Abstract

A study of published and unpublished geologic mapping and potential field, seismic reflection, seismic refraction, and bathymetric data has identified 139 tectono-stratigraphic sedimentary accumulations underlying the Arctic Region between 64° and the North Pole. Petroleum exploration and geologic evaluation of these accumulations suggest that 31 percent of them contain petroleum deposits and that 44 percent are likely to contain and 25 percent possibly contain technically recoverable accumulations of oil, natural gas, and (or) natural gas liquids. Approximately 76 percent of the accumulations occur on continents, 14 percent in the rifted or strike-slip margins of continents, 3 percent in major prodeltas deposited on oceanic crust, and 7 percent in ocean basins seaward of their marginal progradational sedimentary prisms.

Mean estimates from the U.S. Geological Survey’s Circum-Arctic Resource Appraisal suggest that 401 BBOE of undiscovered resources occur in continents north of the Arctic Circle. Of these estimated resources, enumerated as the sum of billions of barrels of oil, natural gas liquids, and oil-equivalent natural gas (BBOE), about 365.3 BBOE (91 percent) occurs in basins created by rift and thermo-isostatic (sag) events, about 18 BBOE (4.5 percent) in foreland basins and another 18 BBOE in transtensional basins, platforms and extensional basins lying adjacent to ocean basins formed by seafloor spreading.

Continental margins, which consist of progradational sedimentary prisms that are commonly underlain by rift deposits or strike-slip faults, contain an estimated 73 BBOE (14 percent) of the undiscovered petroleum resource estimated to lie north of the Arctic Circle. About 67 BBOE (92 percent) of this estimated resource occurs in rifted and 6 BBOE (8 percent) in strike-slip Arctic margins, such as Northern Greenland and the Amerasia Basin margin of Lomonosov Ridge. Another 13.8 BBOE (3 percent) of the estimated resource is assigned to the prodeltas of the major Lena and Mackenzie River systems of Eurasia and North America, which were deposited largely on oceanic crust. Basinward of their marginal progradational sedimentary prisms the ocean basins lying north of the Arctic Circle are estimated to contain only about 37 BBOE (7 percent) of the undiscovered petroleum resource of the Arctic.
References

Asudeh, I., A.G. Green, and D.A. Forsyth, 1988, Canadian expedition to study the Alpha ridge complex: Results of the seismic refraction survey: Geophysical Journal, v. 92., p. 283-301.


TECTONO-STRATIGRAPHIC HABITAT & EST. VOL., UNDISCOVERED PETROLEUM NORTH OF ARCTIC CIRCLE

by

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CARA SYMPOSIUM

June 10, 2009
AEROMAGNETIC EVIDENCE
ORIGINAL POSITION OF CHUKCH MICROPLATE
IN SIBERIA MARGIN

[Map and interpretation by Erik Lundin, STATOIL]
MID-CARBONIFEROUS TO EARLY PERMIAN
FUSULINIDS—NORTHWIND RIDGE

Arctic Fusulinid Province
Canadian Arctic Islands to Western Urals
Absent from Siberia

(Stevens and Ross, 1997)
MAGSAT VERTICAL FIELD ANOMALY, nT

Shelf break, ridge outline. AMR-Alpha-Mendeleev, LR-Lomonosov Ridge

(Mean altitude 331 km)  180° (Haines, 1985; Embry and Osadetz, 1988; Jokat et al., 1999)

Mostly 136-98 Ma

110-90 Ma
COMPARISON OF Vp-DEPTH FUNCTIONS
ALPHA AND MENDELEEV RIDGES

Data from:
Asudeh et al., 1988, Zamansky et al., 1999, Christensen and Mooney, 1995, Lebedeva-Ivanova et al., 2006,
Sverdrup Basin, Canada Arctic Islands

(Embry, 1991)
$\sum = 114$ BBO undiscovered oil in 35 Assessment units (AU)

▲ 50% of oil in East Barents Basins and Arctic Alaska
$\sum = 1,973$ TCF of undiscovered natural gas in 35 Assessment units (AU)

* 75% of natural gas in West Siberia and East Barents Basins and Arctic Alaska

UNDISCOVERED GAS (trillion cubic feet)

- Red: $>100$
- Orange: 6–100
- Brown: 1–6
- Light brown: $<1$
- Gray: Area not quantitatively assessed
- White: Area of low petroleum potential
SEDIMENTARY SUCCESSIONS ON CONTINENTAL CRUST

M    Stable shelf and platform
S    Coastal plain and marine shelf
L    Shelves with rift and thermo-isostatic (sag) basins
S    Transtensional rift basin
M    Extensional basin on continental crust along margin of adjacent ocean basin
M    Extensional basin on continental crust along strike of adjacent ocean basin
       Extensional basin of undetermined origin
M    Foreland basin
S    Fore-arc basin

\[ \sum = 12 \]

SEDIMENTARY SUCCESSIONS ACROSS CONTINENTAL MARGINS

M    Progradational sedimentary succession across predominantly rifted passive margin of existing ocean basin
S    Progradational sedimentary succession across shear margin of existing ocean basin
S    Progradational sedimentary succession across passive margin of extinct ocean basin

SEDIMENTARY SUCCESSIONS ON OCEANIC CRUST

?    Ocean basin (MORB and OCT crust)

L = Large   M = Medium   S = Small
HYDROCARBONS IN ARCTIC SEDIMENTARY SUCCESSIONS
(Est. vol./km²)

—ON CONTINENTS (PANGEA)

Platforms, rifts and sags
Foreland basins
Transtensional basins

—CONTINENTAL MARGINS

Extensional basins
Prograded prisms

—OCEAN BASINS
(Insufficient data)

Oil, Bbls/km²
Gas, MM Cu. Ft./km²