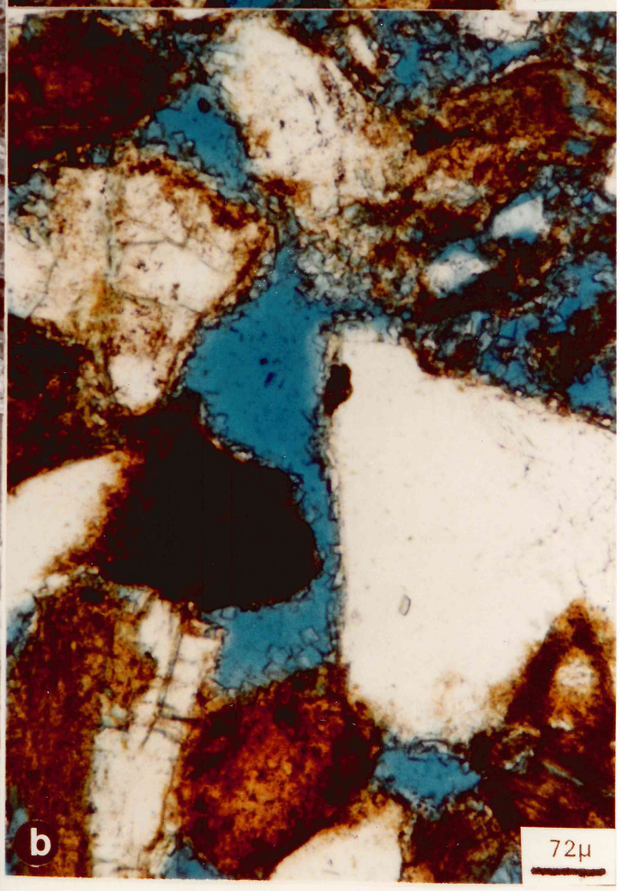
Title: Sample No. I-81-4
T.S. 825088SX
May 11, 1982

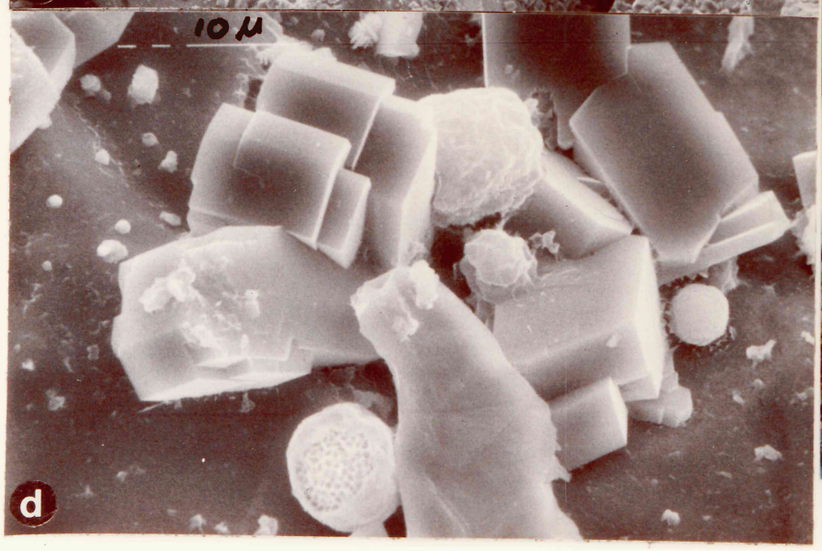
Sparse coatings of the zeolite heulandite are visible as minute euhedra in each of the photos. B and C best show the effects of heulandite cementation: increase in surface area and reduction of pore throat size. The semi-spherical/anhedral masses shown in contact with the heulandite crystals in D register as iron and silica on the Kevex. They are possibly iron and silica hydroxides.

The sandstone is a medium grained feldspathic litharenite containing mostly quartz, feldspar, metamorphic and argillaceous rock fragments.



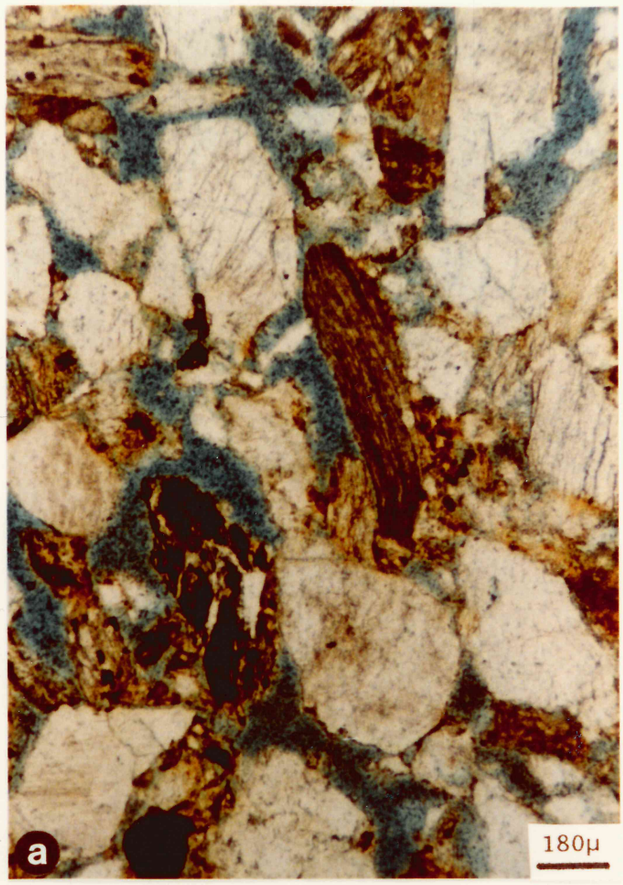


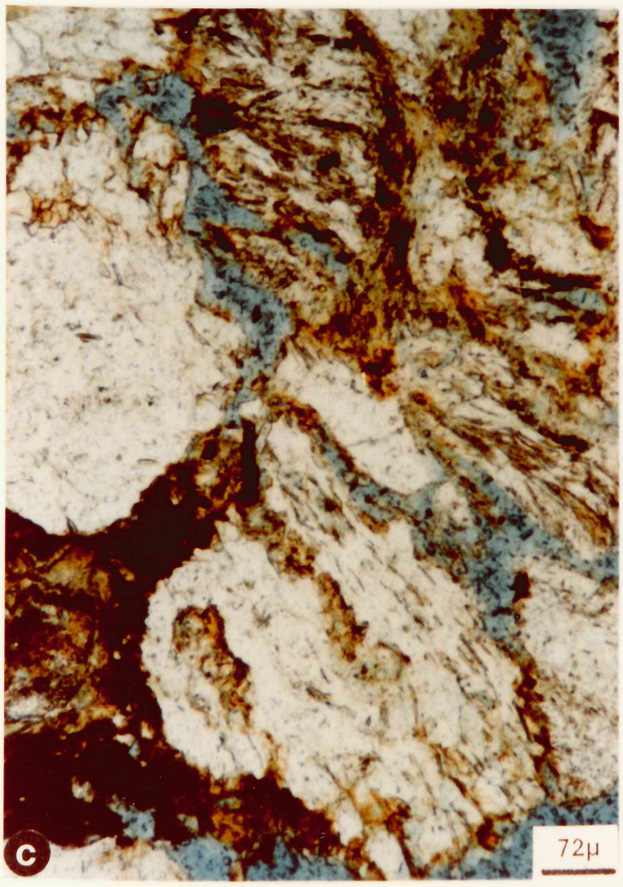




Title: Sample No. I-81-10
T.S. 825088SX
May 11, 1982

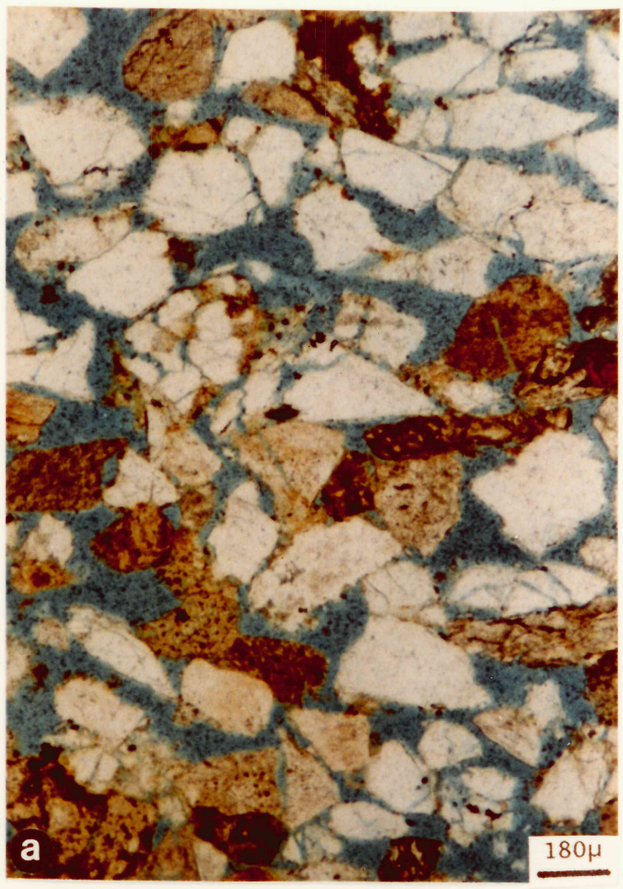
This is a coarse to very coarse grained litharenite composed of quartzose metamorphic rock fragments, quartz and some sedimentary rock fragments. The sample has undergone some fabric disruption indicated by the many broken grains and irregular pore geometry. Photo C shows a crushed opaque grain (organic material?) caught between two quartzose metamorphic rock fragments.

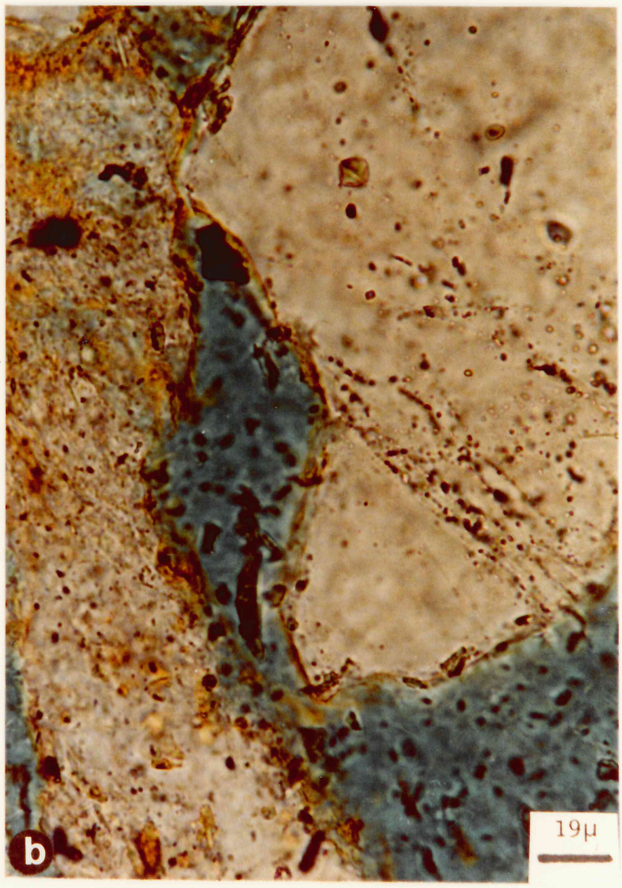




Title: Sample No. I-81-21
T.S. 825088SX
May 11, 1982

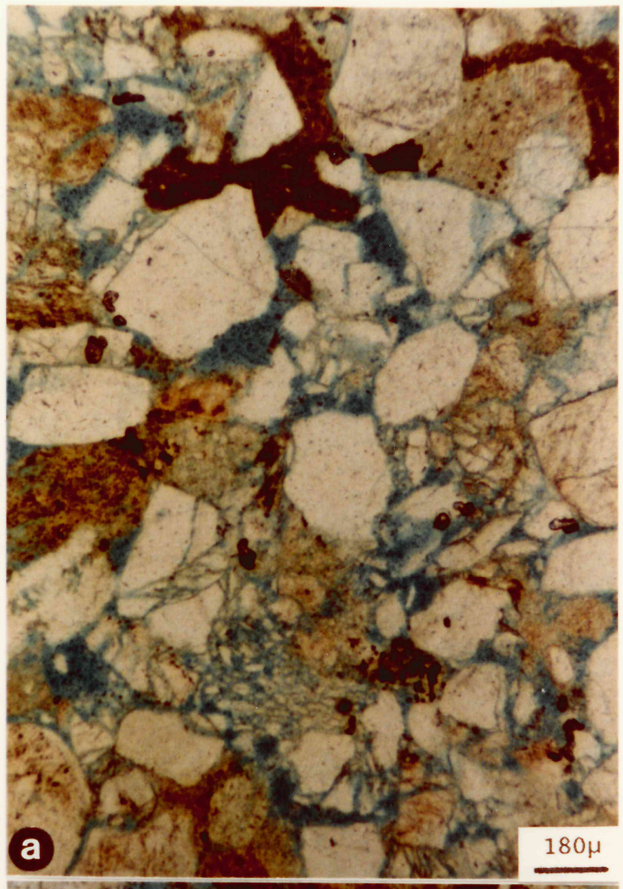
Medium grained litharenite. Note the many grains in A which shows fragmentation, evidence of tectonic deformation. Very porous. Photo B is a close up of a quartz grain which shows an incipient clay coating.

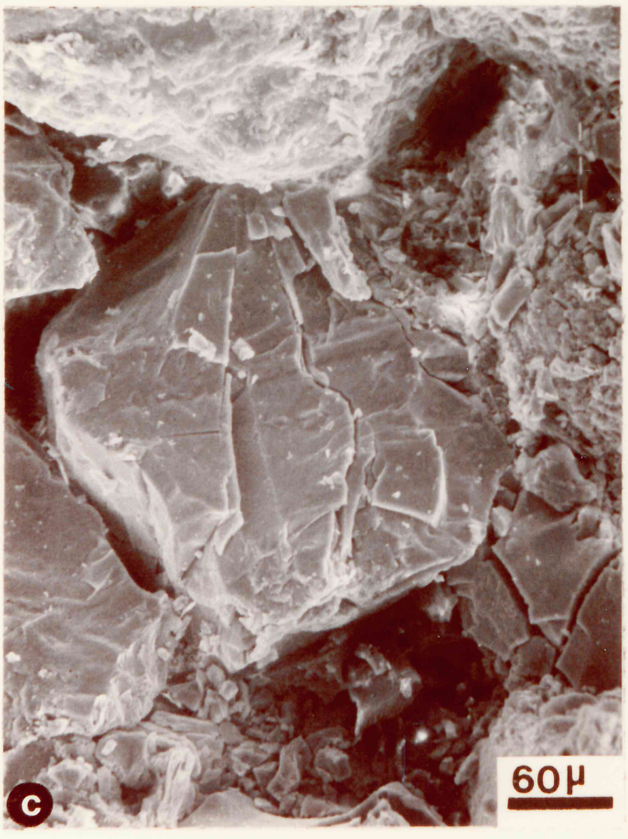


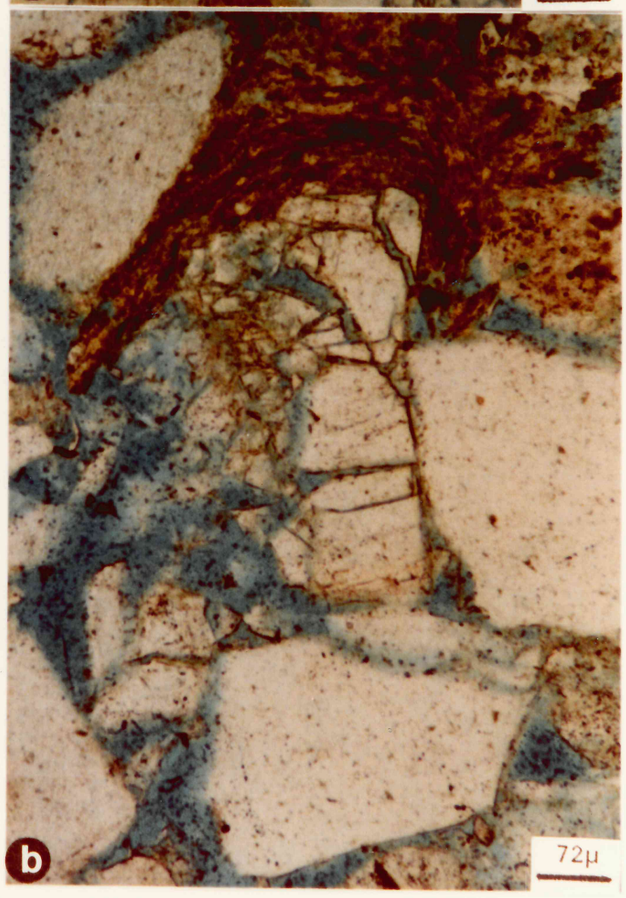


Title: Sample No. I-81-26
T.S. 825088SX
May 11, 1982

This sample has been pervasively shattered. The cataclasis has completely disrupted the internal fabric of the sandstone and reduced the overall grain size.

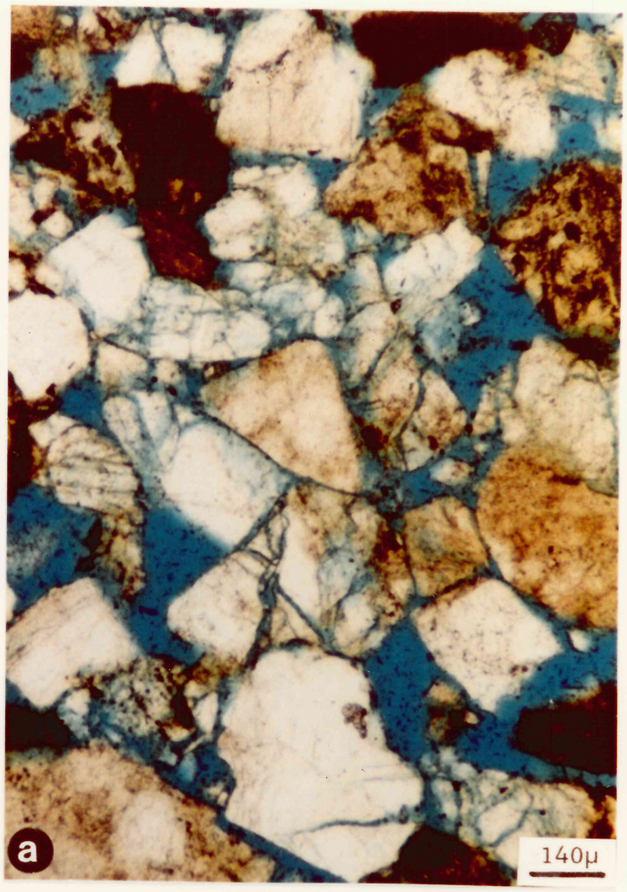


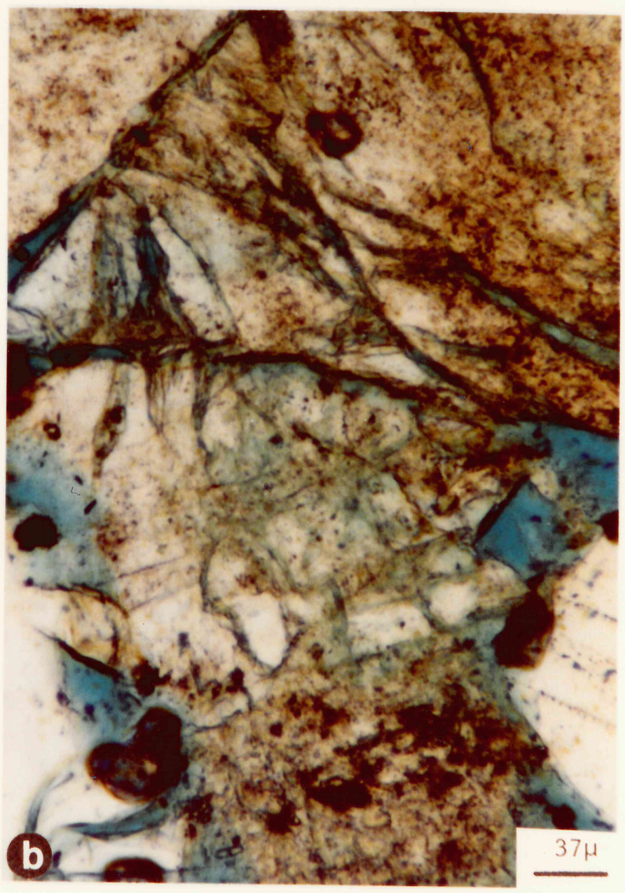




Title: Sample No. I-81-52
T.S. 825088SX
May 11, 1982

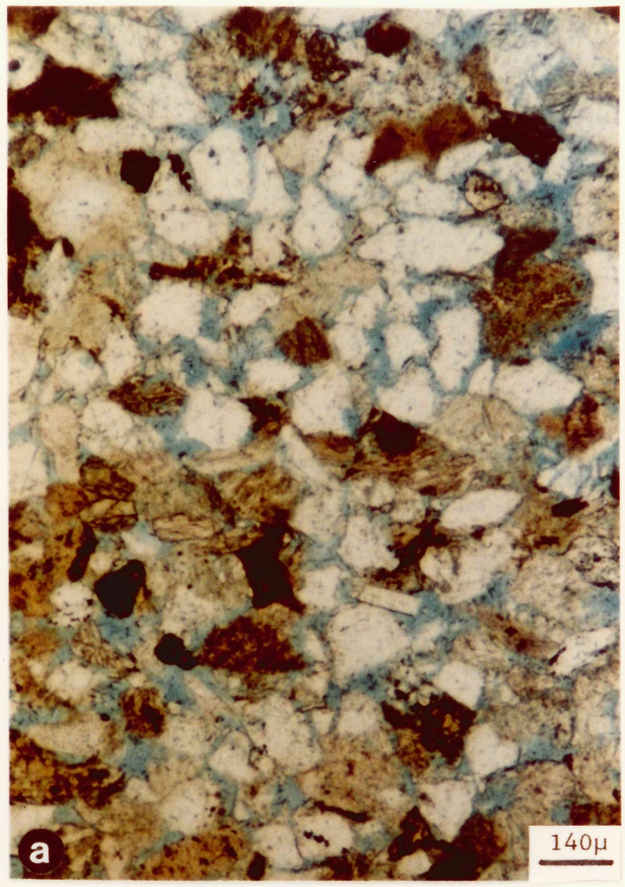
This is a medium grained feldspathic litharenite which has undergone mild cataclasis. Photo B shows a fractured feldspar grain. The fracture walls appear serrated and irregular in width suggesting some dissolution has occurred subsequent to the cataclasis.

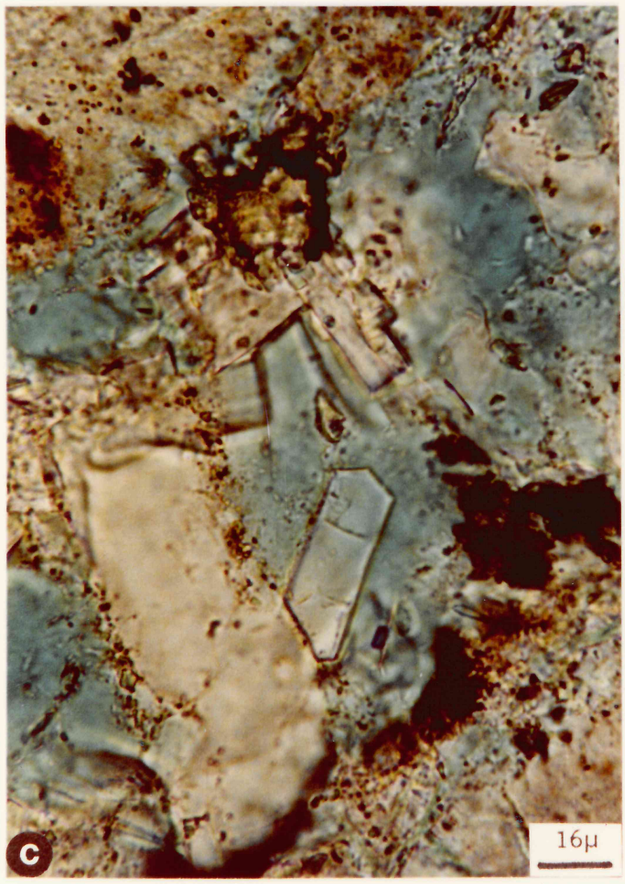


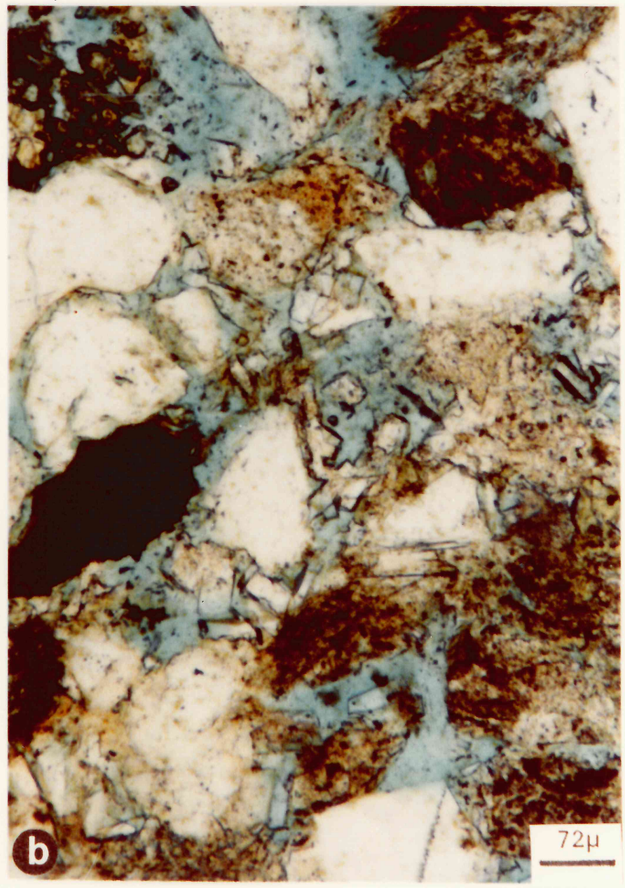


Title: Sample No. I-81-54
T.S. 825088SX
May 11, 1982

This is a fine grained feldspathic litharenite containing mostly quartz, metamorphic and argillaceous rock fragments. Hornblende is a common accessory phase. Crystallites of heulandite shown in Photo B and C are euhedral laths and prisms occupying the intergranular pore spaces.

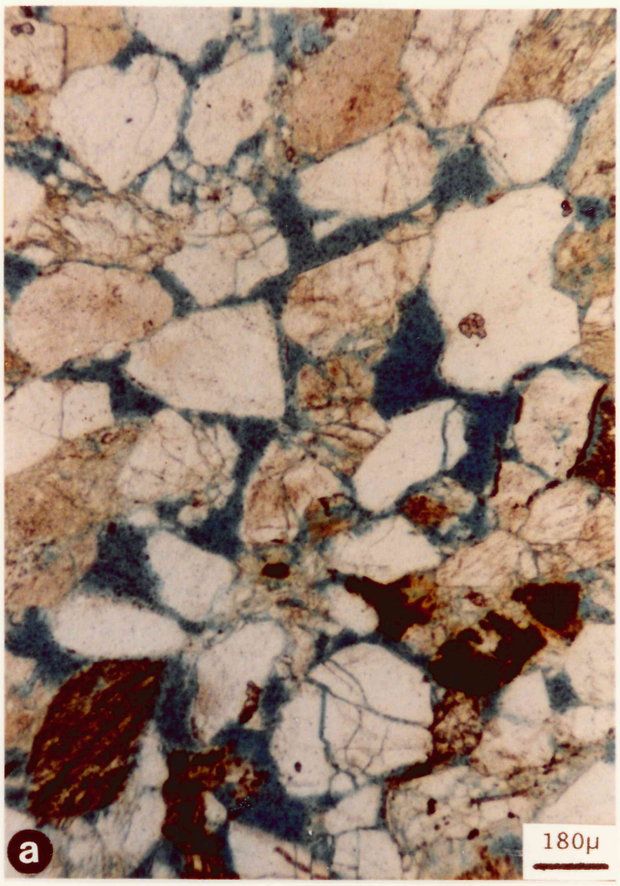


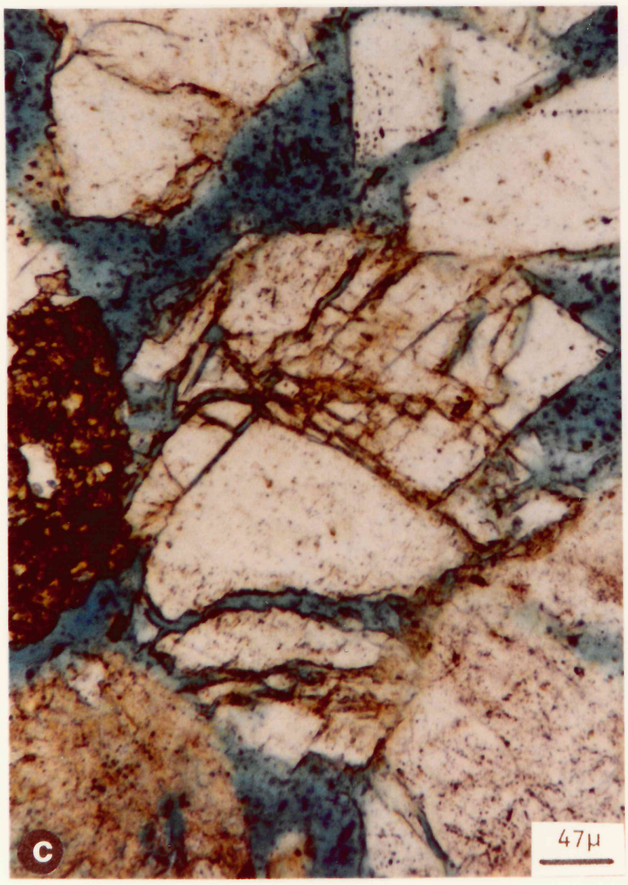


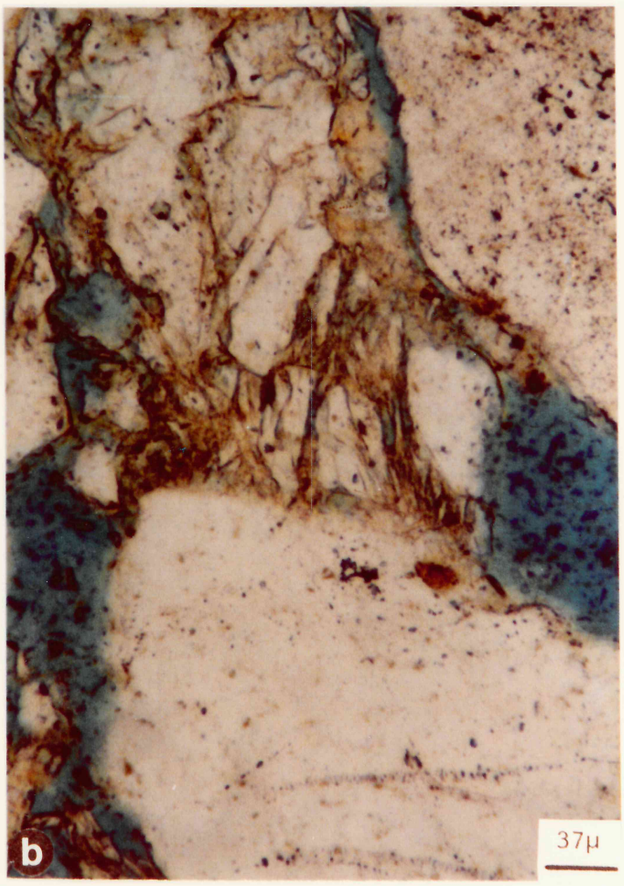


Title: Sample No. I-81-56
T.S. 825088SX
May 11, 1982

This is a medium to fine grained feldspathic litharenite which has undergone cataclasis. The fragmentation is pervasive. Minor dissolution has occurred after fracturing. The green tints observed within the fractured grain in Photo B is suggestive of incipient clay formation.

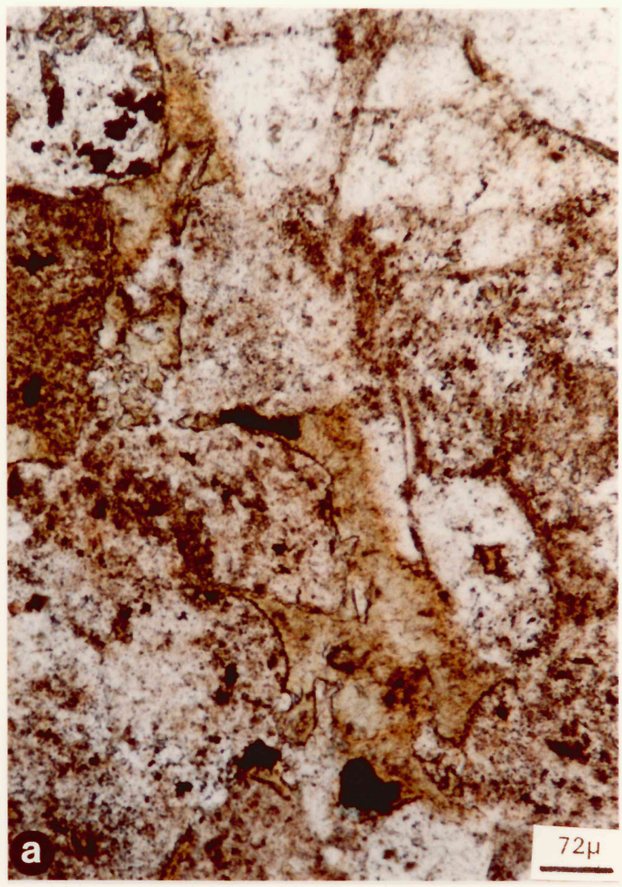


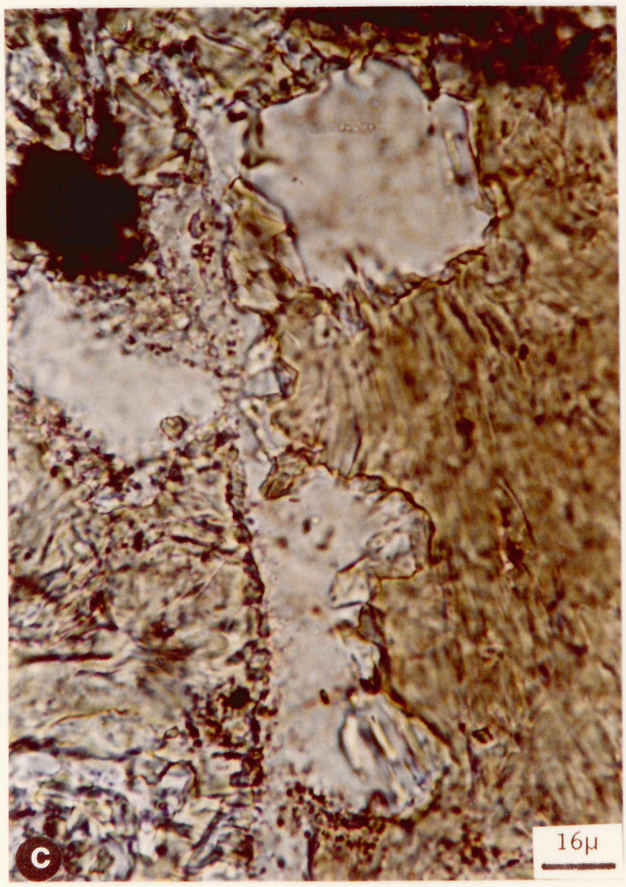


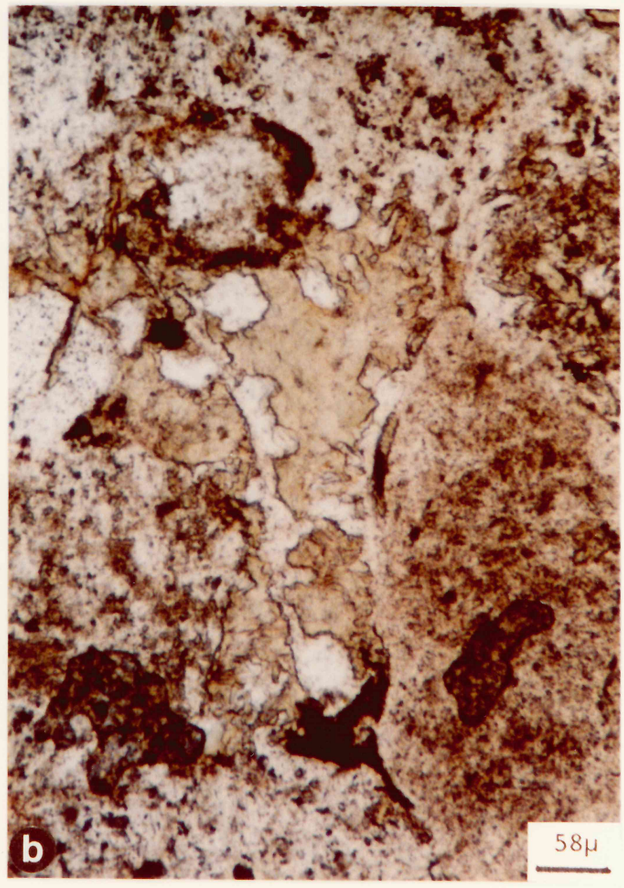


Title: Sample No. I-81-76
T.S. 825088SX
May 11, 1982

This is a poorly sorted medium grained litharenite with only traces of visible porosity. Compaction, clay and quartz cementation have destroyed the original intergranular porosity. Photos B & C show views of an intergranular pore area which has been filled first by quartz and chalcedony cements then by green chlorite clay. The contacts between the chlorite and quartz are irregular and suggest some etching/leaching prior to or concurrent with initial growth of the chlorite. The grains surrounding the pore are chert fragments.

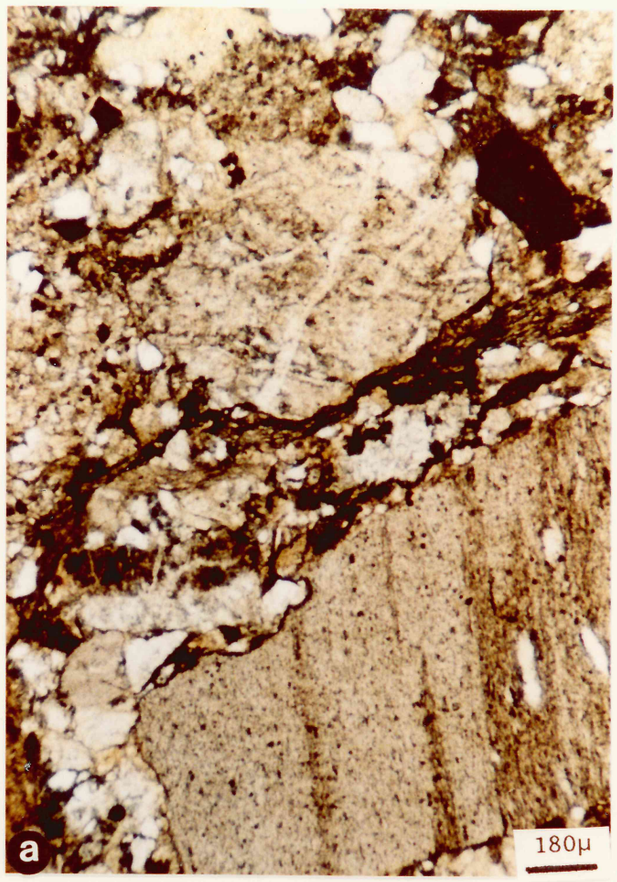


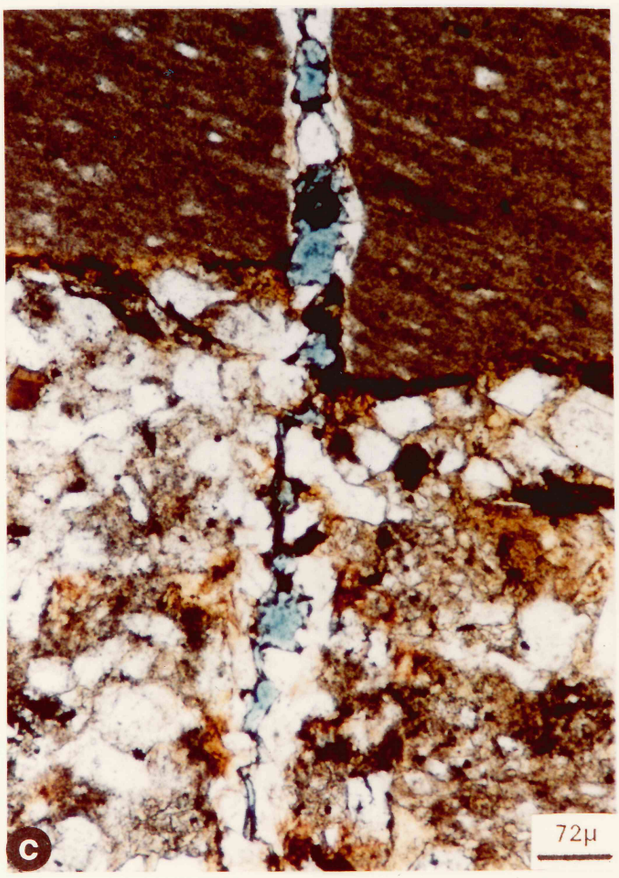


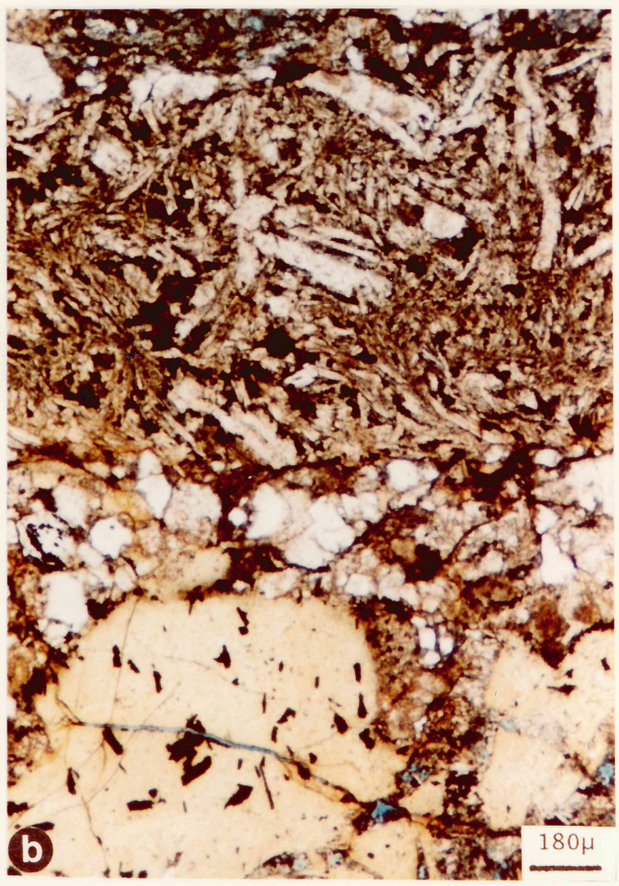


Title: Sample No. I-81-77
T.S. 825088SX
May 11, 1982

The sample bag with this number contained pebbly conglomerates and pebbly gritstones containing fragments of diverse lithologies: volcanic, sedimentary, and metamorphic. Cherts and possibly some serpentinitic material is apparent as well. Microstylolites are present (Photo A). Open fractures, held apart by incomplete cementation where also visible (Photo C).

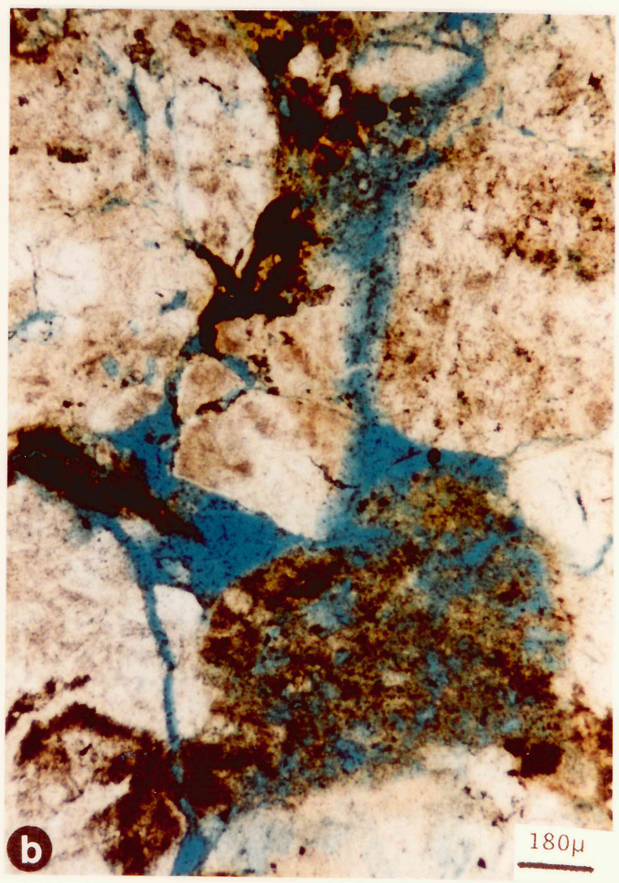






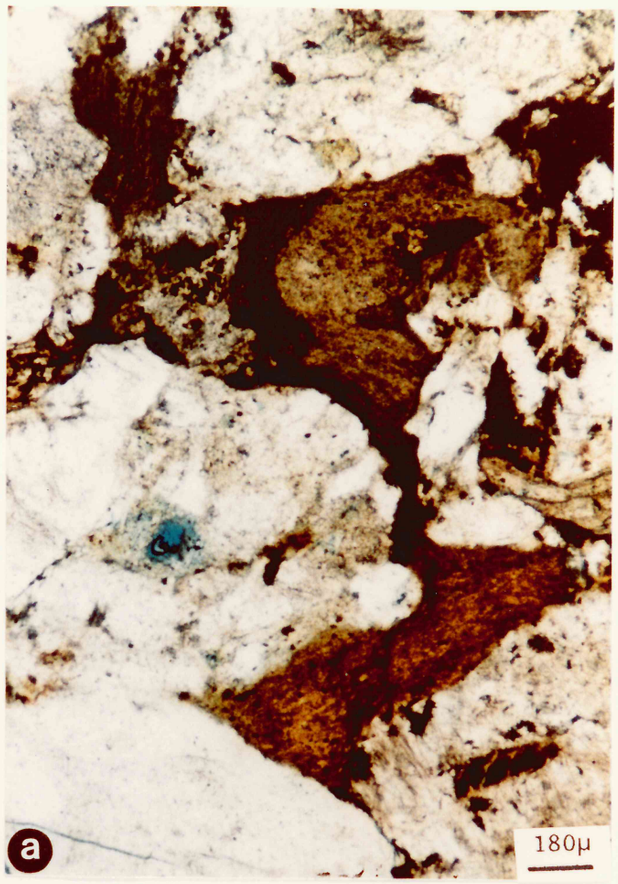
Title: Sample No. I-81-95
T.S. 825088SX
May 11, 1982

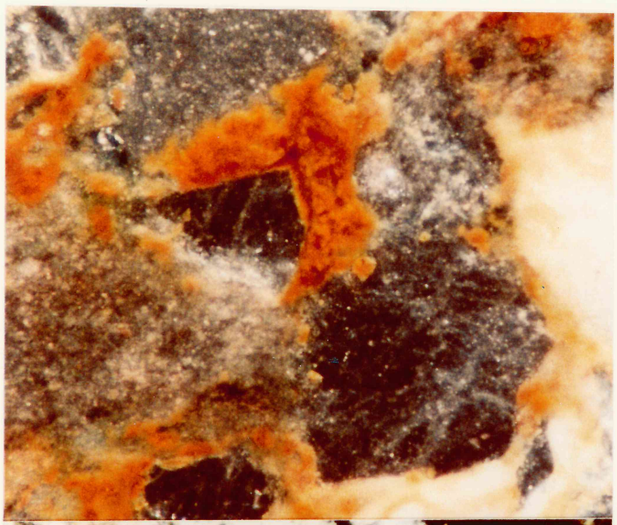
This is a poorly sorted litharenitic gritstone. Minor porosity comprised of primary intergranular, dissolution, and fracture porosity are present. Argillaceous rock fragments and feldspars have undergone partial dissolution. Photo A shows a crushed chert grain. Such mild deformation is common.
Photo B shows evidence of dissolution.

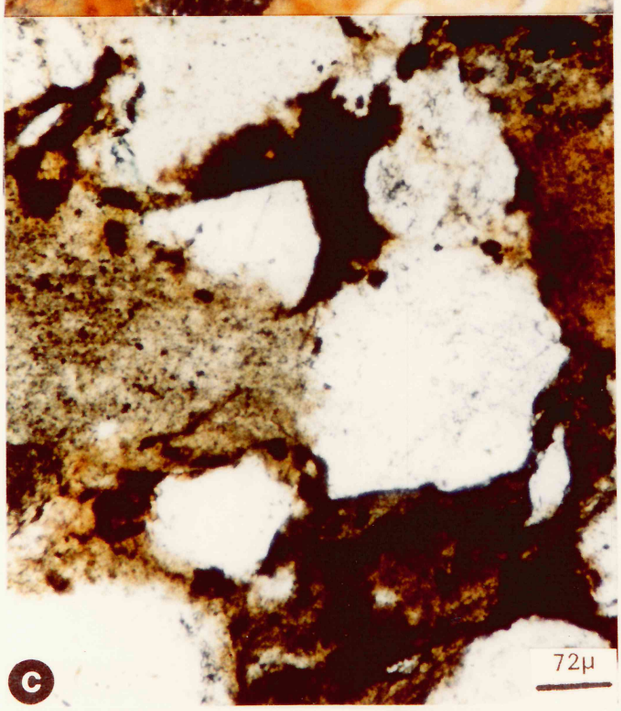


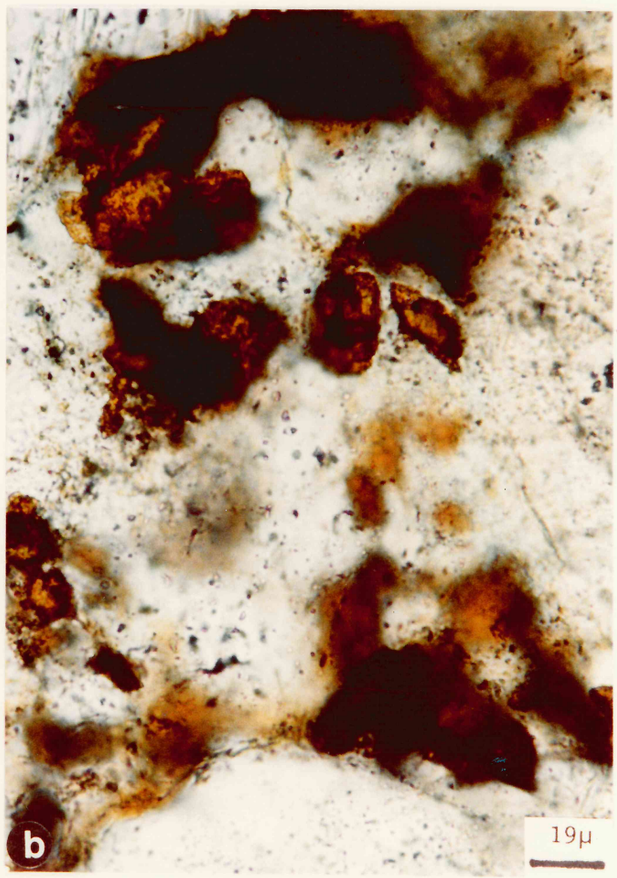
Title: Sample No. I-81-107
T.S. 825088SX
May 11, 1982

This is a litharenitic gritstone containing abundant semiopaque and opaque matrix material comprised of oxides and possibly sphene and/or siderite. The argillaceous lithic fragments have been strongly deformed (Photo A). Photo B and Photo pair C display the dark matrix.



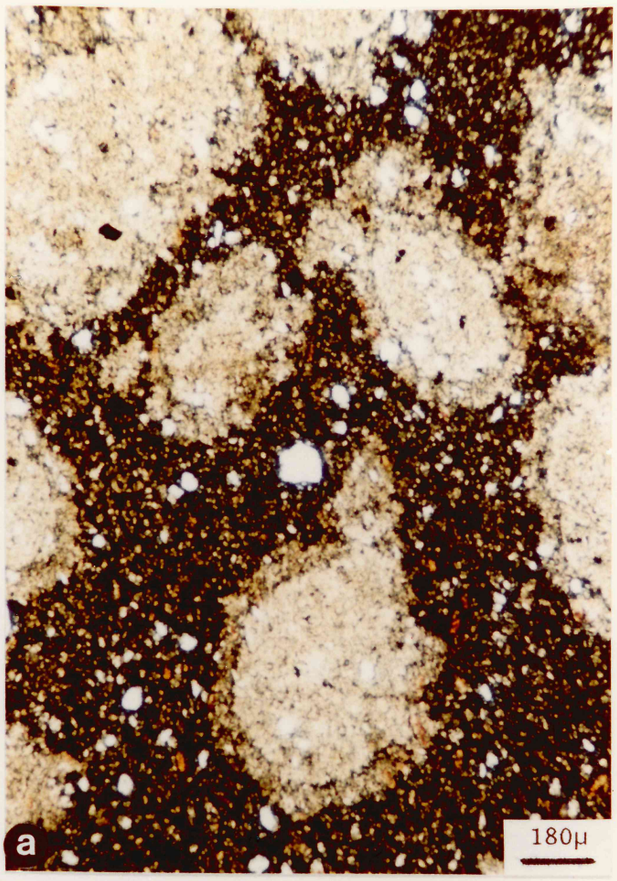


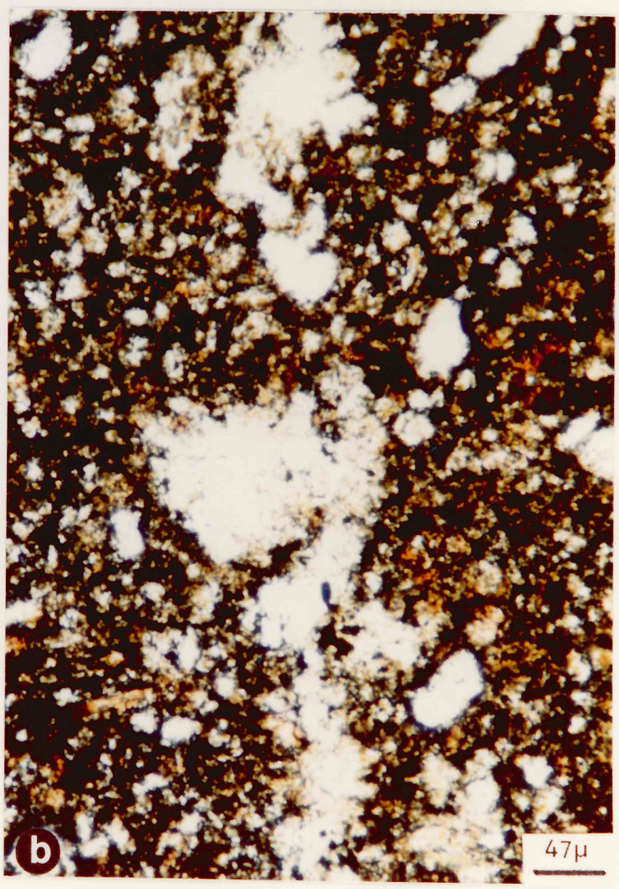




Title: Sample No. I-81-110
T.S. 825088SX
May 11, 1982

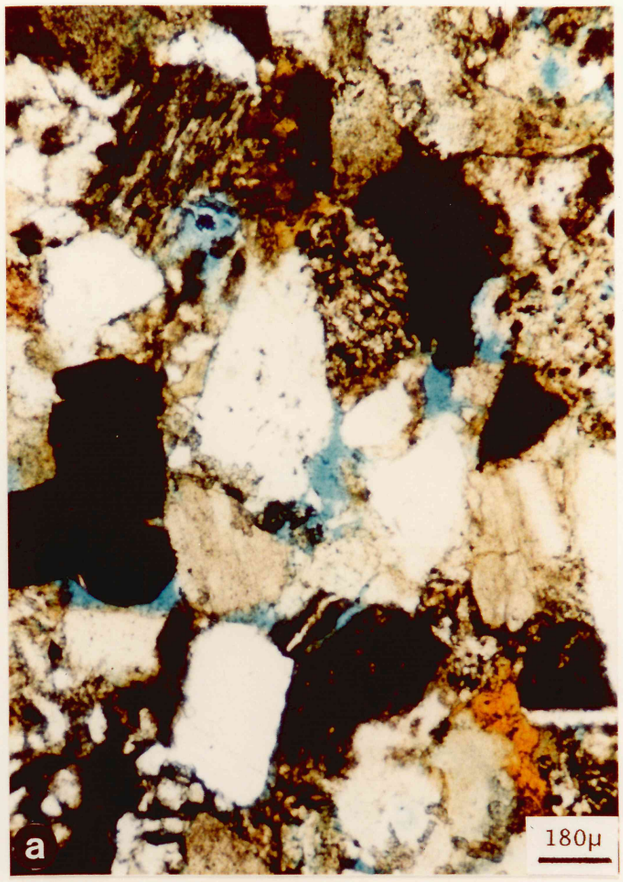
This sample is a spotted sandy siltstone. This incipient mineral segregation is perhaps the result of conditions approaching low-grade metamorphism. The light spots are dominated by illitic material. The dark matrix contains oxides, biotite and chlorite. Photo B shows a quartz annealed fracture cutting across the matrix.

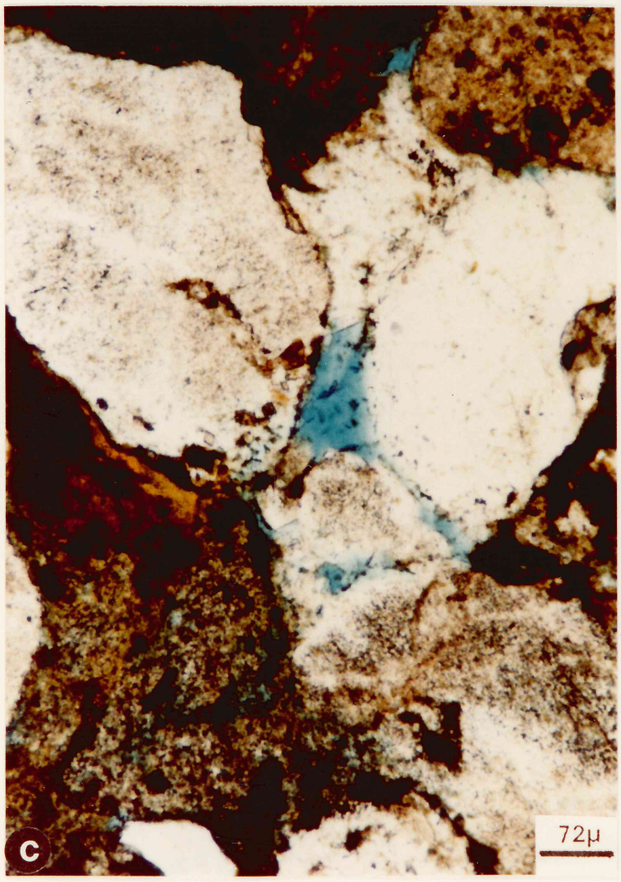


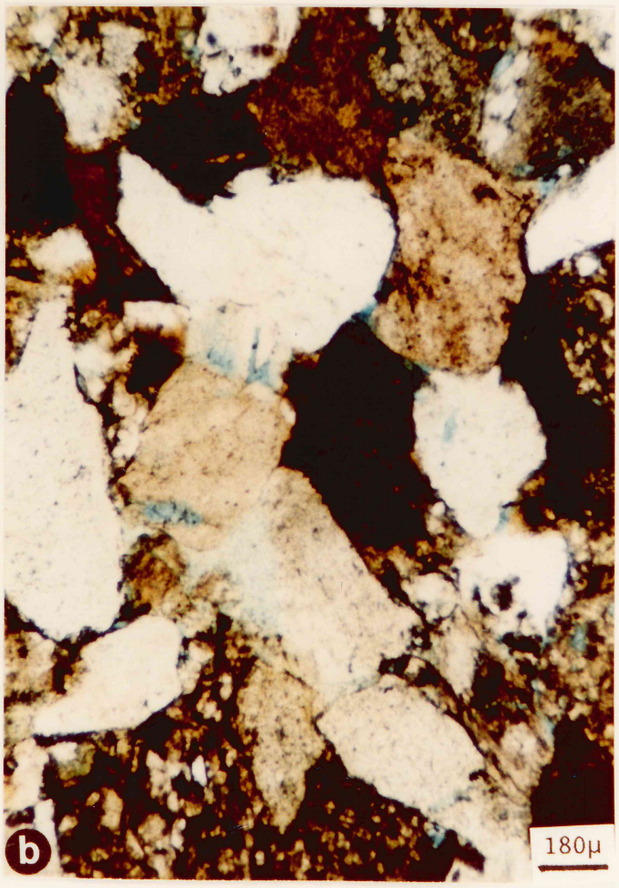


Title: Sample No. I-81-113
T.S. 825088SX
May 11, 1982

This is a litharenitic gritstone. This strongly lithic sand shows indications of both dissolution and primary porosity. Quartz cementation (Photo C) is the most common pore filling. Compaction of the softer, more ductile lithic fragments has also resulted in loss of porosity.







APPENDIX V

Denver
23

82145ART0117

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

SOURCE ROCK EVALUATION

Middle Tanana and Minchumina Basin Outcrops, Alaska

Geochemistry Services Group

R. J. Harwood

Technical Service 825069CX
Requested by B. G. Kemp R.L. Ames (5-28-82)
APC (USA) DENVER FAR WEST RRT

Distribution: R. C. Brooke, Denver
D. J. Versteeg, Denver
Division Geologist Exploration, Denver Far West
B. G. Kemp, Denver
R. R. Thompson/E. R. Michaelis

TECHNICAL SERVICE 825069CX 82145ART0117

Subject: Middle Tanana and Minchumina Basin Outcrops, Alaska (Figure 1)

INTRODUCTION

Twenty-one outcrop samples from the Silurian (?), Cretaceous, and Tertiary in the vicinity of these two basins were submitted for analysis. These samples include five Tertiary age coals. There are no previously analyzed nearby samples, although some samples from the Minchumina Basin have been analyzed (TS 738848CR).

CONCLUSIONS

1. Weathering appears to have affected the quantity and quality of the organic matter in at least some of these samples, probably clouding the interpretation.

2. The Tertiary age samples mostly are very good rated, contain gas and condensate type kerogens, but they are thermally immature and have not generated significant quantities of hydrocarbons.

3. The Cretaceous samples mostly are rated very good also, and appear to contain oil generating kerogen; in all but one case they are very mature and are past peak for both oil and gas generation.

4. One Cretaceous sample from north of the Minchumina Basin is at a distinctly lower thermal maturity than the others, and appears to be at pregeneration for gas and light oil.

5. A major thermal maturity gradient must exist in the Cretaceous from north to south. Also, the great difference in thermal maturity between the Tertiary and most Cretaceous samples possibly indicates major uplift and erosion prior to Tertiary deposition in some areas.

6. The Silurian (?) sample presently is a petroleum nonsource because of a low organic content.

RECOMMENDATION

Unweathered Cretaceous and Paleozoic samples from north of the Minchumina Basin should be collected and analyzed.

DISCUSSION

Tertiary

Petroleum generation ratings based on organic carbon contents for these samples are 1 fair and 10 very good, including the five coal samples with high organic carbon contents (Tables 1, 2). The shale samples are interpreted to contain gas and condensate type kerogens from the low convertibilities on thermal evolution analysis, elemental H/C ratios <1.0, and structured and mixed kerogen characters on visual evaluation (Tables 1, 2, 4). The coals also were interpreted to be composed of gas and condensate type kerogens from the visual and elemental H/C ratio data; their high convertibilities on TEA appear to be an anomaly often affecting coal TEA's and probably not related to the type hydrocarbons

they would generate in nature. Low vitrinite reflectance values indicate that these samples are in a pregeneration stage of thermal maturity (Tables 1, 4, Figure 2). Marked odd-carbon predominance and irregularity of the whole extract chromatograms confirm the thermal immaturity of these samples (Figure 3).

Cretaceous

Petroleum generation ratings of the Cretaceous samples also are based on organic carbon contents and are 1 nonsource, 1 fair, and 7 very good. Based on the amorphous compositions of most of the kerogens these samples are believed to have been oil sources when at lower stages of thermal maturity. All but one of the Cretaceous samples are past peak for both oil and gas generation as indicated by high vitrinite reflectance values, low elemental H/C ratios, low convertibilities on TEA, and in some cases high elemental carbonizations. A high stage of thermal maturity is supported by the appearance of the whole extract chromatograms, which show thermal cracking of the hydrocarbons.

The one exception among the Cretaceous samples is X-3259 from north of the Minchumina Basin. This sample, which is not near any of the other samples, is rated very good, has gas and some light oil generation ability as indicated by the convertibility on TEA, and is in a pregeneration stage of thermal maturity according to the vitrinite reflectance and elemental analysis data. The whole extract gas chromatogram confirms thermal immaturity by odd-carbon predominance of the higher molecular weight straight chain hydrocarbons.

Silurian (?)

The single Silurian (?) sample is rated as a petroleum nonsource because of the low content of organic matter, which precludes further analysis.

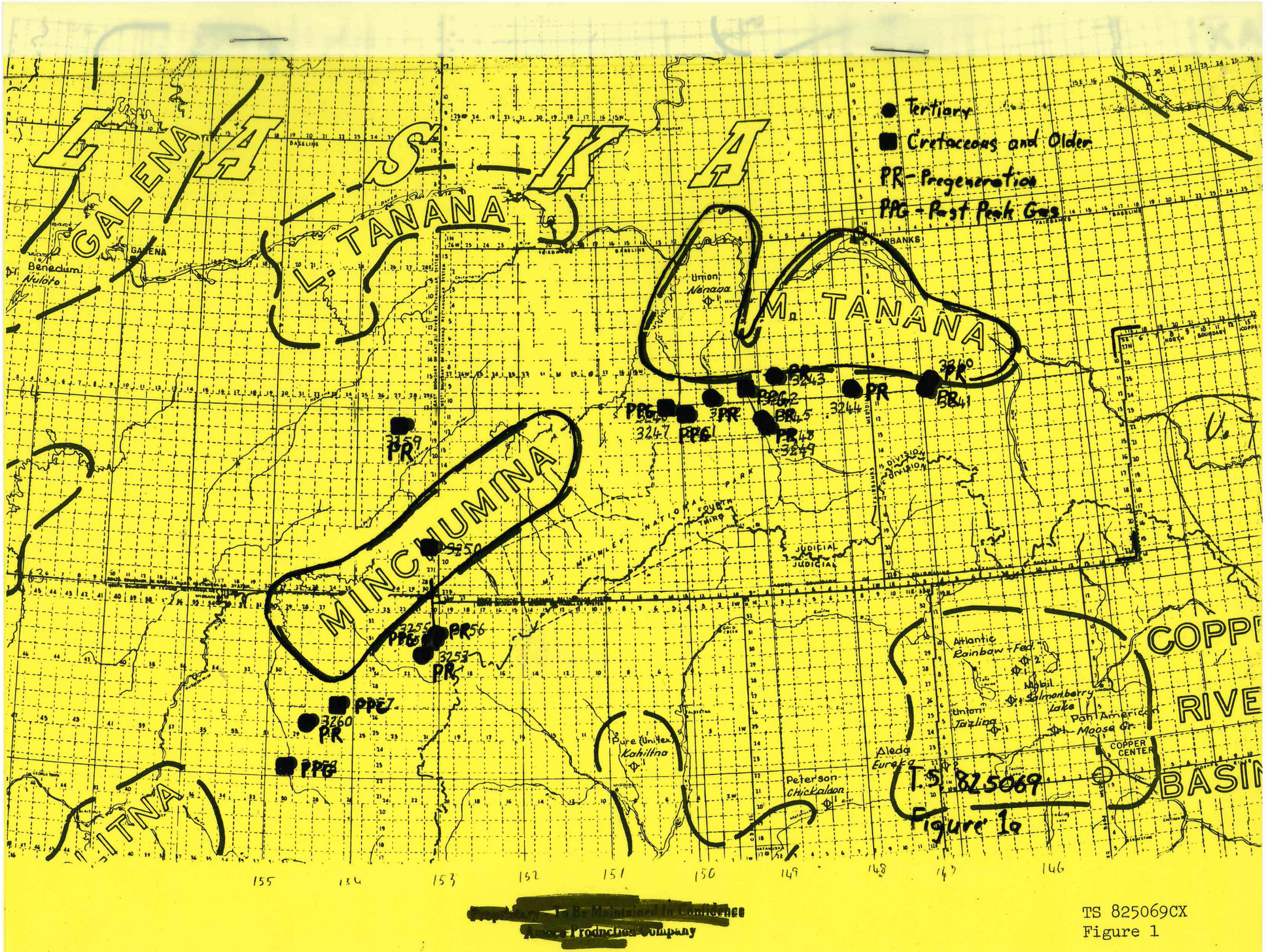
Weathering

As with all outcrop samples, weathering could have adversely affected the quantity and quality of organic matter in all of these samples leading to too pessimistic ratings. Many of the samples are described as earthy to fissile which suggests they are from the weathered zone. The elemental analysis data definitely show that several of the samples have been detectably altered by oxidation (Figure 4).

Exploration Significance

These results show that on the edges of these basins the Tertiary has significant amounts of organic matter. The low level of thermal maturity of the Tertiary samples and their gas-condensate generating characters are cause for concern, however. If the central parts of the basins are deep and hot enough, the Tertiary possibly could have generated gaseous and some liquid hydrocarbons.

The Cretaceous appears much more likely to have generated oil. However, the high stage of thermal maturity of most of the Cretaceous samples is unfavorable as any indigenous oil would have been destroyed and cracked to gas, especially in the depths of basins. The great difference in level of thermal maturity between the Tertiary and Cretaceous suggests



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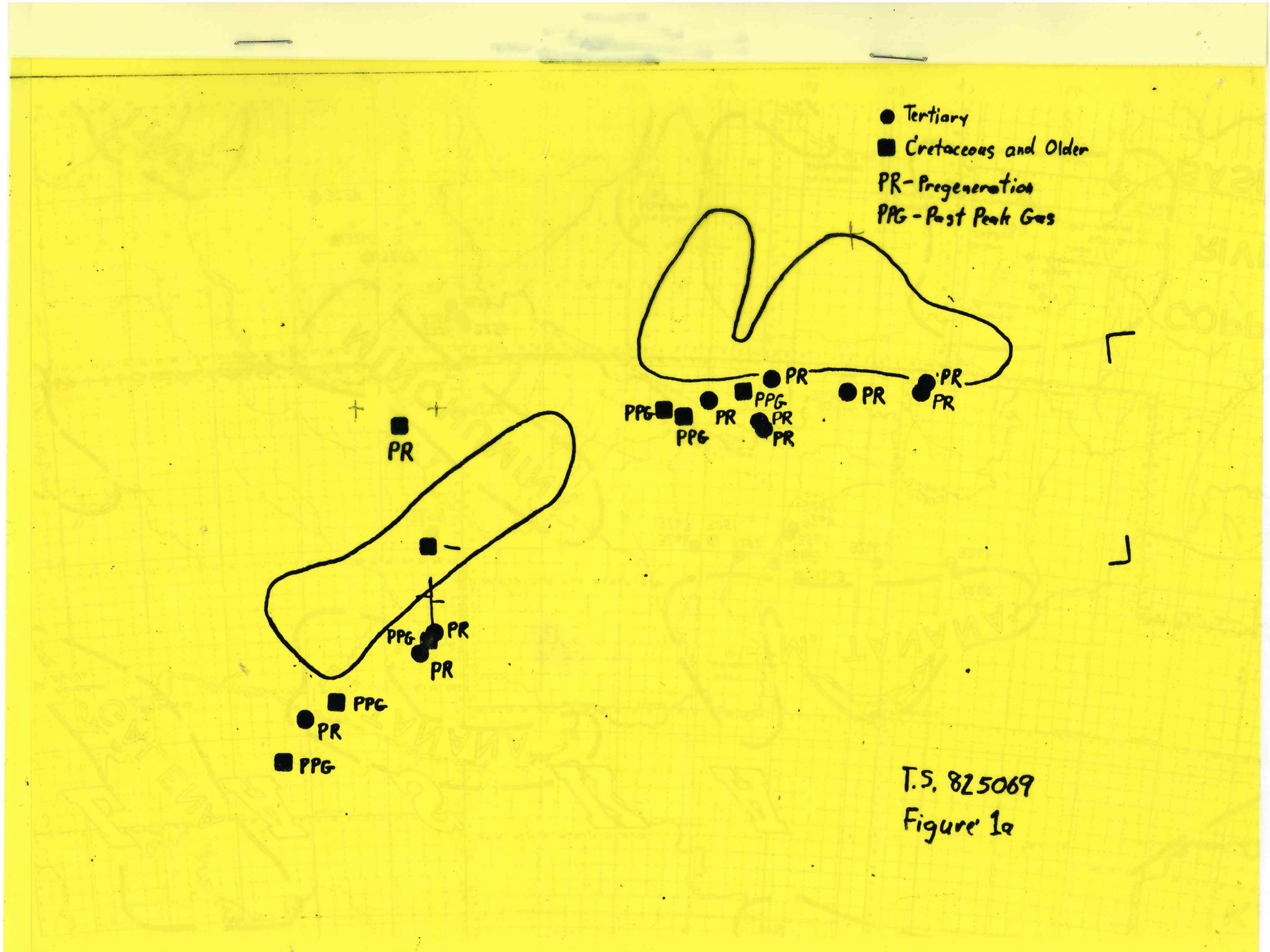
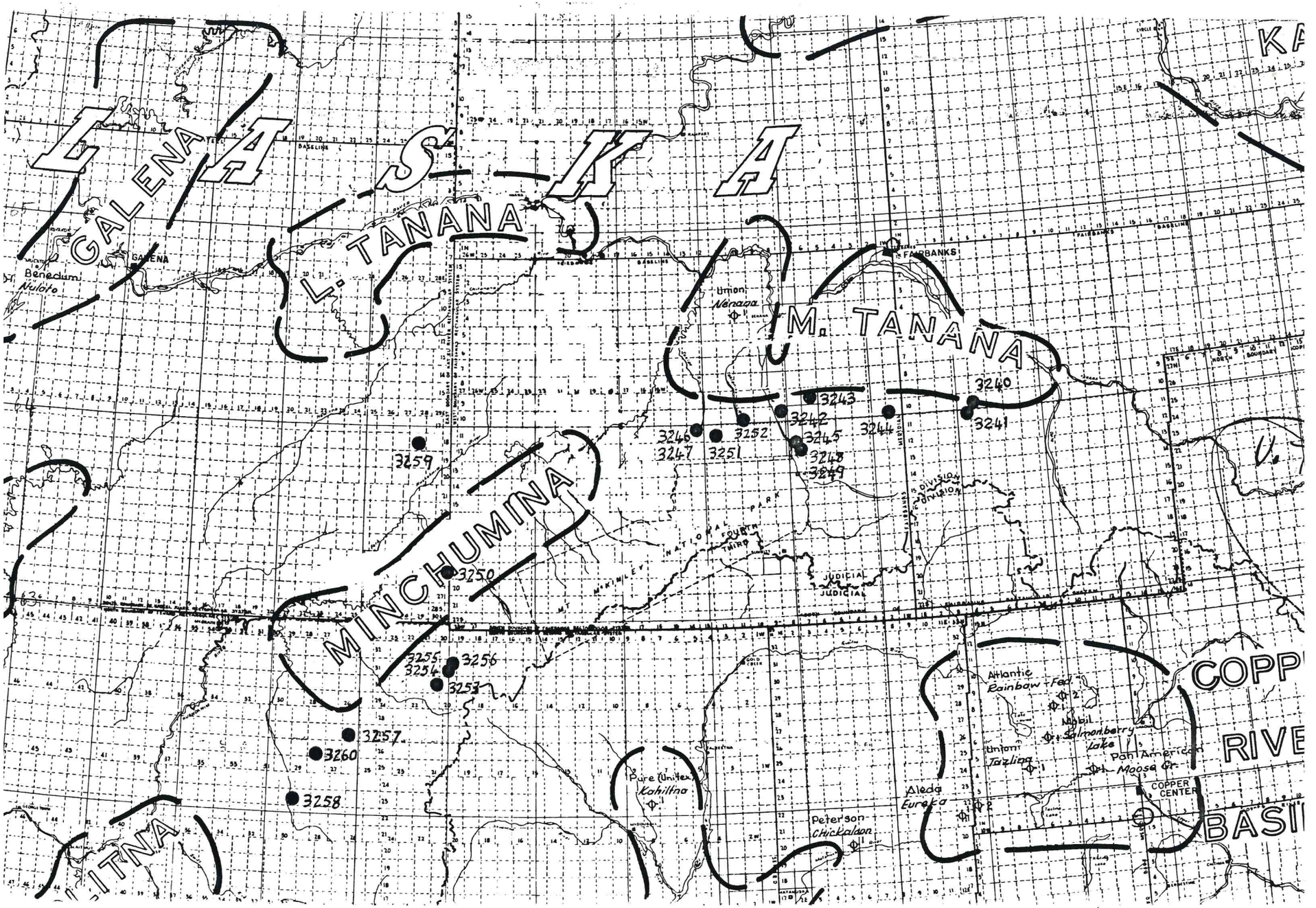
TS 825069CX
Figure 1



T.S. 825069
Figure 1a



[redacted]

TS 825069CX
Figure 1

major uplift and erosion in some areas before Tertiary deposition as a possible explanation. If the Cretaceous is burned out in these areas, the Paleozoic would be even more so. The one Cretaceous exception from north of the Minchumina Basin appears at a more favorable level of thermal maturity; this area probably warrants further study, perhaps even in the Paleozoic. If the Cretaceous here is at pregeneration, basinward it very well may be at peak generation for oil and gas. These Cretaceous thermal maturity data suggest a significant thermal maturity gradient in the Cretaceous from north to south.

Robert J. Harwood

R. J. Harwood

RJH:rjh/ceh

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

OFFICE DENVER DISTRICT FAR WEST
AUTHORIZED BY BOB KEMP
TECHNICAL SERVICE NUMBER 825069

SOURCE ROCK SUMMARY
TABLE 1. a
DATE 05/18/82

SAMPLE NUMBER / LAB NO.	SMPL TYPE	FORMATION	AGE	LITHOLOGY	FIELD NO. OR DEPTH FEET TOP***BASE	PETROLEUM GENERATION CAPABILITY	KEROGEN TYPE (OIL/GAS)	STAGE OF DIAGENESIS	Basin
STATE ALASKA COUNTY BIG DELTA WELL LOCATION NW.SEC.20-T10S-R5E WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS									
X-3240	OT		Mio-PLIO	CLAYSTON	812	FAIR	GAS	PREGENERATION	M. Tanana
STATE ALASKA COUNTY MT. HAYES WELL LOCATION NW.SEC.1-T11S-R4E WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS									
X-3241	OT		Mio-PLIO	SH	816	VERY GOOD	GAS	PREGENERATION	M. Tanana
STATE ALASKA COUNTY FAIRBANKS WELL LOCATION NW.SEC.1-T10S-R8W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS									
X-3242	OT		CRET	SH	8112	VERY GOOD	OIL?	PK-PST PEAK GAS	M. Tanana
STATE ALASKA COUNTY FAIRBANKS WELL LOCATION NE.SEC.21-T9S-R6W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS									
X-3243	OT		EOC	COAL	8115	VERY GOOD	GAS-COND	PREGENERATION	M. Tanana
STATE ALASKA COUNTY FAIRBANKS WELL LOCATION SE.SEC.31-T10S-R1W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS									
X-3244	OT		MIO	COAL	8123	VERY GOOD	GAS-COND	PREGENERATION	M. Tanana
STATE ALASKA COUNTY HEALY WELL LOCATION NW.SEC.3-T12S-R7W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS									
X-3245	OT		MIO	COAL	8129	VERY GOOD	GAS-COND	PREGENERATION	M. Tanana
STATE ALASKA COUNTY MT. MCKINLEY WELL LOCATION SE. SEC.2-T11S-R13W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS									
X-3246	OT		CRET	DIRT	8147	VERY GOOD	OIL?	PAST PEAK GAS	M. Tanana
X-3247	OT		CRET	SH	8148	VERY GOOD	OIL?	PAST PEAK GAS	M. Tanana

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

OFFICE DENVER DISTRICT FAR WEST
AUTHORIZED BY BOB KEMP
TECHNICAL SERVICE NUMBER 825069

SOURCE ROCK SUMMARY
TABLE 1.b
DATE 05/18/82

SAMPLE NUMBER / LAB NO.	SMPL TYPE	FORMATION	AGE	LITHOLOGY	FIELD NO. OR DEPTH FEET TOP***	BASE	PETROLEUM GENERATION CAPABILITY	KEROGEN TYPE (OIL/GAS)	STAGE OF DIAGENESIS	Basin
STATE ALASKA COUNTY HEALY WELL LOCATION NE.SEC.24-T12S-R7W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS										
X-3248	OT		MIO	SH	8153		VERY GOOD	GAS	PREGENERATION	M. Tanana
X-3249	OT		MIO	SH	8155		VERY GOOD	GAS-COND	PREGENERATION	M. Tanana
STATE ALASKA COUNTY MEDFRN WELL LOCATION SW.SEC.18-T19S-R30E WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS										
X-3250	OT		SIL?	SH	8157		NON SOURCE			Minchumina
STATE ALASKA COUNTY HEALY WELL LOCATION SE.SEC.26-T11S-R12W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS										
X-3251	OT		CRET	SH	8160		VERY GOOD	OIL?	PAST PEAK GAS	M. Tanana
STATE ALASKA COUNTY FAIRBANKS WELL LOCATION NW.SEC.32-T10S-R10W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS										
X-3252	OT		MIO	DIRT	8161		VERY GOOD	GAS	PREGENERATION	M. Tanana
STATE ALASKA COUNTY MCGRATH WELL LOCATION NW.SEC.13-T30N-R21W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS										
X-3253	OT		MIO?	COAL	8178		VERY GOOD	GAS-COND	PREGENERATION	M. Tanana
STATE ALASKA COUNTY TALKEETNA WELL LOCATION SW. SEC.27-T31N-R20W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS										
X-3254	OT		CRET	SH	8180		VERY GOOD	OIL?	PAST PEAK GAS	Minchumina
X-3255	OT		CRET	CLAYSTON	8181		NON SOURCE			Minchumina
STATE ALASKA COUNTY MCGRATH WELL LOCATION SE.SEC.22-T31N-R20W WELL NAME AMOCO LEASE INTERIOR BASINS OUTCROPS										
X-3256	OT		MIO?	COAL	8182		VERY GOOD	GAS-COND	PREGENERATION	Minchumina

AMOCO PRODUCTION COMPANY
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OFFICE DENVER DISTRICT FAR WEST
AUTHORIZED BY BOB KEMP
TECHNICAL SERVICE NUMBER 825069

SOURCE ROCK SUMMARY
TABLE 1.c
DATE 05/18/82

SAMPLE NUMBER / LAB NO.	SMPL TYPE	FORMATION	AGE	LITHOLOGY	FIELD NO. OR DEPTH FEET TOP***BASE	PETROLEUM GENERATION CAPABILITY	KEROGEN TYPE (OIL/GAS)	STAGE OF DIAGENESIS	Basin
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO				WELL LOCATION NW.SEC.29-T27N-R26W LEASE INTERIOR BASINS OUTCROPS					
X-3257	OT		CRET	SH	8193	FAIR	OIL?	PAST PEAK GAS	Minchumina
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO				WELL LOCATION SE.SEC.25-T23N-R30W LEASE INTERIOR BASINS OUTCROPS					
X-3258	OT		CRET	LS	8199	VERY GOOD	OIL?	PAST PEAK GAS	Minchumina
STATE ALASKA COUNTY MEDFRN WELL NAME AMOCO				WELL LOCATION NW.SEC.27-T18S-R28E LEASE INTERIOR BASINS OUTCROPS					
X-3259	OT		CRET	SH	81106	VERY GOOD	Gas-Lt. Oil	PREGENERATION	Minchumina
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO				WELL LOCATION SW.SEC.32-T26N-R28W LEASE INTERIOR BASINS OUTCROPS					
X-3260	OT		MIO	SH	81115	VERY GOOD	GAS	PREGENERATION	Minchumina

AMOCO PRODUCTION COMPANY
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OFFICE DENVER
TECHNICAL SERVICE NUMBER 825069

DISTRICT FAR WEST

THERMAL EVOLUTION ANALYSIS
TABLE 2.a
DATE 05/18/82

SAMPLE NO	FIELD NUMBER OR DEPTH TOP***BOTTOM	FORMATION	AGE	TOTAL ORG CARB WT %	VOLATILE HC PPM	VOL HC/ T O C	U LIMIT VOL HC DEG C	GENERATED HC PPM	GEN HC/ T O C	GEN PEAK MAX DEG C	VOL HC/ VOL+GEN
STATE ALASKA COUNTY BIG DELTA WELL NAME AMOCO			WELL LOCATION NW.SEC.20-T10S-R5E LEASE INTERIOR BASINS OUTCROPS								
X-3240	812		PLIO	.6	48	.01	287	341	.06	490	.12
STATE ALASKA COUNTY MT. HAYES WELL NAME AMOCO			WELL LOCATION NW.SEC.1-T11S-R4E LEASE INTERIOR BASINS OUTCROPS								
X-3241	816		PLIO	10.7	192	<.01	325	8809	.08	460	.02
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO			WELL LOCATION NW.SEC.1-T10S-R8W LEASE INTERIOR BASINS OUTCROPS								
X-3242	8112		CRET	2.2	34	<.01	295	38	<.01	385 ?	.47
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO			WELL LOCATION NE.SEC.21-T9S-R6W LEASE INTERIOR BASINS OUTCROPS								
X-3243	8115		EOC	55.1	3547	.01	325	123846	.22	420	.03
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO			WELL LOCATION SE.SEC.31-T10S-R1W LEASE INTERIOR BASINS OUTCROPS								
X-3244	8123		MIO	54.9	8319	.02	329	140484	.26	478	.06
STATE ALASKA COUNTY HEALY WELL NAME AMOCO			WELL LOCATION NW.SEC.3-T12S-R7W LEASE INTERIOR BASINS OUTCROPS								
X-3245	8129		MIO	54.8	7228	.01	325	112888	.21	434	.06
STATE ALASKA COUNTY MT. MCKINLEY WELL NAME AMOCO			WELL LOCATION SE. SEC.2-T11S-R13W LEASE INTERIOR BASINS OUTCROPS								
X-3246	8147		CRET	4.0	9	<.01	325	63	<.01	477	.13
X-3247	8148		CRET	2.0	9	<.01	325	31	<.01	475	.23
STATE ALASKA COUNTY HEALY WELL NAME AMOCO			WELL LOCATION NE.SEC.24-T12S-R7W LEASE INTERIOR BASINS OUTCROPS								
X-3248	8153		MIO	2.1	99	<.01	325	3004	.14	473	.03

AMOCO PRODUCTION COMPANY
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OFFICE DENVER
TECHNICAL SERVICE NUMBER

DISTRICT FAR WEST
825069

THERMAL EVOLUTION ANALYSIS
TABLE 2.b
DATE 05/18/82

SAMPLE NO	FIELD NUMBER OR DEPTH TOP***BOTTOM	FORMATION	AGE	TOTAL ORG CARB WT %	VOLATILE HC PPM	VOL HC/ T O C	U LIMIT VOL HC DEG C	GENERATED HC PPM	GEN HC/ T O C	GEN PEAK MAX DEG C	VOL HC/ VOL+GEN
STATE ALASKA COUNTY HEALY WELL NAME AMOCO			WELL LOCATION NE.SEC.24-T12S-R7W LEASE INTERIOR BASINS OUTCROPS								
X-3249	8155		MIO	2.5	139	.01	325	4596	.18	472	.03
STATE ALASKA COUNTY MEDFRN WELL NAME AMOCO			WELL LOCATION SW.SEC.18-T19S-R30E LEASE INTERIOR BASINS OUTCROPS								
X-3250	8157		SIL?	.1							
STATE ALASKA COUNTY HEALY WELL NAME AMOCO			WELL LOCATION SE.SEC.26-T11S-R12W LEASE INTERIOR BASINS OUTCROPS								
X-3251	8160		CRET	1.8	9	<.01	325	31	<.01	495	.23
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO			WELL LOCATION NW.SEC.32-T10S-R10W LEASE INTERIOR BASINS OUTCROPS								
X-3252	8161		MIO	3.5	103	<.01	325	2640	.08	469	.04
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO			WELL LOCATION NW.SEC.13-T30N-R21W LEASE INTERIOR BASINS OUTCROPS								
X-3253	8178		MIO?	56.5	11000	.02	325	220735	.39	395	.05
STATE ALASKA COUNTY TALKEETNA WELL NAME AMOCO			WELL LOCATION SW. SEC.27-T31N-R20W LEASE INTERIOR BASINS OUTCROPS								
X-3254	8180		CRET	3.4	9	<.01	277	325	.01	480	.03
X-3255	8181		CRET	.3							
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO			WELL LOCATION SE.SEC.22-T31N-R20W LEASE INTERIOR BASINS OUTCROPS								
X-3256	8182		MIO?	52.8	942	<.01	325	102095	.19	415	.01
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO			WELL LOCATION NW.SEC.29-T27N-R26W LEASE INTERIOR BASINS OUTCROPS								
X-3257	8193		CRET	.9	47	.01	325	141	.02	450 ?	.25

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OFFICE DENVER DISTRICT FAR WEST
TECHNICAL SERVICE NUMBER 825069

THERMAL EVOLUTION ANALYSIS
TABLE 2.C
DATE 05/18/82

SAMPLE NO	FIELD NUMBER OR DEPTH TOP***BOTTOM	FORMATION	AGE	TOTAL ORG CARB WT %	VOLATILE HC PPM	VOL HC/ T O C	U LIMIT VOL HC DEG C	GENERATED HC PPM	GEN HC/ T O C	GEN PEAK MAX DEG C	VOL HC/ VOL+GEN
STATE ALASKA COUNTY MCGRATH				WELL LOCATION SE.SEC.25-T23N-R30W							
WELL NAME AMOCO				LEASE INTERIOR BASINS OUTCROPS							
X-3258	8199		CRET	1.6	5	<.01	317	38	<.01	471 ?	.12
STATE ALASKA COUNTY MEDFRN				WELL LOCATION NW.SEC.27-T18S-R28E							
WELL NAME AMOCO				LEASE INTERIOR BASINS OUTCROPS							
X-3259	81106		CRET	4.0	14	<.01	325	8354	.21	486	<.01
STATE ALASKA COUNTY MCGRATH				WELL LOCATION SW.SEC.32-T26N-R28W							
WELL NAME AMOCO				LEASE INTERIOR BASINS OUTCROPS							
X-3260	81115		MIO	1.7	14	<.01	325	2078	.12	488	.01

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

OFFICE DENVER
TECHNICAL SERVICE NUMBER 825069

DISTRICT FAR WEST

SOURCE ROCK DATA
TABLE 3.a
DATE 05/18/82

SAMPLE NUMBER	FIELD NO. OR DEPTH FEET TOP***BOTTOM	GEOL. AGE	INSOL RESID%	TOTAL ORG C WT%	BITUMEN BBL/AF	BITUMEN PPM	SAT HC BBL/AF	SAT HC PPM	SAT HC/ BITUMEN	BITUMEN/ TL ORG C	REMARKS
											BBL/AF = (PPM X .0180)
STATE ALASKA COUNTY BIG DELTA WELL NAME AMOCO					WELL LOCATION NW.SEC.20-T10S-R5E LEASE INTERIOR BASINS OUTCROPS						
X-3240 I	812	PLIO	83	.6	2	85				.01	
STATE ALASKA COUNTY MT. HAYES WELL NAME AMOCO					WELL LOCATION NW.SEC.1-T11S-R4E LEASE INTERIOR BASINS OUTCROPS						
X-3241 I	816	PLIO	83	10.7	7	378				<.01	
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO					WELL LOCATION NW.SEC.1-T10S-R8W LEASE INTERIOR BASINS OUTCROPS						
X-3242 I	8112	CRET	93	2.2	1	40				<.01	
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO					WELL LOCATION NE.SEC.21-T9S-R6W LEASE INTERIOR BASINS OUTCROPS						
X-3243 I	8115	EOC	84	55.1	212	11802				.02	
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO					WELL LOCATION SE.SEC.31-T10S-R1W LEASE INTERIOR BASINS OUTCROPS						
X-3244 I	8123	MIO	83	54.9	134	7436				.01	
STATE ALASKA COUNTY HEALY WELL NAME AMOCO					WELL LOCATION NW.SEC.3-T12S-R7W LEASE INTERIOR BASINS OUTCROPS						
X-3245 I	8129	MIO	81	54.8	255	14174				.03	
STATE ALASKA COUNTY MT. MCKINLEY WELL NAME AMOCO					WELL LOCATION SE. SEC.2-T11S-R13W LEASE INTERIOR BASINS OUTCROPS						
X-3246 I	8147	CRET	77	4.0	1	57				<.01	
X-3247 I	8148	CRET	97	2.0	1	50				<.01	

AMOCO PRODUCTION COMPANY
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OFFICE DENVER DISTRICT FAR WEST
TECHNICAL SERVICE NUMBER 825069

SOURCE ROCK DATA
TABLE 3.b
DATE 05/18/82

SAMPLE NUMBER	FIELD NO. OR DEPTH FEET TOP***BOTTOM	GEOL. AGE	INSOL RESID%	TOTAL ORG C WT%	BITUMEN BBL/AF	BITUMEN PPM	SAT HC BBL/AF	SAT HC PPM	SAT HC/BITUMEN	BITUMEN/TL ORG C	REMARKS
											BBL/AF = (PPM X .0180)
STATE ALASKA COUNTY HEALY					WELL LOCATION NE. SEC. 24-T12S-R7W						
WELL NAME AMOCO					LEASE INTERIOR BASINS OUTCROPS						
X-3248 I	8153	MIO	85	2.1	5	292				.01	
X-3249 I	8155	MIO	89	2.5	13	742				.03	
STATE ALASKA COUNTY MEDFRN					WELL LOCATION SW. SEC. 18-T19S-R30E						
WELL NAME AMOCO					LEASE INTERIOR BASINS OUTCROPS						
X-3250 I	8157	SIL?		.1							
STATE ALASKA COUNTY HEALY					WELL LOCATION SE. SEC. 26-T11S-R12W						
WELL NAME AMOCO					LEASE INTERIOR BASINS OUTCROPS						
X-3251 I	8160	CRET	97	1.8	1	40				<.01	
STATE ALASKA COUNTY FAIRBANKS					WELL LOCATION NW. SEC. 32-T10S-R10W						
WELL NAME AMOCO					LEASE INTERIOR BASINS OUTCROPS						
X-3252 I	8161	MIO	85	3.5	12	665				.02	
STATE ALASKA COUNTY MCGRATH					WELL LOCATION NW. SEC. 13-T30N-R21W						
WELL NAME AMOCO					LEASE INTERIOR BASINS OUTCROPS						
X-3253 I	8178	MIO?	87	56.5	373	20739				.04	
STATE ALASKA COUNTY TALKEETNA					WELL LOCATION SW. SEC. 27-T31N-R20W						
WELL NAME AMOCO					LEASE INTERIOR BASINS OUTCROPS						
X-3254 I	8180	CRET	52	3.4	2	129				<.01	
X-3255 I	8181	CRET	59	.3							
STATE ALASKA COUNTY MCGRATH					WELL LOCATION SE. SEC. 22-T31N-R20W						
WELL NAME AMOCO					LEASE INTERIOR BASINS OUTCROPS						
X-3256 I	8182	MIO?	81	52.8	85	4740				.01	

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DISTRICT FAR WEST

SOURCE ROCK DATA
TABLE 3.C
DATE 05/18/82

SAMPLE NUMBER	FIELD NO. OR DEPTH FEET TOP***BOTTOM	GEOL. AGE	INSOL RESID%	TOTAL ORG C WT%	BITUMEN BBL/AF	BITUMEN PPM	SAT HC BBL/AF	SAT HC PPM	SAT HC/BITUMEN	BITUMEN/TL ORG C	REMARKS
											BBL/AF = (PPM X .0180)
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO					WELL LOCATION NW.SEC.29-T27N-R26W LEASE INTERIOR BASINS OUTCROPS						
X-3257 I	8193	CRET	78	.9	1	44				.01	
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO					WELL LOCATION SE.SEC.25-T23N-R30W LEASE INTERIOR BASINS OUTCROPS						
X-3258 I	8199	CRET	3	1.6	1	43				<.01	
STATE ALASKA COUNTY MEDFRN WELL NAME AMOCO					WELL LOCATION NW.SEC.27-T18S-R28E LEASE INTERIOR BASINS OUTCROPS						
X-3259 I	81106	CRET	93	4.0	6	331				.01	
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO					WELL LOCATION SW.SEC.32-T26N-R28W LEASE INTERIOR BASINS OUTCROPS						
X-3260 I	81115	MIO	83	1.7	2	94				.01	

AMOCO PRODUCTION COMPANY
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TECHNICAL SERVICE NUMBER 825069

KEROGEN DATA
TABLE 4. a
DATE 05/18/82

LAB SAMPLE NUMBER	FIELD NO. OR DEPTH FEET TOP***BOTTOM	GEOL. AGE	NORM. ELEMENTAL ANALYSIS,WT. CARBON	HYDROGEN	OXYGEN	NITROGEN	ATOMIC RATIO O/C	ATOMIC RATIO H/C	VISUAL KEROGEN TYPE	CARBNZ. SCALE	VIT REFLECT %RO
STATE ALASKA COUNTY BIG DELTA WELL NAME AMOCO			WELL LOCATION NW.SEC.20-T10S-R5E LEASE INTERIOR BASINS OUTCROPS								
X-3240 I	812	PLIO	74*	3.9	21*	1.4	.21	.64	MIXED		.49
STATE ALASKA COUNTY MT. HAYES WELL NAME AMOCO			WELL LOCATION NW.SEC.1-T11S-R4E LEASE INTERIOR BASINS OUTCROPS								
X-3241 I	816	PLIO	69	4.8	25	1.1	.26	.84	STRUCTURED		.29
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO			WELL LOCATION NW.SEC.1-T10S-R8W LEASE INTERIOR BASINS OUTCROPS								
X-3242 I	8112	CRET	87*	2.4	10*	.8	.08	.33	AMORPHOUS		2.24
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO			WELL LOCATION NE.SEC.21-T9S-R6W LEASE INTERIOR BASINS OUTCROPS								
X-3243 I	8115	EOC	72	5.3	22	1.0	.22	.88	STRUCTURED		.28
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO			WELL LOCATION SE.SEC.31-T10S-R1W LEASE INTERIOR BASINS OUTCROPS								
X-3244 I	8123	MIO	70	5.3	23	1.1	.24	.91	STRUCTURED		.28
STATE ALASKA COUNTY HEALY WELL NAME AMOCO			WELL LOCATION NW.SEC.3-T12S-R7W LEASE INTERIOR BASINS OUTCROPS								
X-3245 I	8129	MIO	71	5.2	22	1.0	.23	.88	STRUCTURED		.29
STATE ALASKA COUNTY MT. MCKINLEY WELL NAME AMOCO			WELL LOCATION SE. SEC.2-T11S-R13W LEASE INTERIOR BASINS OUTCROPS								
X-3246 I	8147	CRET	93	1.3	5	.9	.03	.16	AMORPHOUS		
X-3247 I	8148	CRET	92	1.4	5	.9	.04	.19	AMORPHOUS		
STATE ALASKA COUNTY HEALY WELL NAME AMOCO			WELL LOCATION NE.SEC.24-T12S-R7W LEASE INTERIOR BASINS OUTCROPS								
X-3248 I	8153	MIO	71	5.5	21	1.6	.22	.93	STRUCTURED		.31

* Oxidized on weathering

AMOCO PRODUCTION COMPANY
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OFFICE DENVER DISTRICT FAR WEST
TECHNICAL SERVICE NUMBER 825069

KEROGEN DATA
TABLE 4. b
DATE 05/18/82

LAB SAMPLE NUMBER	FIELD NO. OR DEPTH FEET TOP***BOTTOM	GEOL. AGE	NORM. ELEMENTAL ANALYSIS,WT. CARBON	HYDROGEN	OXYGEN	NITROGEN	ATOMIC RATIO O/C	ATOMIC RATIO H/C	VISUAL KEROGEN TYPE	CARBNZ. SCALE	VIT REFLECT %RO
STATE ALASKA COUNTY HEALY WELL NAME AMOCO			WELL LOCATION NE.SEC.24-T12S-R7W LEASE INTERIOR BASINS OUTCROPS								
X-3249 I	8155	MIO	69	5.5	23	1.6	.25	.96	STRUCTURED		.31
STATE ALASKA COUNTY MEDFRN WELL NAME AMOCO			WELL LOCATION SW.SEC.18-T19S-R30E LEASE INTERIOR BASINS OUTCROPS								
X-3250 I	8157	SIL?									
STATE ALASKA COUNTY HEALY WELL NAME AMOCO			WELL LOCATION SE.SEC.26-T11S-R12W LEASE INTERIOR BASINS OUTCROPS								
X-3251 I	8160	CRET	83*	3.1	13*	.8	.11	.45	AMORPHOUS		3.44
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO			WELL LOCATION NW.SEC.32-T10S-R10W LEASE INTERIOR BASINS OUTCROPS								
X-3252 I	8161	MIO	67	4.8	26	1.3	.29	.86	MIXED		.39
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO			WELL LOCATION NW.SEC.13-T30N-R21W LEASE INTERIOR BASINS OUTCROPS								
X-3253 I	8178	MIO?	71	5.6	23	.5	.24	.95	STRUCTURED		.20
STATE ALASKA COUNTY TALKEETNA WELL NAME AMOCO			WELL LOCATION SW. SEC.27-T31N-R20W LEASE INTERIOR BASINS OUTCROPS								
X-3254 I	8180	CRET	89	2.0	8	1.2	.06	.27	AMORPHOUS		
X-3255 I	8181	CRET									
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO			WELL LOCATION SE.SEC.22-T31N-R20W LEASE INTERIOR BASINS OUTCROPS								
X-3256 I	8182	MIO?	70	5.3	24	1.0	.25	.91	STRUCTURED		.25
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO			WELL LOCATION NW.SEC.29-T27N-R26W LEASE INTERIOR BASINS OUTCROPS								
X-3257 I	8193	CRET	89	2.6	8	.8	.06	.36	AMORPHOUS		4.36

* Oxidized on weathering

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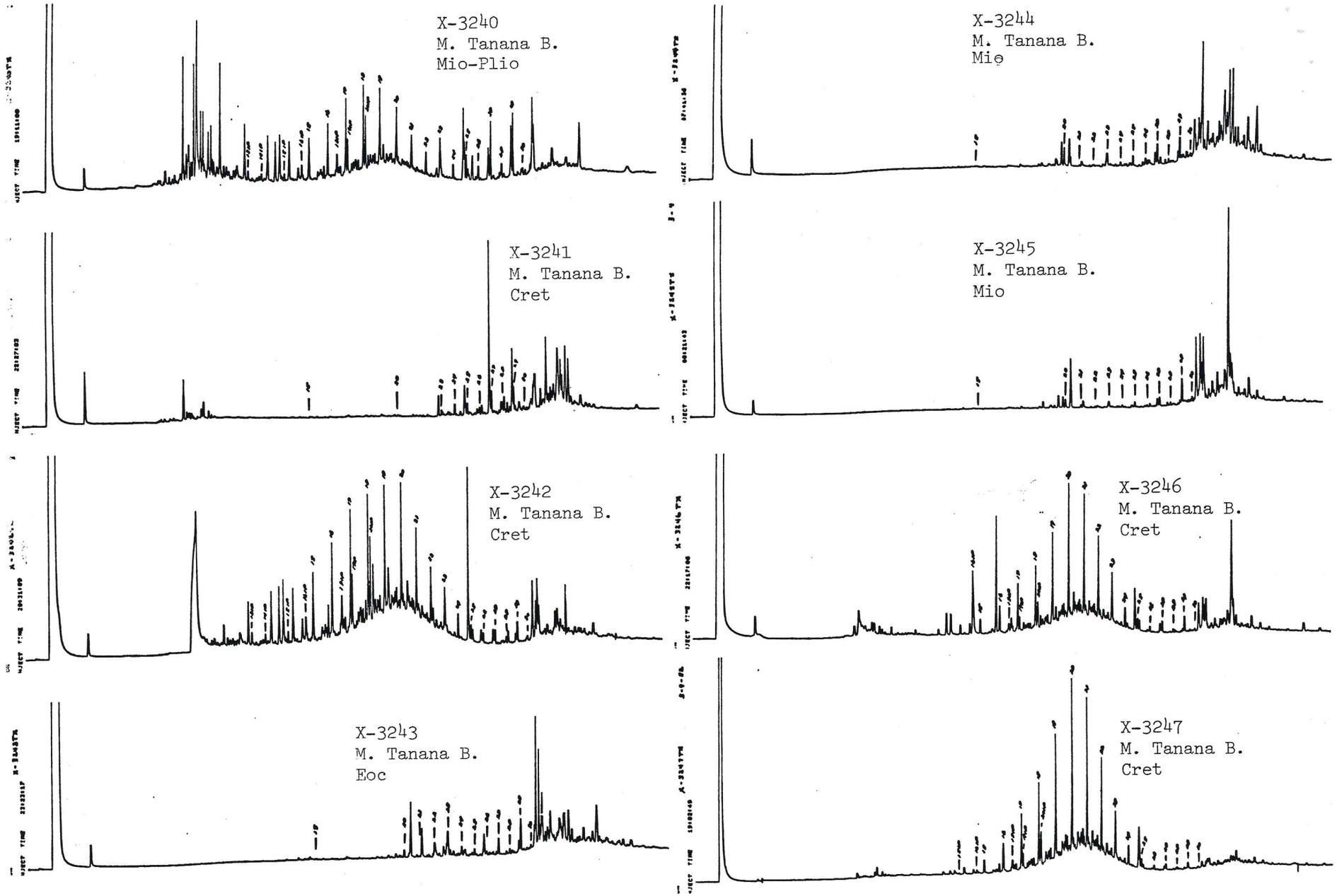
OFFICE DENVER
TECHNICAL SERVICE NUMBER

DISTRICT FAR WEST
825069

KEROGEN DATA
TABLE 4.c
DATE 05/18/82

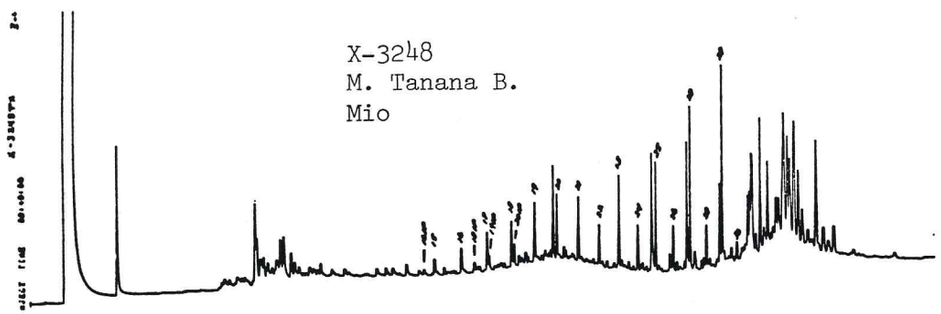
LAB SAMPLE NUMBER	FIELD NO. OR DEPTH FEET TOP***BOTTOM	GEOL. AGE	NORM. ELEMENTAL ANALYSIS,WT. CARBON	HYDROGEN	OXYGEN	NITROGEN	ATOMIC RATIO O/C	ATOMIC RATIO H/C	VISUAL KEROGEN TYPE	CARBNZ. SCALE	VIT REFLECT %RO
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO			WELL LOCATION SE.SEC.25-T23N-R30W LEASE INTERIOR BASINS OUTCROPS								
X-3258 I	8199	CRET	78*	2.3	18*	1.0	.17	.35	AMORPHOUS		
STATE ALASKA COUNTY MEDFRN WELL NAME AMOCO			WELL LOCATION NW.SEC.27-T18S-R28E LEASE INTERIOR BASINS OUTCROPS								
X-3259 I	81106	CRET	72	5.1	21	2.0	.21	.85	MIXED		.53
STATE ALASKA COUNTY MCGRATH WELL NAME AMOCO			WELL LOCATION SW.SEC.32-T26N-R28W LEASE INTERIOR BASINS OUTCROPS								
X-3260 I	81115	MIO	76	4.8	16	2.3	.16	.76	MIXED		.57

* Oxidized on weathering

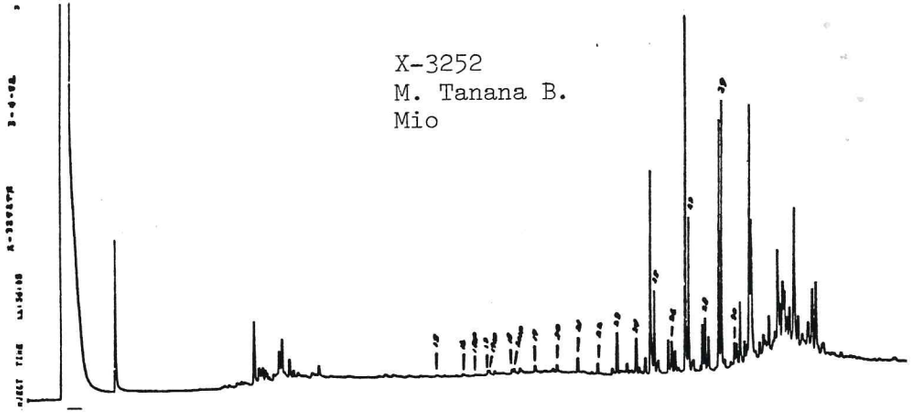


Whole Extract Chromatograms

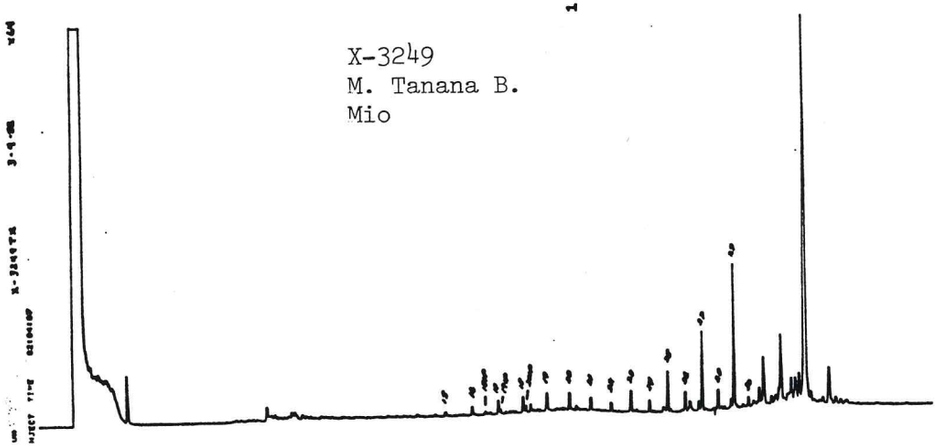
TS 825069CX
Figure 3a



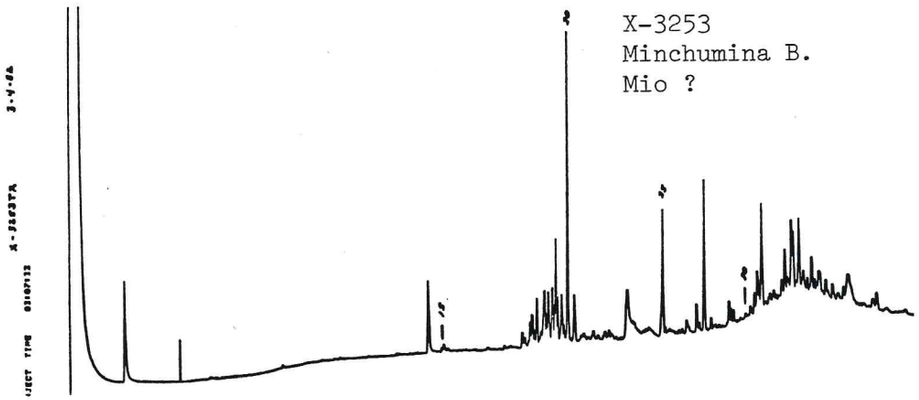
X-3248
M. Tanana B.
Mio



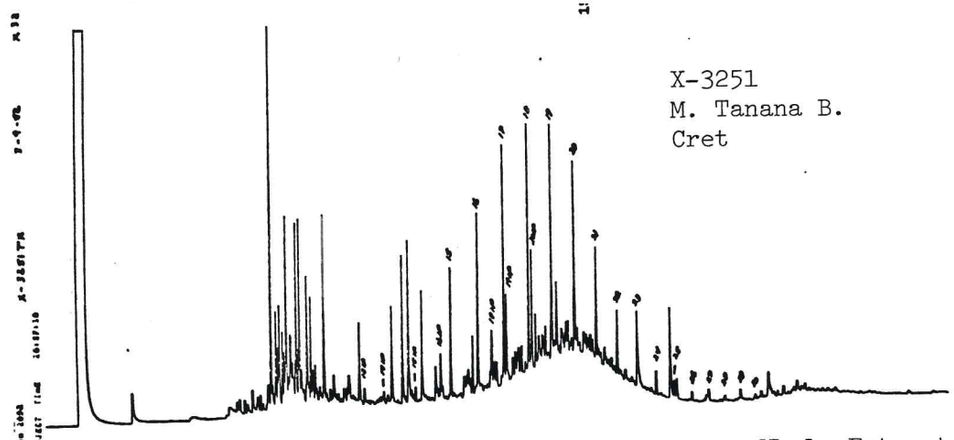
X-3252
M. Tanana B.
Mio



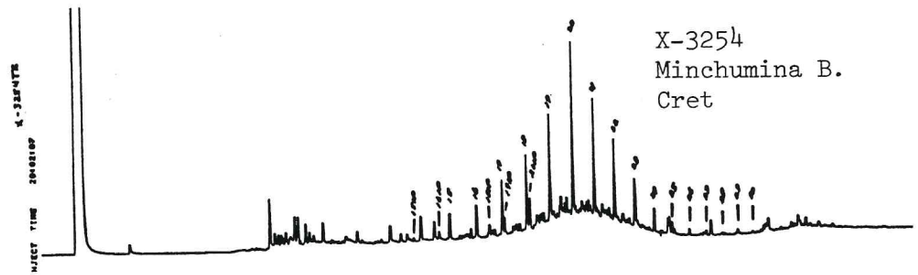
X-3249
M. Tanana B.
Mio



X-3253
Minchumina B.
Mio ?



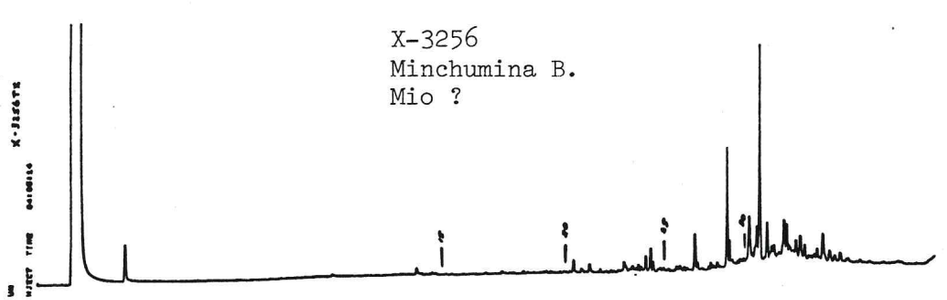
X-3251
M. Tanana B.
Cret

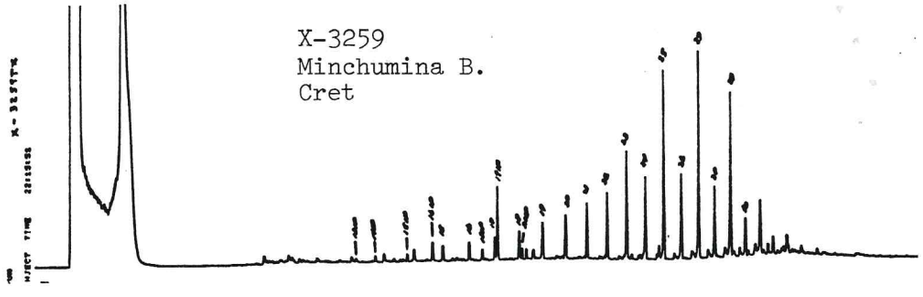


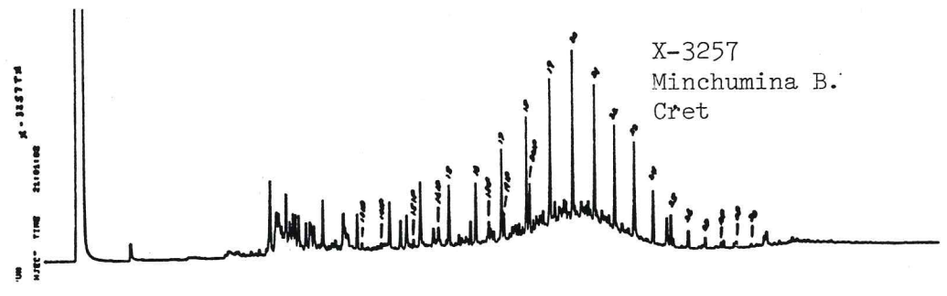
X-3254
Minchumina B.
Cret

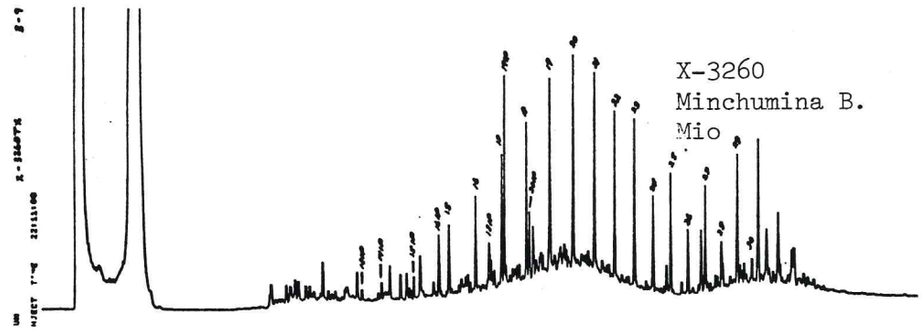
Whole Extract Chromatograms

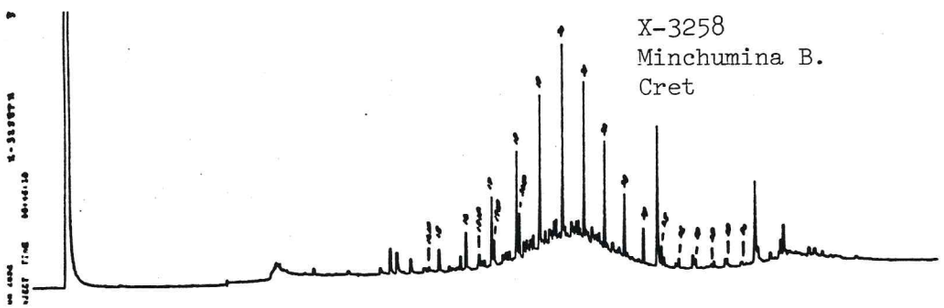
TS 825069CX
Figure 3b









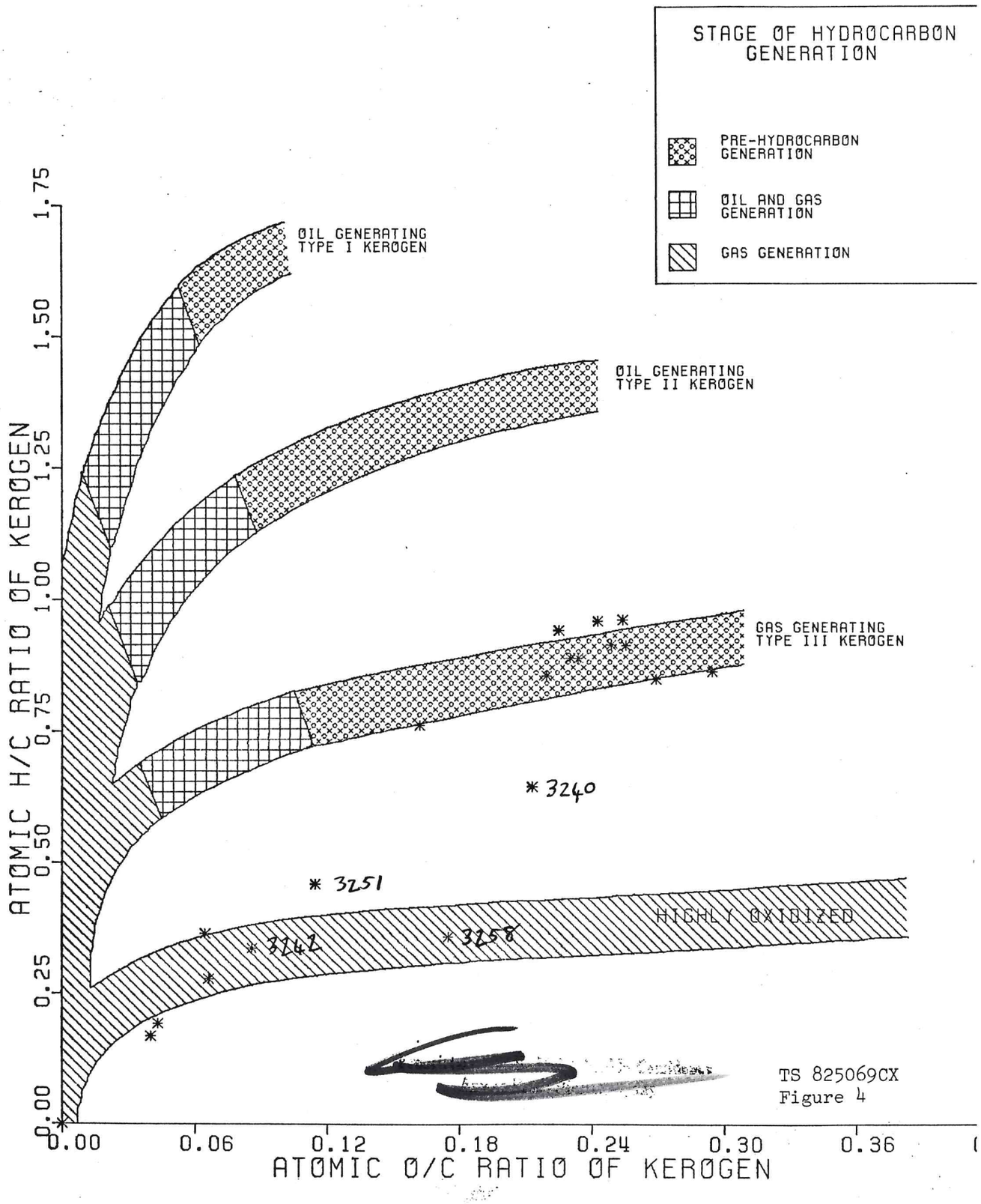


Whole Extract Chromatograms

TS 825069CX
Figure 3c

AMOCO PRODUCTION COMPANY
GEOLOGICAL DATA

TECH SERVICE 506982

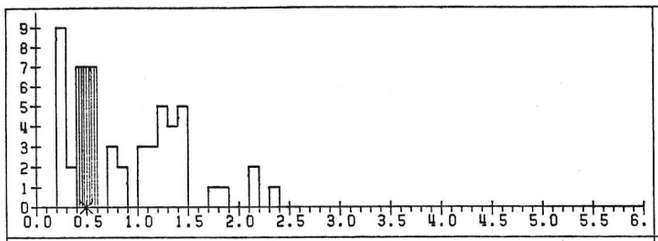


TS 825069CX
Figure 4

VITRINITE REFLECTANCE ANALYSIS

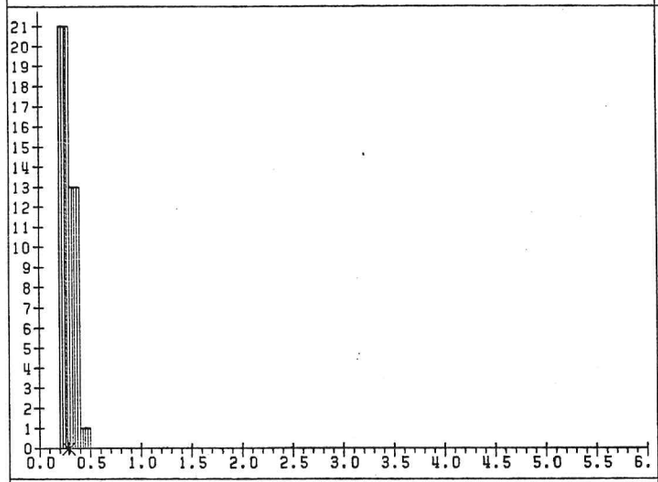
INTERIOR BASINS OUTCROPS; ALASKA

LOCALITY 5069 TECH SVC NO.5069



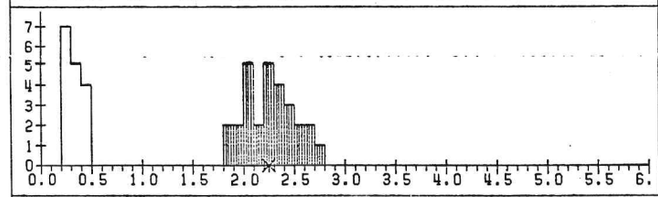
V-3240 RL
OUTCROP 5-14-82
KERO=MIX

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.49	0.50	0.038	14



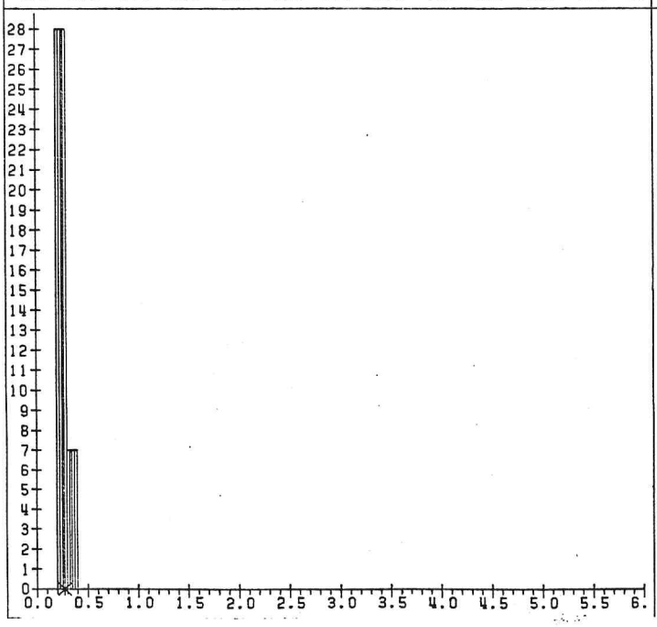
V-3241 RL
OUTCROP 5-14-82
KERO=STR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.29	0.28	0.048	35



V-3242 RL
OUTCROP 5-14-82
KERO=AMOR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	2.24	2.26	0.253	28

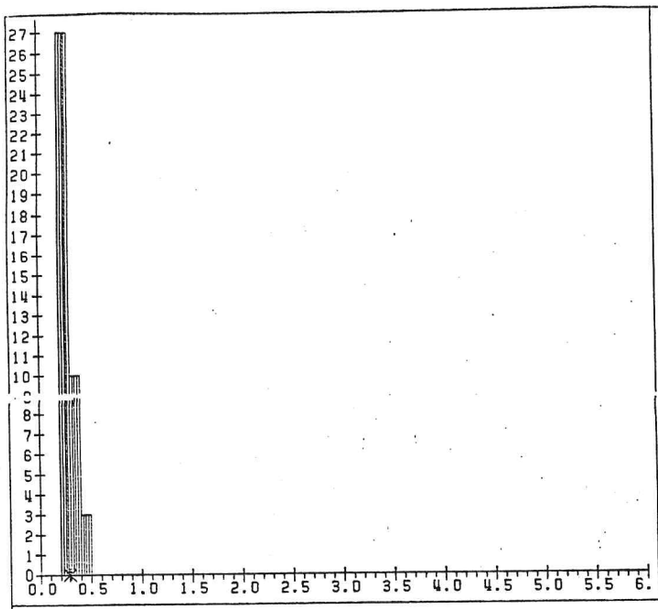


V-3243 RL
OUTCROP 5-14-82
KERO=STR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.28	0.26	0.048	35

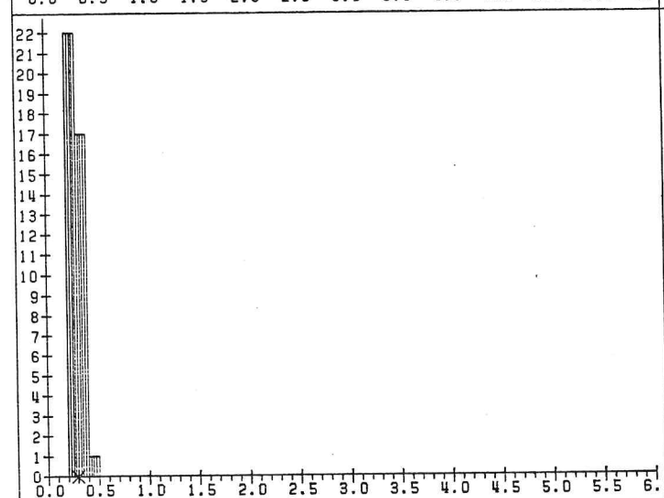
[redacted]

TS 825069CX
Figure 2a



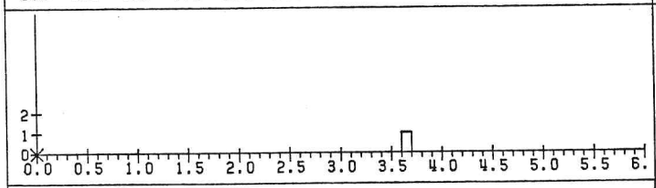
V-3244 RL
OUTCROP 5-14-82
KERO=STR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.28	0.27	0.058	40



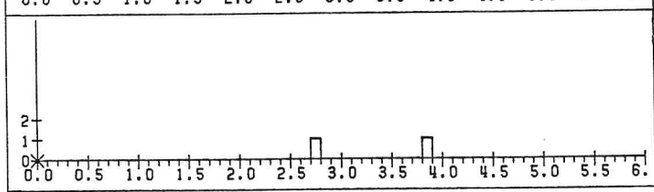
V-3245 RL
OUTCROP 5-14-82
KERO=STR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.29	0.29	0.038	40



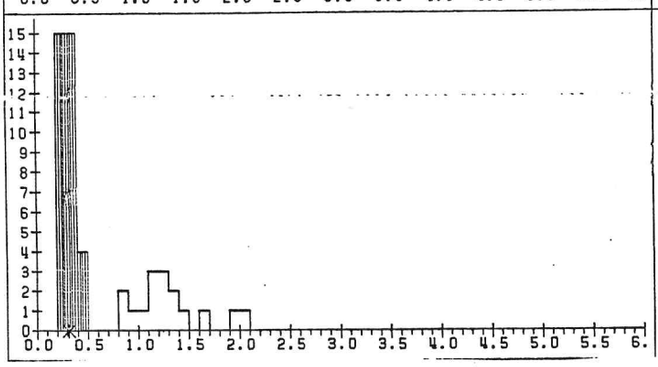
V-3246 RL
OUTCROP 5-14-82
KERO=AMOR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.00	0.00	0.000	0



V-3247 RL
OUTCROP 5-14-82
KERO=AMOR

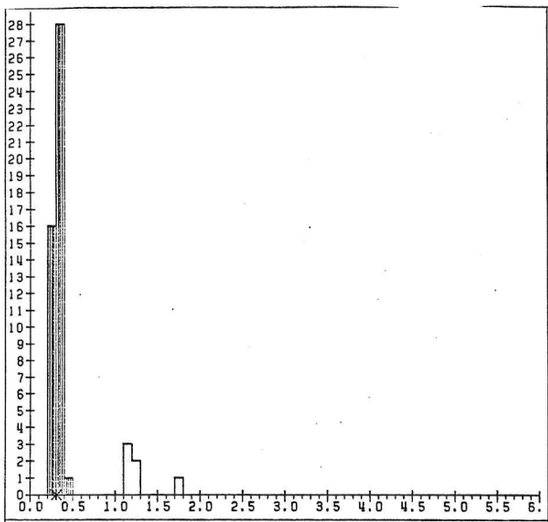
	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.00	0.00	0.000	0

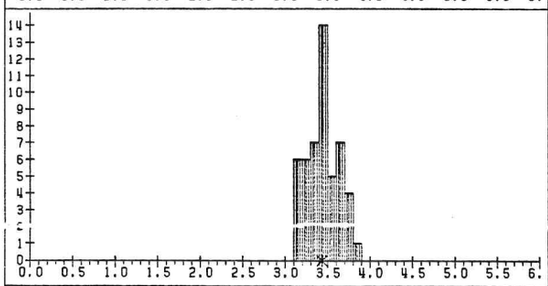


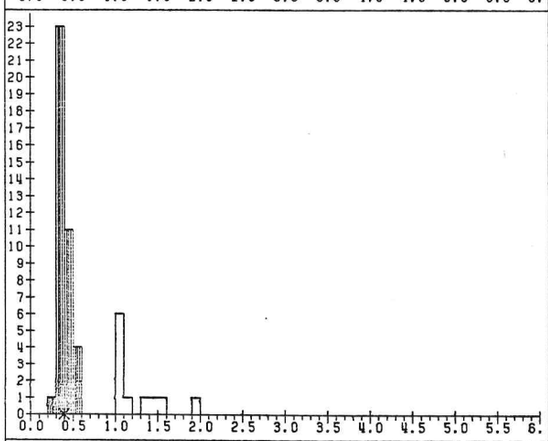
V-3248 RL
OUTCROP 5-14-82
KERO=STR

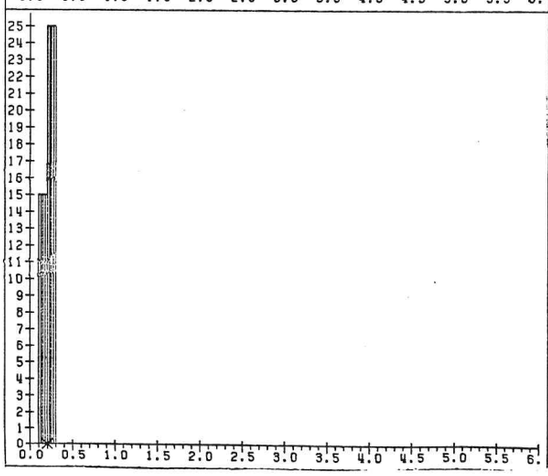
	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.31	0.31	0.063	34

TS 825069CX
Figure 2b

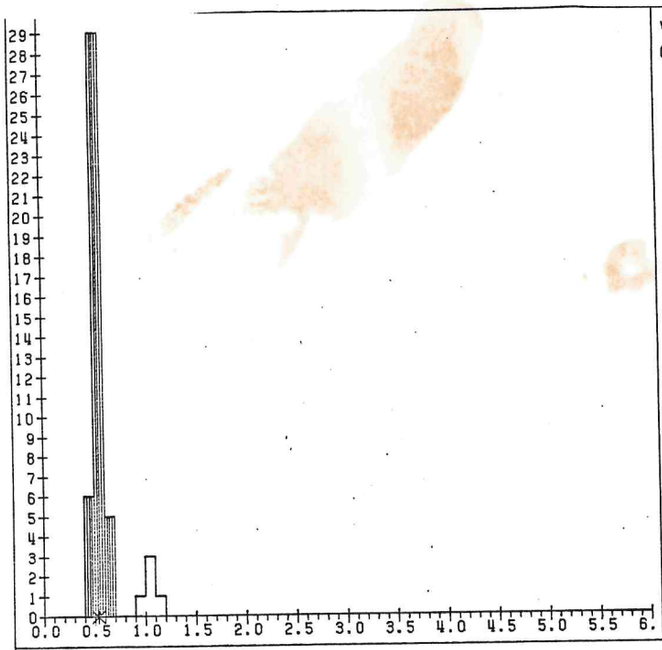






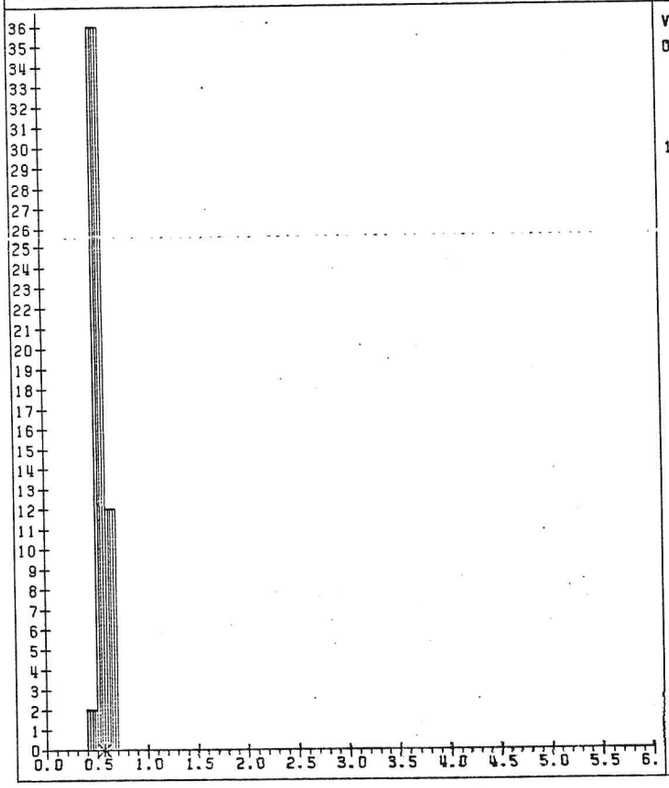


TS 825069CX
Figure 2c



V-3259 RL
OUTCROP 5-14-82
KERO=MIX

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.53	0.55	0.044	40



V-3260 RL
OUTCROP 5-14-82
KERO=MIX

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.57	0.56	0.042	50

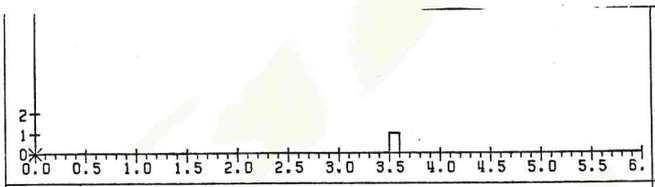
TS 825069CX
Figure 2e

X-AXIS = PERCENT REFLECTANCE OF VITRINITE (%RO)

Y-AXIS = FREQUENCY

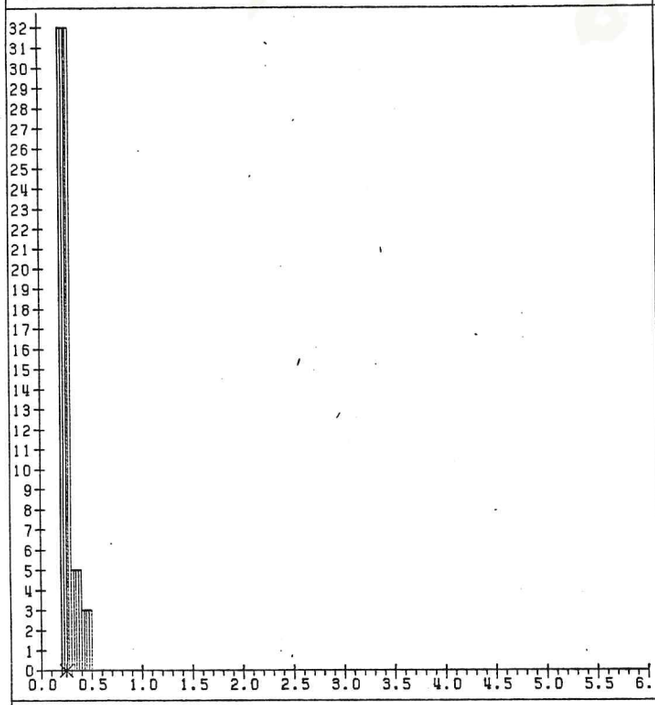
AVERAGE %RO FOR POP.1 = 0.77

[redacted]



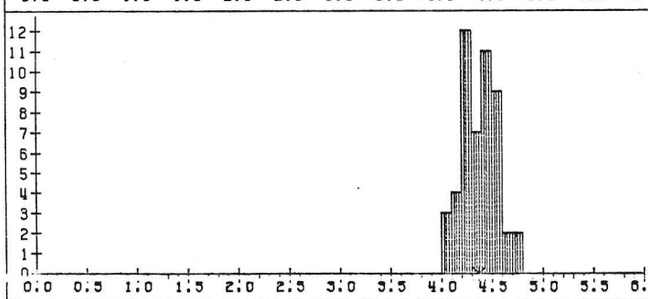
V-3254 RL
OUTCROP 5-14-82
KERO=AMOR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) ✳	0.00	0.00	0.000	0



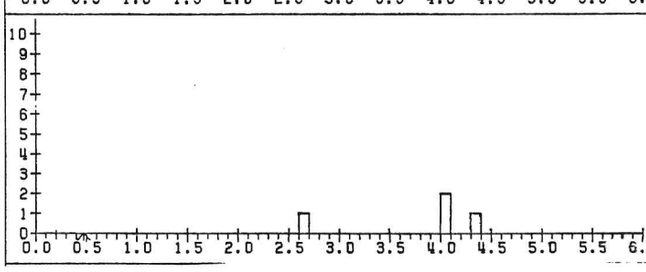
V-3256 RL
OUTCROP 5-14-82
KERO=STR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) ✳	0.25	0.26	0.062	40



V-3257 RL
OUTCROP 5-14-82
KERO=AMOR

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) ✳	4.36	4.39	0.170	50



V-3258 RL
OUTCROP 5-14-82
KERO=AMOR

AVG.%RO	MEDIAN	S.DEV.	POINTS

TS 825069CX
Figure 2d

May 4, 1982

D. J. ~~VerSteeg~~
~~2302~~ AB

ATTN: B. Kemp

PALYNOLOGICAL ANALYSIS OF 25 OUTCROP SAMPLES
FROM THE 1981 ALASKA INTERIOR BASINS FIELD PROGRAM

I-81-3	20-10S-5E	Claystone; recovery good, age Upper Miocene or Lower Pliocene.
I-81-5	20-10S-5E	Coal; recovery not age diagnostic*.
I-81-7	1-11S-4E	Claystone; recovery not age diagnostic*.
I-81-8	1-11S-4E	Claystone; recovery good, age Upper Miocene or Lower Pliocene with Eocene age rework.
I-81-13	1-10S-8W	Shale/phylite; barren; age pre-Tertiary?
I-81-16	21-9S-6W	Claystone; recovery moderate; age Eocene.
I-81-19	30-10S-3W	Claystone; recovery moderate; age Miocene.
I-81-22	31-10S-1W	Claystone; recovery moderate; age Miocene.
I-91-23	31-10S-1W	Coal; recovery not age diagnostic*.
I-81-27	3-12S-7W	Coal; recovery not age diagnostic*.
I-81-28	3-12S-7W	Claystone; recovery fair; age probably Miocene.
I-81-29	3-12S-7W	Coal; recovery not age diagnostic.,
I-81-53	24-12S-7W	Claystone; recovery poor; age possibly Miocene.
I-81-55	24-12S-7W	Claystone; recovery fair; age probably Miocene.
I-81-61	32-10S-10W	Claystone; recovery good; age middle or upper Miocene.
I-81-62	32-10S-10W	Coal; recovery poor; age possibly Miocene.
I-81-78	13-30N-21W	Coal; recovery not age diagnostic.
I-81-79	27-31N-20W	Shale/phylite; barren; age pre-Tertiary?
I-81-82	22-31N-20W	Coal, recovery not age diagnostic.
I-81-94	29-27N-26W	Claystone; recovery poor; age probably Tertiary.
I-81-96	19-27N-26W	Coal; recovery not age diagnostic.
I-81-97	19-27N-26W	Claystone; palynology recovery poor but probably Tertiary; leaf taxa Neogene, probably Miocene.
I-81-98	[illegible]	Claystone; same data as for sample I-81-97.
I-81-105	27-18S-28E	Claystone; recovery poor but diagnostic; age Campanian or Maastrichtian.
I-81-114	32-26N-28W	Claystone; recovery not age diagnostic.

* This catagory includes such materials as wood fragments, most cuticle pieces, most fungal hyphae and pollen/spores that 1) could as well be Mesozoic as Cenozoic, 2) are stratigraphically out of place through cave or rework, or 3) are too badly degraded to be identified with reasonable certainty.

Bill Baxendale
R. W. Baxendale

APPENDIX VII

20.

82236ART0052

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

SOURCE ROCK EVALUATION

Tertiary Sanctuary Outcrops, South of the Middle Tanana Basin, Alaska

Geochemistry Services Group

R. J. Harwood

Technical Service 825212CX
Requested by S. F. Waller
APC (USA) DENVER FAR WEST

Distribution: R. C. Brooke, Denver
D. J. Versteeg, Denver
G. W. Rohr, Denver
S. F. Waller, Denver
R. R. Thompson/E. R. Michaelis

20.

TECHNICAL SERVICE 825212CX 82236ART0052

Subject: Tertiary Sanctuary Outcrops, South of the Middle Tanana Basin, Alaska

INTRODUCTION

Fourteen outcrop samples from the Tertiary Sanctuary Formation located south of the Middle Tanana Basin (Figure 1) were submitted as part of the central Alaska play. These samples were submitted on a high priority basis to supplement previous results from the area; preliminary results were reported to S. F. Waller (telecon from R. J. Harwood, June 21 and 25, 1982).

EVALUATION

1. Based on organic carbon contents these samples are rated as mostly good and very good in petroleum generation ability (Tables 1, 2). However, hydrocarbon amounts generated on pyrolysis analysis would give nonsource to fair ratings (Table 2), but the amounts may be low because of weathering.

2. Low convertibilities to hydrocarbons on pyrolysis suggest that the kerogens are gas generating (Tables 1, 2).

3. The low vitrinite reflectance values and immature characters of the bitumen chromatograms indicate that these samples are pregeneration for gas (Tables 1, 4, Figure 2).

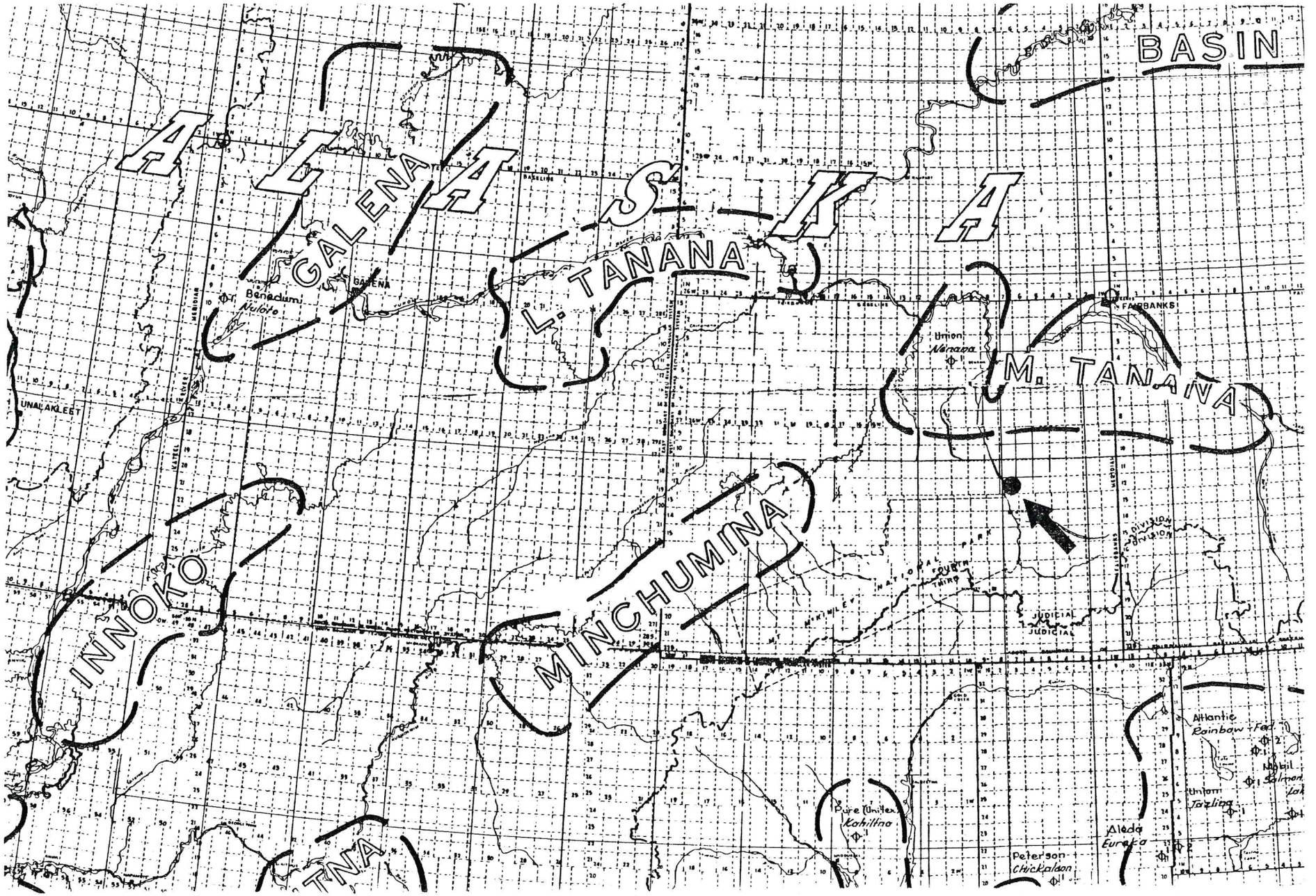
4. These results are similar to previous results from the area (T.S. 825069CX).

5. As with all outcrop samples, weathering could have reduced both the quality and quantity of organic matter in the samples leading to underestimation of their petroleum generating abilities (enclosure).

Robert J. Harwood

R. J. Harwood

RJH:rjh/lmw
Enclosure



TS 825212CX
Figure 1

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

OFFICE DENVER DISTRICT FAR WEST
AUTHORIZED BY STEPHEN F. WALLER
TECHNICAL SERVICE NUMBER 825212

SOURCE ROCK SUMMARY
TABLE 1.
DATE 08/19/82

SAMPLE NUMBER LAB NO.	SMPL TYPE	FORMATION	AGE	LITHOLOGY	FIELD NO. OR DEPTH FEET TOP***BASE	PETROLEUM GENERATION CAPABILITY	KEROGEN TYPE (OIL/GAS)	STAGE OF DIAGENESIS
STATE ALASKA COUNTY FAIRBANKS WELL NAME AMOCO				WELL LOCATION SECT.24-T12S-R7W LEASE				
X-3575	OT	SANCTUARY	TERT	Mudstn	SW82 01	FAIR *	GAS	PREGENERATION
X-3576	OT	SANCTUARY	TERT	"	SW82 02	VERY GOOD	GAS	PREGENERATION
X-3577	OT	SANCTUARY	TERT	"	SW82 03	GOOD	GAS	PREGENERATION
X-3578	OT	SANCTUARY	TERT	"	SW82 04	FAIR	GAS	PREGENERATION
X-3579	OT	SANCTUARY	TERT	"	SW82 05	FAIR	GAS	PREGENERATION
X-3580	OT	SANCTUARY	TERT	"	SW82 06	GOOD	GAS	PREGENERATION
X-3581	OT	SANCTUARY	TERT	"	SW82 07	VERY GOOD	GAS	PREGENERATION
X-3582	OT	SANCTUARY	TERT	"	SW82 08	GOOD	GAS	PREGENERATION
X-3583	OT	SANCTUARY	TERT	"	SW82 09	GOOD	GAS	PREGENERATION
X-3584	OT	SANCTUARY	TERT	"	SW82 10	GOOD	GAS	PREGENERATION
X-3585	OT	SANCTUARY	TERT	"	SW82 11	VERY GOOD	GAS	PREGENERATION
X-3586	OT	SANCTUARY	TERT	"	SW82 12	GOOD	GAS	PREGENERATION
X-3587	OT	SANCTUARY	TERT	"	SW82 13	GOOD	GAS	PREGENERATION
X-3588	OT	SANCTUARY	TERT	"	SW82 14	GOOD	GAS	PREGENERATION

* Nonsource to poor from generated hydrocarbons on pyrolysis (Table 2).

* R825212 ROCKEVAL PYROLYSIS DATA

* SAMPLE NO.	TOP OF ANALYZED INTERVAL	FORMATION	TOTAL ORGANIC CARBON WT% (TOC)	PPM VOLATILE HYDROCARBONS (S1 X 1000)	VOL/ TOC	PPM GENERATED HYDROCARBONS (S2 X 1000)	GEN/ TOC	TEMP OF MAX GEN	VOL/ VOL + GEN
X-3575	OT	SANCTUARY	0.7	40	0.01	100	0.02	444	0.29
X-3576	OT	"	1.7	30	<0.01	1530	0.09	419	0.02
X-3577	OT	"	1.4	30	<0.01	630	0.05	426	0.05
X-3578	OT	"	0.9	20	<0.01	100	0.01	445	0.17
X-3579	OT	"	0.8	10	<0.01	160	0.02	360	0.06
X-3580	OT	"	1.3	30	<0.01	450	0.03	444	0.06
X-3581	OT	"	1.4	40	<0.01	470	0.03	451	0.08
X-3582	OT	"	1.2	30	<0.01	250	0.02	386	0.11
X-3583	OT	"	1.3	30	<0.01	390	0.03	449	0.07
X-3584	OT	"	1.4	20	<0.01	340	0.02	454	0.06
X-3585	OT	"	1.5	40	<0.01	510	0.03	446	0.07
X-3586	OT	"	1.2	10	<0.01	270	0.02	400	0.04
X-3587	OT	"	1.0	20	<0.01	240	0.02	366	0.08
X-3588	OT	"	1.0	20	<0.01	250	0.02	388	0.07

Table 2

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

OFFICE DENVER DISTRICT FAR WEST
TECHNICAL SERVICE NUMBER 825212

SOURCE ROCK DATA
TABLE 3.
DATE 08/19/82

BBL/AF = (PPM X .0180)

STATE ALASKA COUNTY FAIRBANKS WELL LOCATION SECT.24-T12S-R7W
WELL NAME AMOCO LEASE

SAMPLE NUMBER	FIELD NO. OR DEPTH FEET TOP***BOTTOM	GEOL. AGE	INSOL RESID%	TOTAL ORG C WT%	BITUMEN BBL/AF	BITUMEN PPM	SAT HC BBL/AF	SAT HC PPM	SAT HC/ BITUMEN	BITUMEN/ TL ORG C	REMARKS
X-3575	SW82 01	TERT	79	.7	2	101				.02	
X-3576	SW82 02	TERT	79	1.7	3	140				.01	
X-3577	SW82 03	TERT	86	1.4	4	232		20	.09	.02	
X-3578	SW82 04	TERT	84	.9	2	137				.01	
X-3579	SW82 05	TERT	85	.8	3	145				.02	
X-3580	SW82 06	TERT	85	1.4	3	193				.01	
X-3581	SW82 07	TERT	85	1.5	3	179				.01	
X-3582	SW82 08	TERT	84	1.2	3	149				.01	
X-3583	SW82 09	TERT	87	1.4	4	208	1	29	.14	.02	
X-3584	SW82 10	TERT	85	1.4	3	168				.01	
X-3585	SW82 11	TERT	86	1.6	4	224		14	.06	.01	
X-3586	SW82 12	TERT	85	1.2	2	113				.01	
X-3587	SW82 13	TERT	87	1.0	1	82				.01	
X-3588	SW82 14	TERT	86	1.0	2	117				.01	

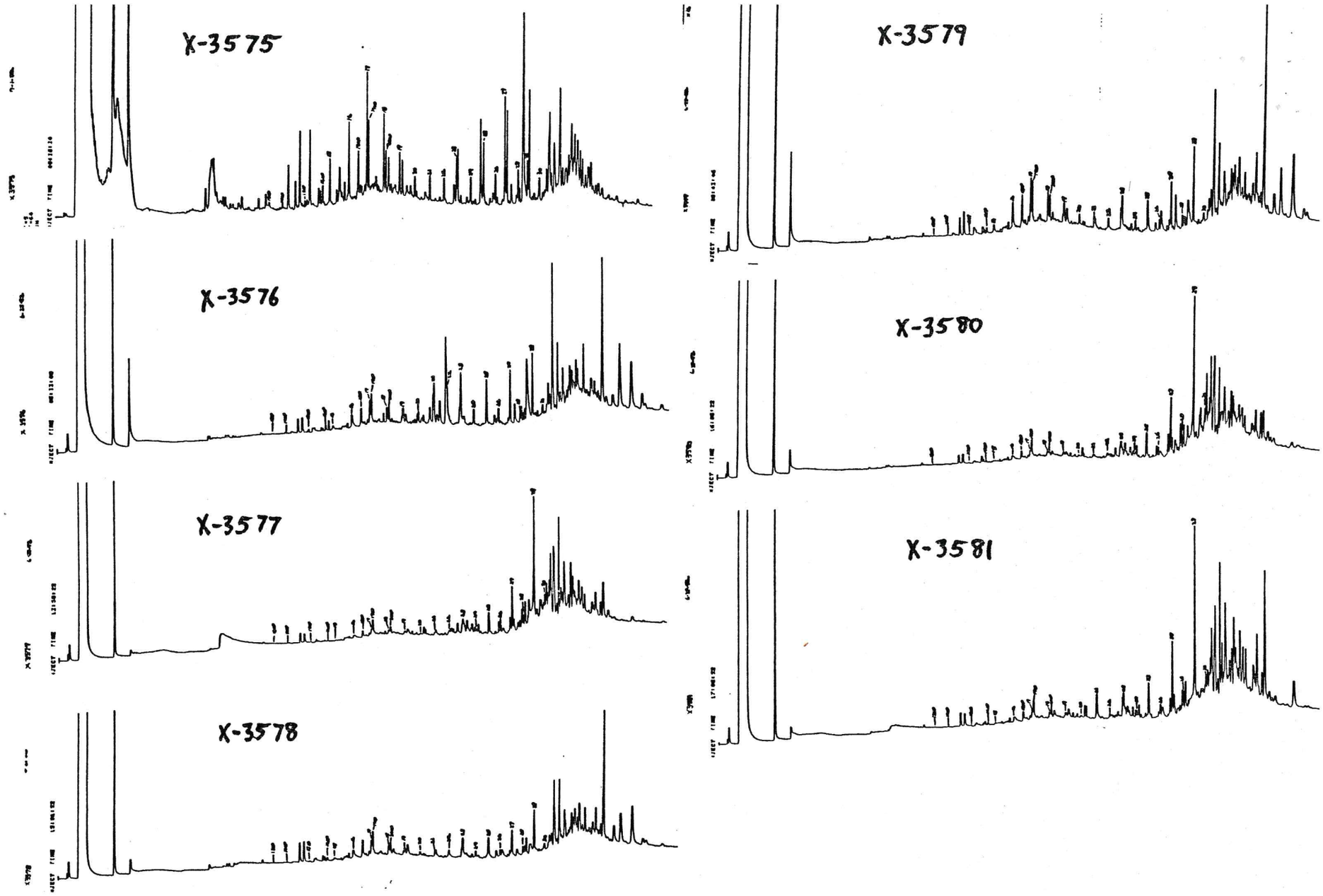
AMOCO PRODUCTION COMPANY
RESEARCH CENTER

OFFICE DENVER DISTRICT FAR WEST
TECHNICAL SERVICE NUMBER 825212

KEROGEN DATA
TABLE 4.
DATE 08/19/82

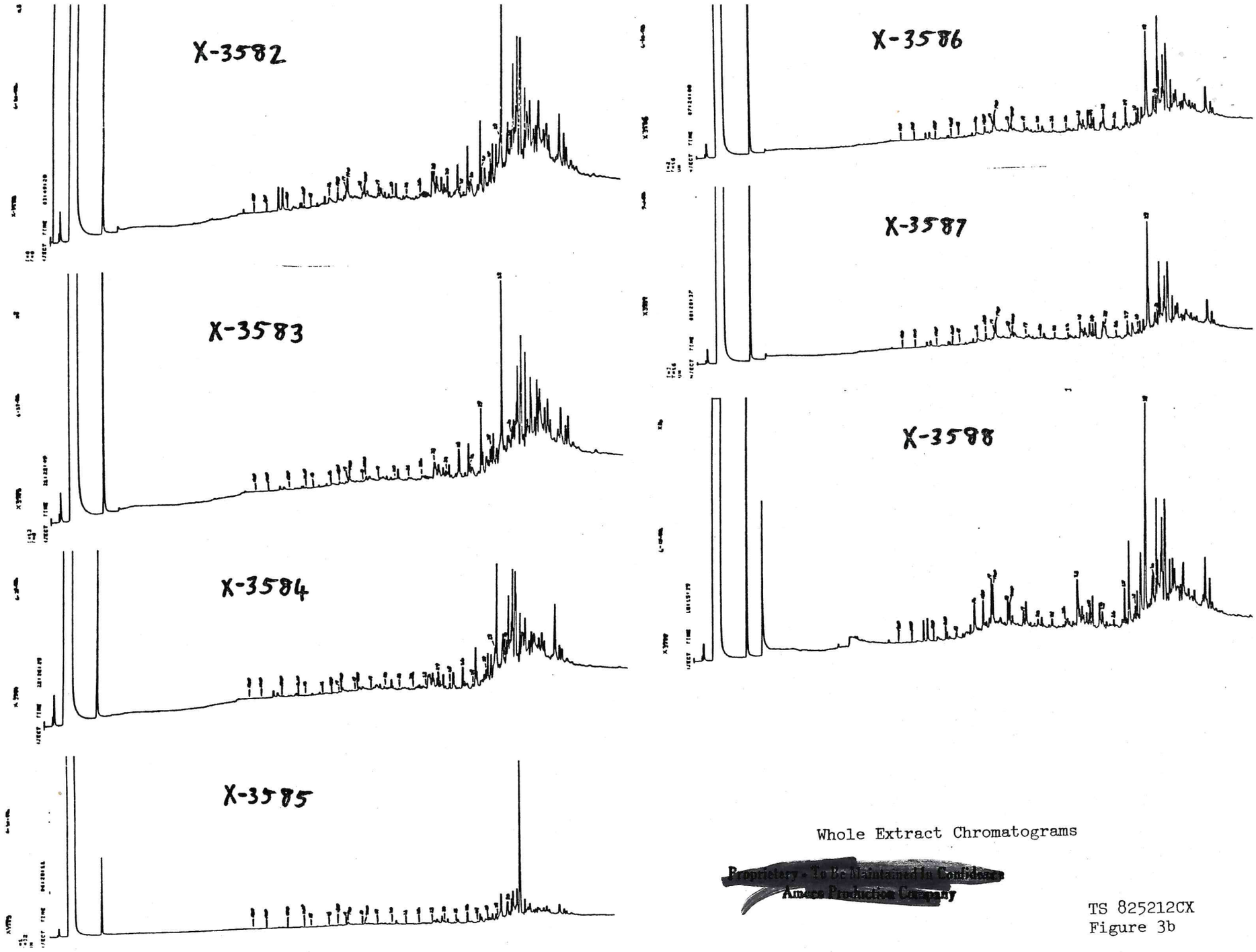
STATE ALASKA COUNTY FAIRBANKS WELL LOCATION SECT.24-T12S-R7W
WELL NAME AMOCO LEASE

LAB SAMPLE NUMBER	FIELD NO. OR DEPTH FEET TOP***BOTTOM	GEOL. AGE	NORM. ELEMENTAL ANALYSIS,WT. CARBON	HYDROGEN	OXYGEN	NITROGEN	ATOMIC RATIO O/C	ATOMIC RATIO H/C	VISUAL KEROGEN TYPE	CARBNZ. SCALE	VIT REFLECT %RO
X-3575	SW82 01	TERT							AMORPHOUS	3	
X-3576	SW82 02	TERT							AMORPHOUS	3	.41
X-3577	SW82 03	TERT							MIXED	3	.38
X-3578	SW82 04	TERT							MIXED	3	.44
X-3579	SW82 05	TERT							MIXED	3	.44
X-3580	SW82 06	TERT							MIXED	3	.40
X-3581	SW82 07	TERT							MIXED	3	.39
X-3582	SW82 08	TERT							MIXED	3	.40
X-3583	SW82 09	TERT							MIXED	3	.41
X-3584	SW82 10	TERT							MIXED	3	.41
X-3585	SW82 11	TERT									
X-3586	SW82 12	TERT							STRUCTURED	3	.38
X-3587	SW82 13	TERT							STRUCTURED	3	.41
X-3588	SW82 14	TERT							MIXED	3	.39



Whole Extract Chromatograms

TS 825212
Figure 3a



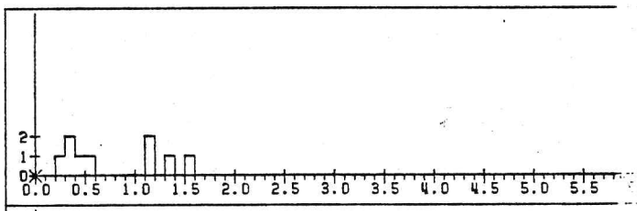
Whole Extract Chromatograms

TS 825212CX
Figure 3b

VITRINITE REFLECTANCE ANALYSIS

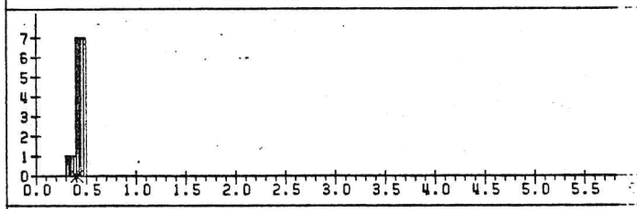
ALASKA OUTCROPS; FAIRBANKS, ALASKA

LOCALITY 5212 TECH SVC N05212



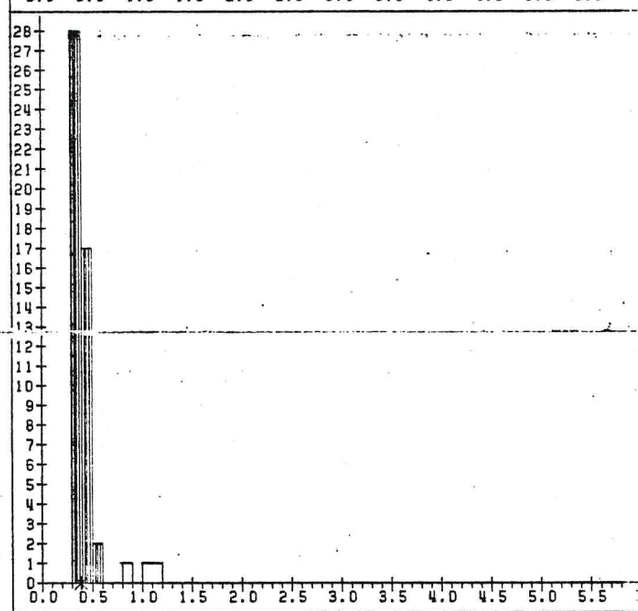
V-3575 RL
OUTCROP 8-18-82
CS=3 KERO=AMOR
FLUORESCENT-YES

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.00	0.00	0.000	0



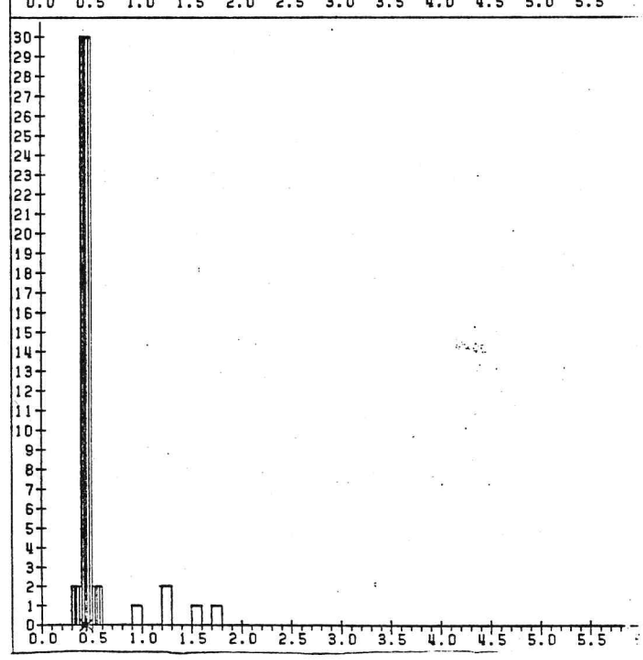
V-3576 RL
OUTCROP 8-18-82
CS=3 KERO=AMOR
FLUORESCENT-YES

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.41	0.44	0.028	8



V-3577 RL
OUTCROP 8-18-82
CS=3 KERO=MIX
FLUORESCENT-YES

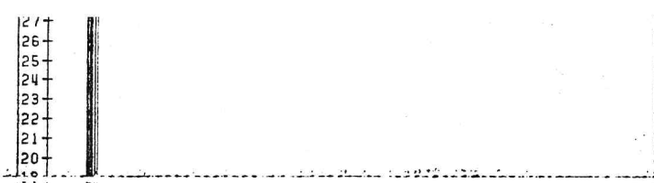
	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.38	0.38	0.040	47



V-3578 RL
OUTCROP 8-18-82
CS=3 KERO=MIX
FLUORESCENT-YES

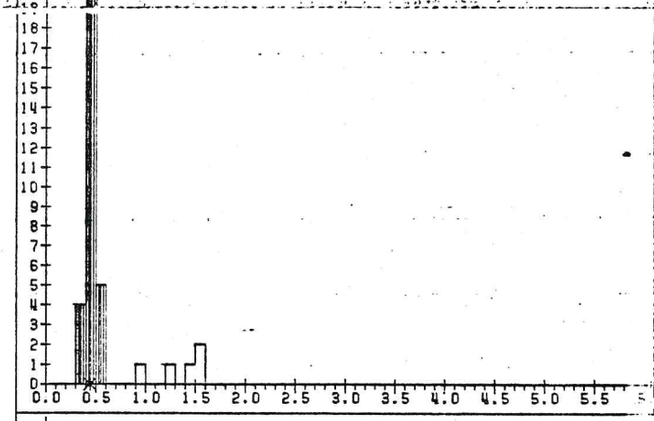
	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.44	0.45	0.029	34

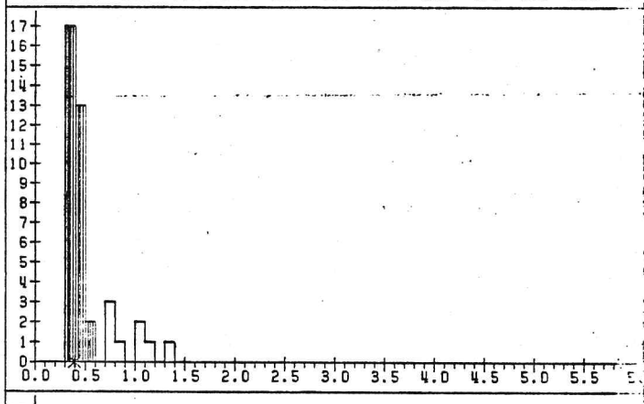
TS 825212CX
Figure 2a



OUTCROP 8-18-82
CS=3 KERO=MIX
FLUORESCENT-YES

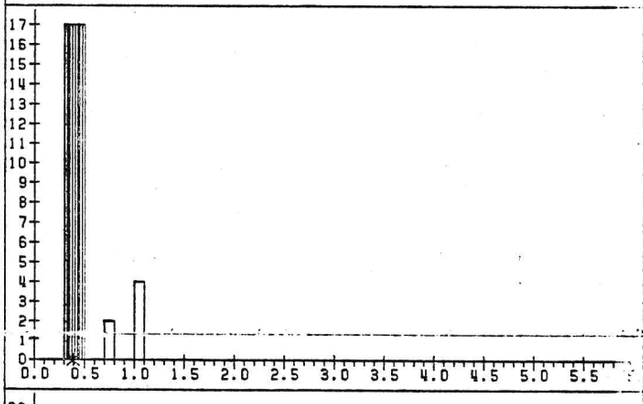
	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.44	0.45	0.050	37





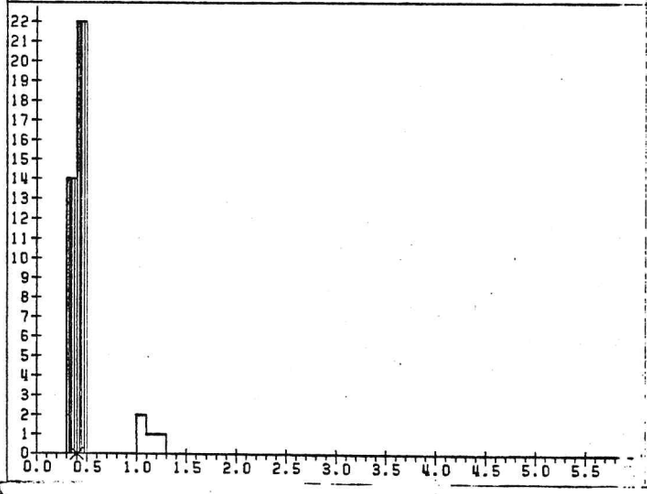
V-3580 RL
OUTCROP 8-18-82
CS=3 KERO=MIX
FLUORESCENT-YES

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.40	0.39	0.042	32



V-3581 RL
OUTCROP 8-18-82
CS=3 KERO=MIX
FLUORESCENT-YES

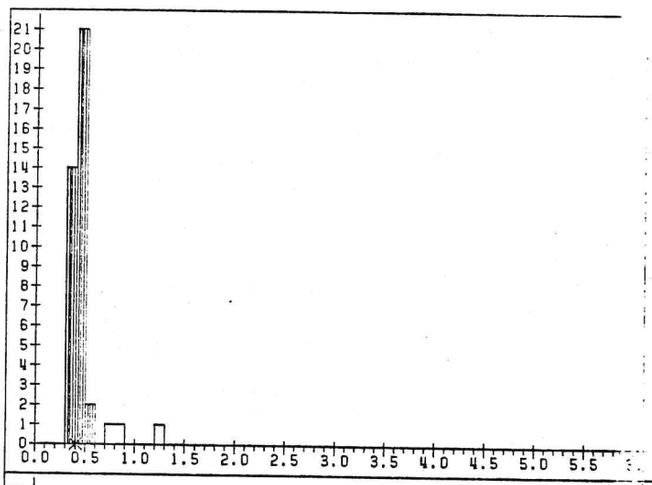
	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.39	0.40	0.032	34

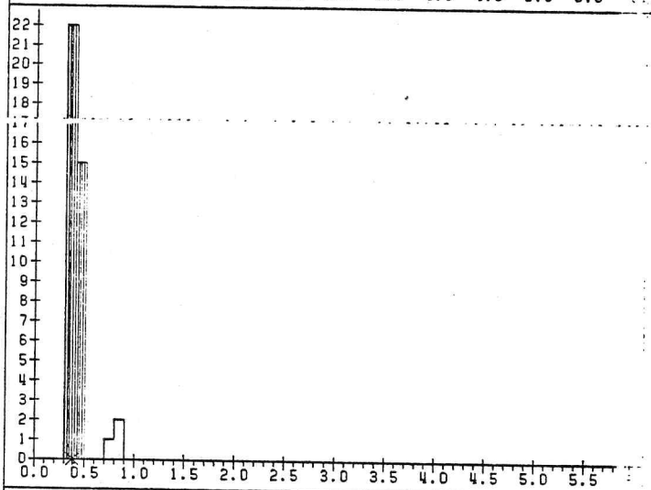


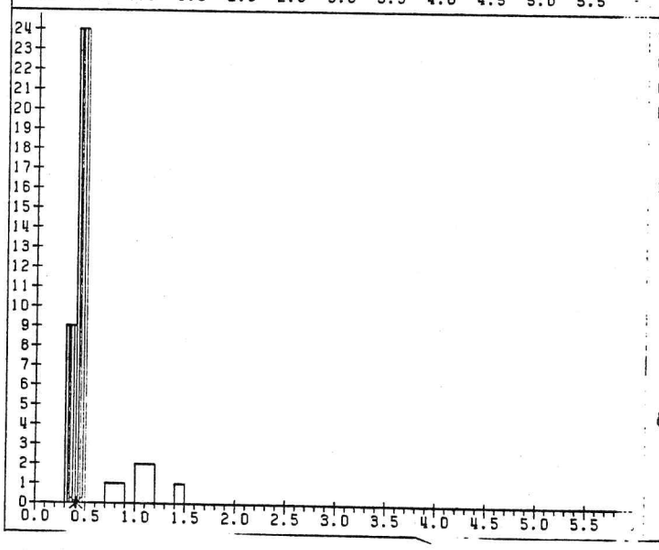
V-3582 RL
OUTCROP 8-18-82
CS=3 KERO=MIX
FLUORESCENT-YES

	AVG.%RO	MEDIAN	S.DEV.	POINTS
1) *	0.40	0.42	0.031	36

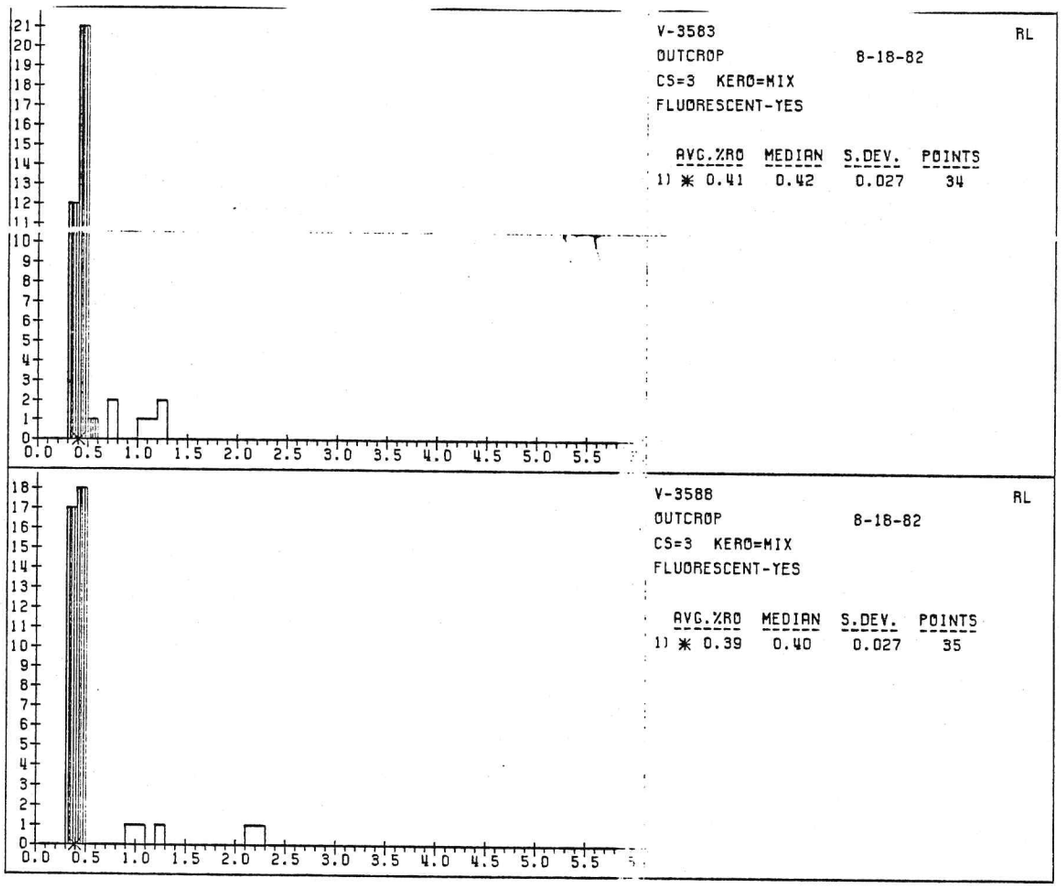
TS 825212CX
Figure 2b







TS 825212CX
Figure 2c



X-AXIS = PERCENT REFLECTANCE OF VITRINITE (%RO)

Y-AXIS = FREQUENCY

AVERAGE %RO FOR POP.1 = 0.37

TS 8252120
Figure 2d

EFFECTS OF WEATHERING ON SOURCE ROCK MEASUREMENTS OF OUTCROP SAMPLES

Weathering on the outcrop often affects the organic contents to the extent that reliable source rock evaluation is not possible. The organic matter content can be both diminished and changed in character. Thus, effective hydrocarbon source rocks can measure as non-source, and the organic matter modified to an extent that precludes the determination of the kerogen type (oil versus gas) and stage of thermal maturity.

On the other hand, many outcrops can be properly sampled to obtain rock material that is relatively unweathered and can be used to obtain reliable source rock evaluations. A guide to the best method of sampling outcrops is given in Research Department Report M80-G-16 "Preliminary Report on the Evaluation of Outcrop Weathering and Its Influence on Source Rock Evaluation" by M. D. Lewan. This report demonstrates that to obtain good quality, unweathered outcrop samples for source rock evaluation, the samples should be taken below the weathering zones where the rocks are "blocky" or "slabby", well lithified, and do not have a significant oxidized rind (Figures 1-2). Such samples can often be taken in cliffs, road cuts and quarries or other features that promote ready penetration of the zone of weathering. In attempts to obtain useful samples, the outcrop should be penetrated as deeply as possible (a full size pickax or pick-mattock is very helpful) and blocks of the rock removed with a large cold chisel and heavy sledge hammer. Even with this procedure, it is not always possible to penetrate the weathered zone, especially in thick soil profiles, and a particular site may not be suitable for source rock sampling. Only those samples which meet the criteria listed in M8-G-16 as being representative of a formation in the unweathered stage should be submitted for source rock analysis. Weathered samples give a pessimistic, unrealistic evaluation of the formation and should be avoided.

RRT:sma
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SURFACE WEATHERING SERIES

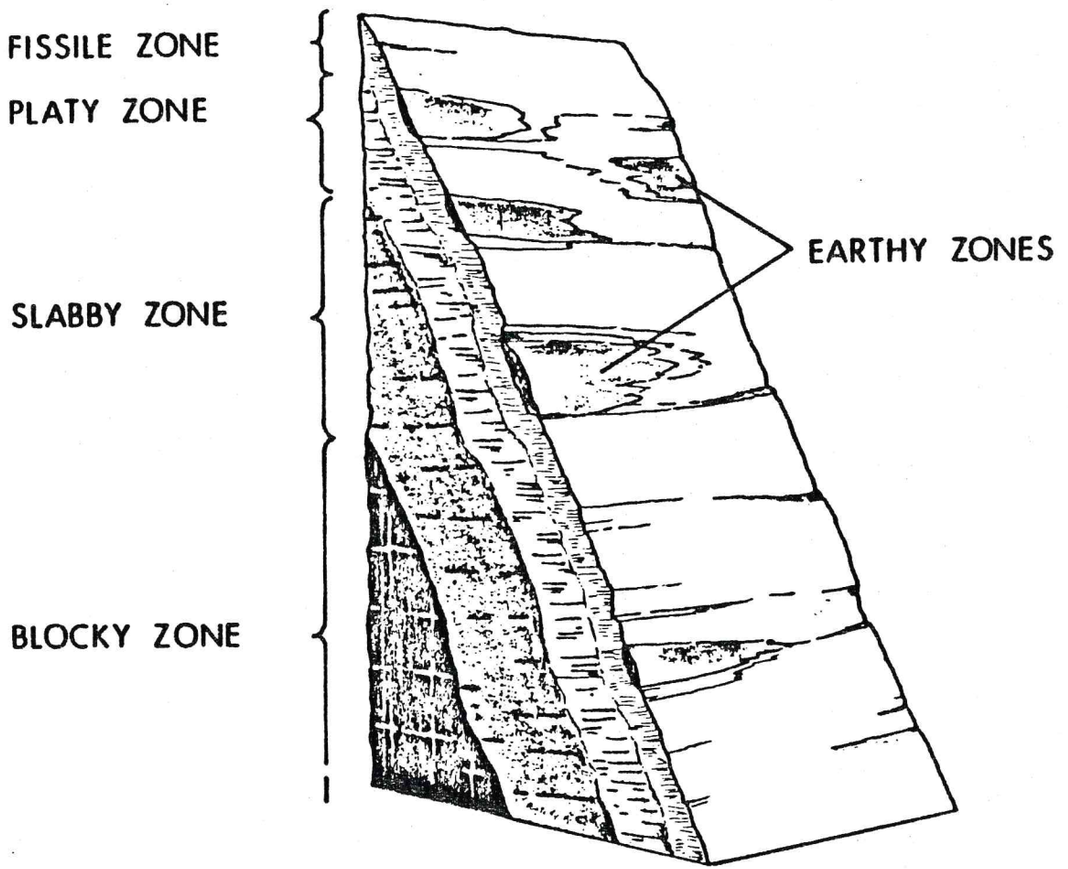

Figure 1: Conceptual View of the Lateral Propagation of Surface Weathering on an Outcrop Face, and the Five Major Zones that may Develop. Taken from Geological Research Report M80-G-16 by M. D. Lewan.

PEDOGENIC WEATHERING PROFILES

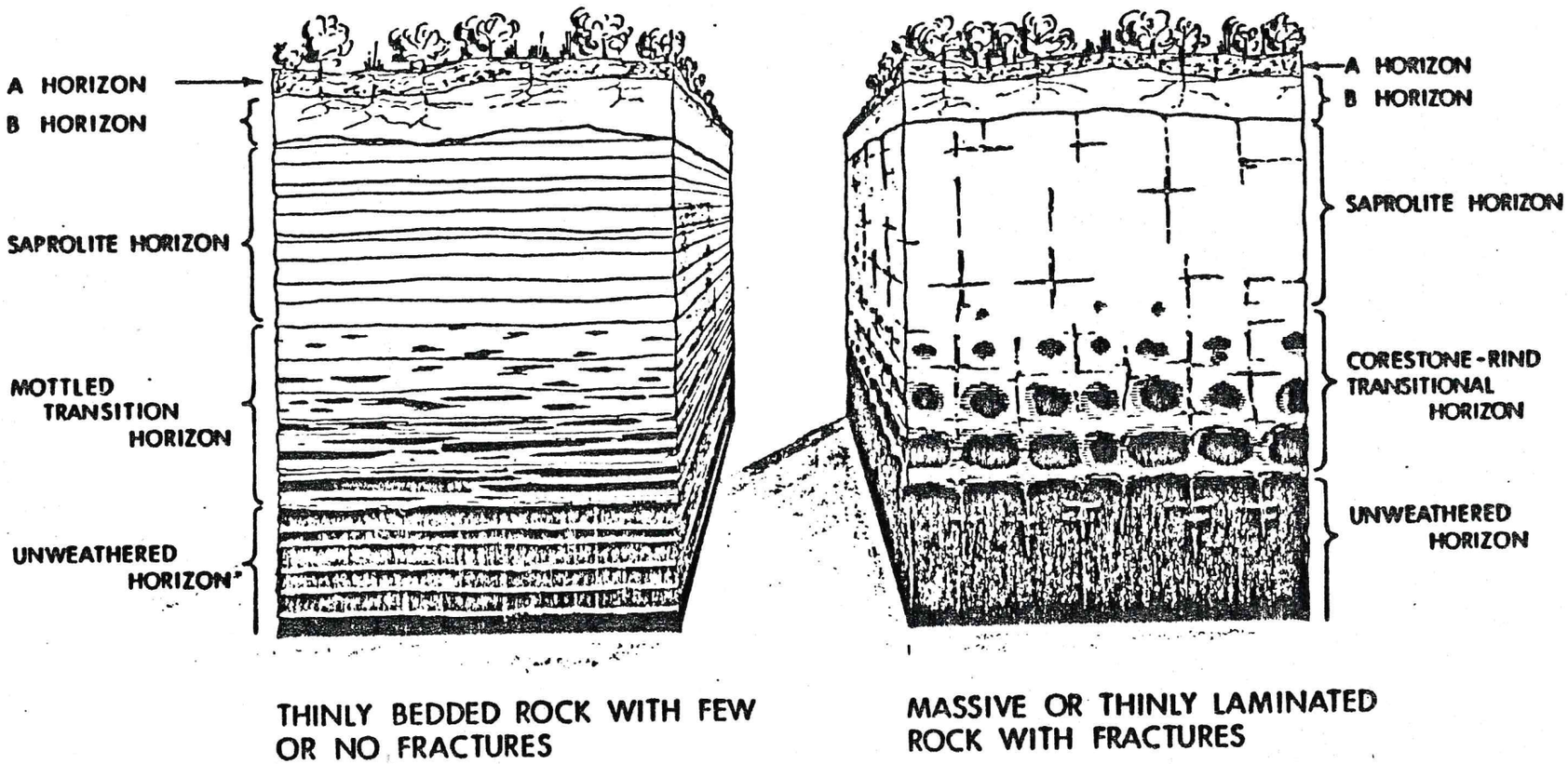

Figure 2: Conceptual View of the Downward Propagation of Pedogenic Weathering and the Major Horizons that May Develop. Taken from Geological Research Report M80-G-16 by M. D. Lewan.