

NORTH SLOPE OIL STUDY

**REGIONAL PETROLEUM GEOCHEMISTRY
AND CORRELATION OF CRUDE OILS FROM
THE NORTH SLOPE OF ALASKA
AND THE BEAUFORT SEA**

GEO**MARK
RESEARCH, INC.**

PROSPECTUS

EXECUTIVE SUMMARY

GeoMark Research Inc. has completed a regional crude oil study of the North Slope of Alaska, including the Canadian Beaufort Sea. The purpose of this study is to provide new insight into the potential of this region by presenting a single set of oil analyses (125 samples), used to portray both genetic oil families and the ensuing petroleum systems.

Each of the oils were characterized by a detailed analytical program which includes bulk composition data, quantitative biomarker analysis of terpanes and steranes, and determination of stable carbon isotope composition of both saturate and aromatic hydrocarbon fractions. With this information, and the use of cluster and principal component analyses, the following has been accomplished:

- Determine the number of genetically distinct oil families and subfamilies in the region.
- Map the stratigraphic and geographic distribution of the oil families and distinguish areas with single oil families from those with multiple oil families (multiple sources).
- Utilize geochemical characteristics of the oil families to deduce their source depositional facies (Triassic, Jurassic, Cretaceous, or Tertiary), thermal maturity level, and degree of preservation.
- Estimate migration directions, migration extent, and sequencing of migration episodes by comparing oil family distributions (vertical and horizontal) with the location of known or inferred source depocenters.
- Estimate the degree of mixing if some regions are found to be sourced by more than one oil family.
- Assess the commercial significance of each of the petroleum systems within each of the geographical regions.

All of the analytical data generated from the oils are included in a set of Data Volumes together with a bound interpretive report. The final interpretive report will include wall-sized, full color maps/montages showing the distribution of oil families and associated petroleum systems.

The cost of the study is US \$34,500.

METHODOLOGY AND EXPLORATION APPLICATIONS

In areas such as the North American Arctic region where substantial production has been established, a regional oil study is an excellent way of identifying, evaluating, and estimating the various petroleum systems that have contributed to reserves. A regional oil study approach is particularly useful for comparing the remaining potential of the various regions and for identifying underdeveloped plays.

The regional petroleum systems within the study area have been evaluated by determining the number of effective source units within the region by establishing the number of compositionally distinct oil families using multivariate statistical techniques. The source facies of each oil family were deduced from the oil geochemistry (e.g., Zumberge, 1987; Moldowan *et al.*, 1985). Conclusions were reached regarding source lithology, anoxicity, salinity, organic input (e.g., marine, lacustrine, marginal marine), and thermal maturity using a multiparameter approach based on molecular and bulk composition.

A list of the oil samples included in the study is given in Appendix A. The location of the samples is illustrated in the accompanying map.

ANALYTICAL PROGRAM

The following techniques have been employed on each of the oil samples:

- API Gravity
- % Sulfur
- Nickel/Vanadium concentration
- C15+ vs. <C15
- Deasphalting
- Liquid Chromatography (%Sat, %Aro, %NSO)
- Capillary Gas Chromatography of Whole Crudes
- Stable Carbon Isotopes for both Sat and Aro Hydrocarbon Fractions
- GC/MS of branched/cyclic fraction for Terpane/Sterane Distributions
- GC/MS of the aromatic fraction (qualitative)

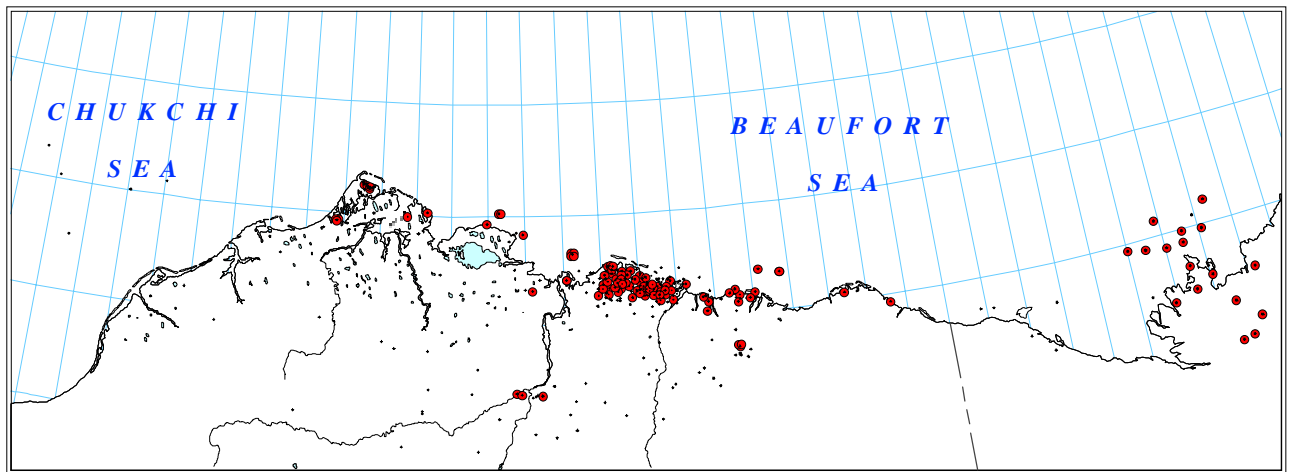


Figure 1. Location map showing analyzed samples.

PRESENTATION OF RESULTS

Results of the study are presented in both analytical and interpretive formats to insure that all findings are readily accessible to explorationists and research personnel. All of the analytical data are provided in hard copy and on magnetic media.

Analytical data is presented within **Data Volumes**, and include the following:

- physical property data
- liquid chromatographic data
- gas chromatograms
- stable carbon isotope data
- GC/MS mass chromatograms
- PC Data Base (Access™)

A synthesis and interpretation of all information is presented in a comprehensive **Final Report**, which includes sections for:

- regional geology
- differentiation of oil families/
mixing by multivariate statistics
- inferred oil/source correlations
- oil generation and migration
- interpretation of oil characteristics

The final interpretive report includes wall-sized, full color maps/montages showing the distribution of oil families and associated petroleum systems.

PARTICIPATION

The cost of the study is US \$34,500.

TIMING

This project is complete and available for immediate delivery.

FOR ADDITIONAL INFORMATION CONTACT:

Mr. Stephen W. Brown
GEOMARK RESEARCH, INC.
9748 Whithorn Drive
Houston, TX 77095

Telephone: (281) 856-9333

Fax: (281) 856-2987

E-mail: sbrown@geomarkresearch.com

REFERENCES

- MOLDOWAN J.M., SEIFERT W.K., AND GALLEGOS E.J.** (1985) Relationship between petroleum composition and depositional environment of source rocks. *AAPG Bul.*, **69**, 1255-1268.
- ZUMBERGE J.E.** (1987) Prediction of source rock characteristics based on terpane biomarkers in crude oils: A multivariate statistical approach. *Geochim. Cosmochim. Acta*, **51**, 1625-1637.

Table I
Samples Analyzed for this Study

Basin	Field	Basin	Field
BEAUFORT	ADGO F-28	NORTH SLOPE	KAVEARAK 32-25
BEAUFORT	ADLARTOK P-09	NORTH SLOPE	KAVEARAK POINT-1; DST3
BEAUFORT	AMAULIGAK 1-65	NORTH SLOPE	KAVEARAK-1
BEAUFORT	ARLUK E-90	NORTH SLOPE	KUPARUK STATE
BEAUFORT	ATKINSON H-25	NORTH SLOPE	KUPARUK STATE
BEAUFORT	GARRY P-04	NORTH SLOPE	KUPARUK STATE-1; DST1
BEAUFORT	IMNAK J-29	NORTH SLOPE	KUPARUK STATE; DST3
BEAUFORT	ISSERK I-15	NORTH SLOPE	KUPARUK STATE; DST4
BEAUFORT	ISSUNGNAK 2-0-61	NORTH SLOPE	M-3
BEAUFORT	ISSUNGNAK 2-0-61	NORTH SLOPE	M-4
BEAUFORT	ITTIYOK I-27	NORTH SLOPE	MANDAY CREEK SEP
BEAUFORT	IVIK J-26	NORTH SLOPE	MIKKELSON BAY STATE-1
BEAUFORT	KAMIK	NORTH SLOPE	MIKKELSON BAY STATE-1; DST3
BEAUFORT	KOAKOAK O-22	NORTH SLOPE	MIKKELSON BAY STATE-1; DST4
BEAUFORT	KOPANOAR 21-44	NORTH SLOPE	MIKKELSON BAY STATE-1; DST6
BEAUFORT	KOPANOAR M-13	NORTH SLOPE	MILNE POINT-2; DST2
BEAUFORT	KUGPIK O-13	NORTH SLOPE	MILNE POINT-2; DST3A
BEAUFORT	KUMAK J-06	NORTH SLOPE	MUKLUK-1; DST4
BEAUFORT	MAYOGIAK J-17	NORTH SLOPE	N-8
BEAUFORT	NERLERK M-98	NORTH SLOPE	NIAKUK-5
BEAUFORT	NIGLINTGAK M-19	NORTH SLOPE	NIAKUK-6
BEAUFORT	NIPTERK L-19A	NORTH SLOPE	NORTH KUPARUK-1
BEAUFORT	NIPTERK P-32	NORTH SLOPE	NORTH KUPARUK-1
BEAUFORT	PITSULIAK A-05	NORTH SLOPE	NORTH KUPARUK-1; DST2
BEAUFORT	TARSUIT A-25	NORTH SLOPE	NORTH KUPARUK-1; DST4
BEAUFORT	UVILUK P-66	NORTH SLOPE	NORTH KUPARUK-33
NORTH SLOPE	FISH CREEK-1	NORTH SLOPE	PHOENIX-1; DST1
NORTH SLOPE	ANGUN SEEP	NORTH SLOPE	PHOENIX-1; DST3
NORTH SLOPE	ANTARES-1; DST4	NORTH SLOPE	POINT STORKERSON-1; DST1
NORTH SLOPE	ANTARES-2; DST3	NORTH SLOPE	PRUDHOE BAY STATE-1; DST1
NORTH SLOPE	B-2	NORTH SLOPE	PRUDHOE BAY STATE-1; DST2
NORTH SLOPE	BARROW-12	NORTH SLOPE	PRUDHOE BAY STATE-1; DST3
NORTH SLOPE	BELI UNIT-1; DST2	NORTH SLOPE	PRUDHOE BAY STATE-1; DST5
NORTH SLOPE	C-1	NORTH SLOPE	PRUDHOE BAY-1
NORTH SLOPE	CAPE SIMPSON SP-24	NORTH SLOPE	PRUDHOE BAYSTATE-1; DST10
NORTH SLOPE	DALTON-1	NORTH SLOPE	PUT RIVER D-3
NORTH SLOPE	DS-1-1	NORTH SLOPE	RUBY-1
NORTH SLOPE	DS-1C-6	NORTH SLOPE	S. BARROW-19
NORTH SLOPE	DS-1E-12	NORTH SLOPE	S. BARROW-20
NORTH SLOPE	DS-1F-15	NORTH SLOPE	SAG RIVER-1
NORTH SLOPE	DS-2C-8	NORTH SLOPE	SEABEE-1
NORTH SLOPE	DS-2F-9	NORTH SLOPE	SIMPSON CORE TEST
NORTH SLOPE	DS-2X-8	NORTH SLOPE	SIMPSON-11
NORTH SLOPE	E-5	NORTH SLOPE	SOUTH BARROW-12; DST4
NORTH SLOPE	E1-1	NORTH SLOPE	STAINES RIVER ST.-1
NORTH SLOPE	F-4	NORTH SLOPE	STAINES RIVER-1
NORTH SLOPE	FISH CREEK-1	NORTH SLOPE	STATE-1
NORTH SLOPE	FISH CREEK-1	NORTH SLOPE	UMIAT-1
NORTH SLOPE	FOGGY ISLAND-1; DST4	NORTH SLOPE	UMIAT-4
NORTH SLOPE	G-2	NORTH SLOPE	UMIAT-4
NORTH SLOPE	GWYDYR BAY S-1	NORTH SLOPE	W. MIKKELSEN BAY STATE-1; DST5
NORTH SLOPE	GWYDYR BAY-1; DST3	NORTH SLOPE	WEST KUPARUK-1
NORTH SLOPE	H-4	NORTH SLOPE	WEST KUPARUK-1
NORTH SLOPE	HEMI SPRINGS STATE-1; DST1	NORTH SLOPE	WEST KUPARUK-1; DST1
NORTH SLOPE	HEMI SPRINGS STATE-1; DST2	NORTH SLOPE	WEST KUPARUK-1; DST2
NORTH SLOPE	HEMI SPRINGS STATE-1; DST3+4	NORTH SLOPE	WEST KUPARUK-1; DST6
NORTH SLOPE	HURL STATE-1; DST1	NORTH SLOPE	WEST SAK-2
NORTH SLOPE	HURL STATE-1; DST5	NORTH SLOPE	WEST STAINES-1
NORTH SLOPE	J-3	NORTH SLOPE	WEST STAINES-1
NORTH SLOPE	JOHNSON CREEK SEEP	NORTH SLOPE	WEST STAINES-1; DST1
NORTH SLOPE	JOHNSON CREEK SEEP	NORTH SLOPE	WEST STAINES-1; DST10+11
NORTH SLOPE	KAVEARAK 32-25	NORTH SLOPE	WEST STAINES-1; DST2