Eváluación of basalt samples (17,859' - 17,888") from the Husky Oil NPRA Tunalik No. 1 well, Western Alaska.

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Mr. O. M. Worrall  
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Dear Mr. Worrall:

REFERENCE: SHELL OIL COMPANY/SHELL WESTERN E&P INC. RESEARCH AGREEMENT

At your request members of our staff examined basalt samples from the Tunalik #1 well, western Alaska, for stratigraphic control. The primary goals were to determine whether the basalts were intrusive or extrusive and if K/Ar age dating was viable. Textural relations indicate that the basalts were quenched and therefore cooled at or near the earth’s surface. K/Ar dating will not yield reliable results due to the absence of K-bearing minerals and the high degree of alteration in the basalts. The age of the basalt is therefore best constrained by its stratigraphic position.

Thin section photomicrographs along with a more detailed discussion are forwarded to R. R. Smith.

Very truly yours,

Dean N. Malouta  
Manager Geology Research

TRT:rm1

Enclosure

cc: Shell Western E&P Inc.  
    R. R. Smith (w/o enclosure)
EVALUATION OF BASALT SAMPLES FROM THE HUSKY OIL NPRA TUNALIK NO. 1 WELL, WESTERN ALASKA

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Purpose: At the request of SWEPI Alaska Division Exploration six core samples of basalt from the Husky NPRA Tunalik #1 well were examined in hand sample and thin section. The samples were taken from depths of 17,859' to 17,888' and are underlain and overlain by sedimentary rocks of Permian age. These igneous rocks are of interest for their potential use in regional stratigraphic calibration and prediction. Three questions were addressed in this study: 1) Are these basalts extrusive, having cooled at or near the earth's surface or are they intrusive having crystallized at depth? 2) If the basalts are extrusive, did they crystallize on the seafloor or on land? 3) Can the basalts be dated using K/Ar techniques and are previously determined K/Ar data reliable?

Sample Description: All the samples examined are relatively fine-grained, amygdaoidal basalt. The original mineralogy consisted of acicular plagioclase, olivine, pyroxene, an opaque phase (magnetite? ilmenite?), and glass. The samples exhibit varying degrees of alteration. The alteration products are chlorite, calcite and quartz. Pyroxene phenocrysts are commonly altered to chlorite, often from the core outward. Fresh pyroxene is relatively rare. Irregular patches of chlorite and radial fibrous chlorite that lines amygdules most likely formed by hydration of glass. In rare occurrences, glass remains in a relatively unaltered state. Amygdules are filled with calcite, chlorite or in some cases quartz. Calcite-filled veins are also present.

K/Ar Dating: Due to the high degree of alteration and the absence of K-bearing minerals such as amphiboles, plagioclase represents the only phase from which a K/Ar date could be derived. Four K/Ar ages were previously determined from plagioclases by the University of Alaska. The ages are Tertiary (50.3 m.y., 50.4 m.y.), Jurassic (186 m.y.), and Devonian (385 m.y.). None of the ages can be considered as a reliable crystallization age for the basalt. The two youngest ages, although overlapping within the errors of the technique, are from altered plagioclases with K40 values of 2.095%, far in excess of that in pristine diabasic plagioclase. Typical values are less than 0.3%. Therefore, most of the argon that is measured is from potassium added to the system during alteration. The unreliability of the data is also reflected in the radiogenic yields of the samples. Good K/Ar data has radiogenic yields of over 90%. The lower values reported in these analyses (51 - 67%) suggest that a great deal of the argon is coming from extraneous sources.

Synthesis: The textural relationships seen in thin section, most notably the abundance of acicular plagioclase and the presence of glass, are indicative of very rapid cooling (quenching). It is likely that the basalts were either extruded at the surface or emplaced at a very shallow level. Given the size of
the samples, it is difficult to determine whether extrusion was on the seafloor or on land. Previously determined K/Ar ages are unreliable and due to the altered nature of the basalts no further age dating is recommended. The age of the basalt is best constrained by its stratigraphic position.
USGS/NPR-A
HUSKY, TUNALIK NO. 1
17859.5±', 1.9X
FLAT SIDE

USGS/NPR-A
HUSKY, TUNALIK NO. 1
17859.5±', 1.9X
ROUGH SIDE

GMC Data Report No. 195
USGS/NPR-A
HUSKY, TUNALIK NO. 1
17866', 1.9X
FLAT SIDE

USGS/NPR-A
HUSKY, TUNALIK NO. 1
17866', 1.9X
ROUGH SIDE
USGS/NPR-A
HUSKY, TUNALIK NO. 1
17868.5', 1.9X
FLAT SIDE

USGS/NPR-A
HUSKY, TUNALIK NO. 1
17868.5', 1.9X
ROUGH SIDE
USGS/NPR-A
HUSKY, TUNALIK NO. 1
17881', 1.9X
FLAT SIDE

USGS/NPR-A
HUSKY, TUNALIK NO. 1
17881', 1.9X
ROUGH SIDE
USGS/NPR-A
HUSKY, TUNALIK NO. 1
17859.55", 2.3X
FLAT SIDE

USGS/NPR-A
HUSKY, TUNALIK NO. 1
17859.55", 2.3X
ROUGH SIDE
USGS/NPR-A
HUSKY, TUNALIK NO. 1
17868.5', 2.3X
FLAT SIDE

USGS/NPR-A
HUSKY, TUNALIK NO. 1
17868.5', 2.3X
ROUGH SIDE
USGS/NPR-A
HUSKY, TUNALIK NO. 1
17876', 2.3X
FLAT SIDE
USGS/NPR-A
HUSKY, TUNALIK NO. 1
17866', 4.6X
FLAT SIDE

USGS/NPR-A
HUSKY, TUNALIK NO. 1
17866', 4.6X
ROUGH SIDE
17859.5'
HUSKY TUNALIK
40X

17859.5'
HUSKY TUNALIK
40X

17866.5'
HUSKY TUNALIK
64X

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HUSKY TUNALIK
64X

HUSKY TUNALIK
64X
17876'
HUSKY TUNALIK
64X
17888'
HUSKY TUNALIK
64x