extends from northern Melville Island northeasterly through the Ringnes Islands to Axel Heiberg Island—the deepest part of the basin. Tertiary tectonics produced north to northeasterly trending structures in the eastern part of the Sverdrup Basin. In the remaining part of the basin folding was less intense. Along the sedimentary axis of the basin are piercement domes and diapiric folds.

The Winter Harbour anticline was chosen as the location for the first well in the Arctic Islands because of its accessibility as well as favorable geology. In a normal season, ships could reach Winter Harbour from the east through Lancaster Sound. The structure is a large gentle fold on the southern side of the Parry Island fold belt. The primary objective was the Read Bay-Allen Bay reef carbonates of Silurian-Ordovician age.

Dome *et al.* Winter Harbour No. 1 was spudded September 10, 1961, and abandoned April 7, 1962, at depth of 12,543 feet. It drilled continuously throughout the winter without any serious difficulty. The section drilled consisted of an upper unit, 7,874 feet thick, of non-marine sandstone, siltstone and shale of Upper and Middle Devonian age. This was followed by 3,730 feet of Devonian-Silurian marine shale. The remaining 939 feet was Silurian and possibly Ordovician nonporous dolomite and anhydrite. The marine shale sequence represents, in part, the off-reef shale facies of the main objective, the Read Bay-Allen Bay carbonates. Although good reservoir beds were not encountered, the information obtained will assist greatly in future exploration of the Arctic Islands.

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CYCLICITY IN PERMIAN EVAPORITES OF WESTERN OKLAHOMA

Four major evaporite cycles are widely present in Lower and Middle Permian strata of western Oklahoma, interstratified with clastic sediments in a sequence 4,000 feet thick. Named in ascending order the Wellington, Cimarron, Blaine (including salt beds that underlie and overlie it in subsurface), and Cloud Chief, they consist almost exclusively of anhydrite and rock salt. Thin beds of dolomite also are present, but potassium salts have not been found. The cycles diminish in thickness upward, as the maximum thickness of the lower two is 1,000 feet, the next younger 600 feet, and the youngest 100 feet.

The uppermost or Cloud Chief evaporites consist only of massive anhydrite, whereas each of the three lower cycles is divisible into individual subcycles, some of them traceable over a region covering more than 15,000 square miles. A single cycle of anhydrite overlain by salt characterizes each of these major units. Dolomite-anhydrite couplets in the 150-foot thickness of the Blaine also are outstanding for their demonstrable continuity and persistence.

Continuous cores of nearly pure rock salt 150 feet thick in the lower part of the Cimarron evaporites likewise show pronounced cyclical development, which is reflected in the isomorphous potassium of the halite, in the range of 100 to 400 ppm. Low potassium values in the lower part of each cycle contrast with high values in the upper part, producing geochemical discontinuities at the boundaries between successive cyles.

Also arranged in cycles are the clastic sediments of the framework that contains the cyclic evaporites. Particularly conspicuous are the interbedded brownish red and gray-green shales of the Flowerpot, Blaine, and Dog Creek Formations. Investigations of boron thus far suggest a marine environment for the shales, and in one area the highest shale values (250 ppm boron) are associated with as much as 4.5 per cent copper.

Cyclicity in the Permian evaporites of Oklahoma are related to cyclical changes in environment during the progressive sinking of a sedimentary basin. Roles are doubtless played by tectonism and climate, in forming the basin itself as well as in producing the aridity necessary for the precipitation of evaporites, but eustatic change in level of the sea must also have been a prominent factor during Early Permian time, when continental glaciation in the southern hemisphere was repeatedly raising and lowering the sea.

HAWKINS, JAMES E., AND SCHOELLHORN, SIDNEY W., Seismograph Service Corporation, Tulsa, Oklahoma

FIELD RESULTS OBTAINED WITH THE VIBROSEIS® METHOD

The VIBROSEIS® method has been used by Seismograph Service Corporation and its subsidiaries in field operations for about two years. Three U.S.A. crews are currently operating. Much of the domestic work has been for clients who wanted to see what the method would do in certain problem areas, either for planning further exploration programs or for evaluation before committing themselves for foreign contracts.

Field operations were commenced in Libya in the fall of 1961 and have continued there since that time. Crews have also operated or are operating in Ireland, France, Belgium, and England. Field results from some of these countries are illustrated together with a discussion of field techniques employed, quality of records and production figures. The paper is illustrated by examples of records obtained in different areas and under different surface and geological conditions.

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PHOTOGEOLOGY AND GEOPHYSICS

There are many ways in which surface geology can be useful to geophysics, not only as an aid to structural interpretation, but in refining the accuracy and improving the efficiency of geophysical methods. That the vast majority of geophysical work has been accomplished in relative ignorance of the surface geology is an established fact. Many specific examples of misinterpretation and waste can be attributed to a lack of consideration of surface geology. Because of this historical lack of surface geologic consideration, there is a large reservoir of data which can be high-graded and refined very inexpensively. Photogeology is by far the most rapid, effective and inexpensive way to do surface geology.

Possibly the geophysical tool most critically affected by the surface geology is gravity. From Newton's First Inverse-Square Law it follows that density changes closest to the gravimeter, affect it most critically. Four practical ways in which gravity data can be refined by coordination with photogeology are cited, along with slides to demonstrate the problems. Inexpensive coordination procedures are described. In many areas they represent an easy improvement and an effective prospecting program.

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