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Naval Petroleum Reserve No. 4

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Explanation for Preliminary Cross Section A-A',

Simpson Seeps Core Tests

During the 1949 drilling season eight core tests were completed in the Simpson Seeps area up to October 25th. This program, which is still in progress, was undertaken to provide an explanation for the surface seeps near Cape Simpson. The shallowest of the eight holes reached 800 feet; the deepest was drilled to a depth of 1460 feet.

Geophysical data on the shallow horizons indicate that the Simpson Seeps Core Tests shown on the section have been drilled in an area of nearly north-south strike. The five core tests that most nearly approximate a section normal to the strike were chosen for the accompanying cross section. An east-west strike, accompanied by strong anomalous dips of fifteen to twenty degrees to the north is indicated by geophysical data about five miles north of the cross section.

Simpson Core Test No. 13, the first test, was cored continuously to a depth of 1210 feet, though it reached a total depth of 1438 feet. Fewer cores were taken from succeeding tests, but increased familiarity with the stratigraphic section and electric log control have aided correlation.

It has been possible to establish a good correlation between Core Tests 13, 14, 15, 16, and 17 based upon paleontologic, lithologic, and electric log criteria. An Inoceramus-ammonite-fish bone zone (Inoceramus labiatus - Borisjacoceras sp.) proved to be an excellent marker. This is part of Zone F and is characterized lithologically by the presence of bentonite in successive beds through a zone of about sixty feet. Lower in the section an abundant Zone E fauna is associated with Laevidentalium, a scaphopod. This zone also constitutes a persistent marker. Unmistakable correlation of sands is afforded by the electric log and the following lithologic criteria: carbonaceous streaks, clay-ironstone concretions, biotite and distinctive color of quartz grains.

The section below the Inoceramus-ammonite zone consists almost entirely of nearly unconsolidated silt to medium-grained sands. Above the Inoceramus-ammonite zone is a monotonous section of moderately hard shaly clays and silts with a few calcareous streaks. These five holes (13,14,15,16,17) all are characterized by the sand section below the Inoceramus zone. The sand section is entirely lacking in all the other holes (18,19 and 20).

The Gubik has an excellent microfauna, and can be traced continuously throughout this area to an approximate depth of eighty feet.

A normal north-south fault, downthrown to the west (approximately 400 feet displacement) is indicated in Core Tests 13 and 17 by comparison with Core Tests 14, 15, and 16. Beds disturbed along the fault zone have dips as great as thirty degrees. Elsewhere in these tests, as well as in the entire section in other tests, dips generally are about five degrees.

With data now available, a horst seems the most probable interpretation for the abrupt change in lithology away from the closely similar tests 13, 14, 15, 16, and 17. The lithology of tests 18, 19, and 20 most closely resembles the monotonous clay section above the Inoceramus-ammonite zone in the other tests. The loss of the Inoceramus zone west of Core Test No. 13 requires a second fault possibly paralleling that encountered in tests 13 and 17. Displacement on this fault has to be in excess of 800 feet to result in the disappearance of the Inoceramus-ammonite zone in No. 18.

Distinctive kicks in the electric logs for 18 and 19 permit the correlation of three horizons at least. These correlations indicate slight westward dip. The electric log and lithology for 20 is similar to 18 and 19, but definite correlation cannot be established. However, the absence of a good sand section in 20 suggests the presence of another normal fault between 14 and 20, downthrown to the east. The proposed location for Core Test No. 22, soon to be drilled, is in this area.

The alignment of the surface seeps is in accord with this interpretation of the structure. There is little reason to doubt that the oil has migrated along the fault planes to and through the Gubik to the surface.

Alternative explanations of the structure have been considered:

1. A possible interpretation is that the sand section may have been deposited as off-shore bars. The thick section through which these sands persist, together with their rapid disappearance to the east and west preclude this possibility. No trace can be found in holes 18, 19, and 20 of the facies encountered in the other tests. The distances involved are too short to suspect that the facies could change so rapidly as to be wholly dissimilar.

2. Steep dips to the west away from the sandy section are contradicted by the flat dips encountered within the sandy section and electric log correlation between 18 and 19. Evidence between 14 and 20 is inconclusive at the present.

Information obtained from Core Test No. 21, now nearing completion, and Core Test No. 22, soon to be drilled, may permit more accurate interpretation of the structure. It is planned that the cross section will be revised to utilize new data as it becomes available.