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DESIGN OF PRODUCTION WELLS THROUGH PERMAFROST

Interactions between production wells through thick permafrost are considered in general terms. These interactions include thaw and freeze-back, subsidence and heave, and compressive and tensile forces caused by relative movement between soil and well casing. Magnitudes of these interactions are predicted for permafrost and well conditions found in the Prudhoe Bay oil field. There are various design possibilities.

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CRUSTAL STRUCTURE OF QUEEN ELIZABETH ISLANDS AND POLAR CONTINENTAL MARGIN

Free-air and Bouguer anomaly maps have been compiled from about 9,000 gravity measurements made throughout the Canadian Arctic Archipelago and the Arctic Ocean. These measurements were made as part of a major study of the Arctic being carried out by the Canadian government.

The major feature of the free-air anomaly map is a series of large positive elliptically shaped anomalies overlying the continental margin and striking parallel with the continental break. These anomalies, which are approximately 120 km wide and between 150 and 300 km long, have amplitudes in excess of 100 mgal and regional horizontal gradients as large as 2.3 mgal/km. Interpretation of the gravity data, using seismic and geologic data for control, indicates that a composite structure consisting of a sedimentary layer up to 10 km thick and a crust which thins as much as 17 km can best explain this large positive anomaly with relatively steep, horizontal gradients.

Correlation of Bouguer anomalies with geology and physiography shows that negative anomalies occur over sedimentary basins and mountainous regions and positive anomalies occur over folded belts and the ocean basin.

Regionally, the Archipelago west of 90°W long. appears to be in approximate isostatic equilibrium as the average free air anomaly is about 7 mgal. The mean elevation for the same area is 15 m.

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HISTORY OF STRUCTURAL DEVELOPMENT OF SPITSBERGEN AND ADJOINING SHELVES

The Spitsbergen archipelago is the northwesternmost outcrop of the continental structures of Eurasia. Four main periods of its development can be distinguished.

1. The most ancient, typically geosynclinal period ended at the beginning of the late Precambrian with the formation of the crystalline basement of the Spitsbergen Caledonides. The eastern area of the archipelago became a part of an extensive consolidated region which later formed a rigid block (Barents massif).

2. The Riphean-early Paleozoic period was characterized by a "trough" miogeocynclinal development. The accumulation of the sediments occurred in 3 stages: early Riphean, middle-late Riphean (including Vendian), and early Paleozoic. The general inversion of the tectonic regime began in the middle of the Ordovician. In the Silurian the granitic subalkaline intrusions occurred. The consolidation of the Caledonides was completed at the end of Silurian time.

3. The Devonian orogenic period was marked by active block movements that resulted in the formation of superimposed depressions filled with thick variegated molasse sediments. Analogous formations are typical for the whole North Atlantic Caledonian belt.

4. Since Early Carboniferous time, Spitsbergen has been a mobile platform. There were late Paleozoic, Mesozoic, and early and late Cenozoic stages of platform development. They coincide with the main sedimentary cycles and are separated by periods of general uplift and subsequent leveling. The main phase of basic magmatism was at the end of the Mesozoic. The greatest rate of sedimentation began at the time of the intensification of block movements, and reached its maximum at the beginning of the Cenozoic. The areas of maximal subsidence shortened at that time; the Paleogene basins are fault troughs. In the Neogene intensive block movements along the zones of the ancient faults formed the modern structure of the archipelago. The most intensive uplift can be dated by the tectonic inversion and mobile-zone development in Vestspitsbergen during the Paleogene. North of the archipelago, Holocene volcanism was localized in these inverted mobile zones.

Spitsbergen is on the northwestern edge of Barents-Kara platform. The western part of the archipelago is characterized by increased mobility, which characterized the entire history of the platform. In the late Paleozoic and Mesozoic, the different degree of mobility of the western and eastern parts of the archipelago was related to the heterogenous structure of the platform basement. The increased mobility of the western part in Cenozoic time may be related to the influence of the rift zones of the mid-ocean ridge.

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EFFECT OF CLIMATIC CHANGES ON CHEMICAL CONTENT OF DEEP-WATER MUDS EXEMPLIFIED BY DEPOSITS OF ARCTIC AND ATLANTIC OCEANS

1. Within deep-water deposits formed in different Quaternary physiographic environments, characteristic changes in mud chemical content are observed.

2. Investigations of the Arctic Ocean deposits (Makarov basin) showed compositional variation in absorbed complexes. For cold epochs (during Sartan, Zyryan, and Samar glaciations, as well as during the Boreal transgressions), the K content of absorbed complexes ranges from 14 to 15.5%. For warm epochs (postglacial time, Kargin transgression, Boreal transgression) the K content is between 16 and 17.5%.

3. While studying the Atlantic Ocean deposits (50°28'N and 26°23'W), it was observed that the higher absorbed K content was related to higher carbonate content of the deposits. Relative K content of 18–20% corresponds to warm periods, whereas that of 9.5–17.5% is connected with cold periods; carbonate content (CaCO + MgO weight %) is 23–40% for warm periods, and 9–16.5% for cold periods.

4. Investigations in the Caribbean showed that the higher relative carbonate content correlates with an increase in seawater temperatures.

5. Compositional variations in absorbed complexes and relative carbonate contents also may be correlative with physiographic conditions. If true, it may be possible to correlate the values of various chemical compo-