

by the turbulent water broke up the top layer or two of thin anhydrite and dolomite laminations, moving and agitating the thin, flaky parts from the layers enough to break them into small irregular fragments. These fragments of the microlayers are now found mixed in with the other sandy materials of the entire layer deposited during turbulence. With them in the sediment are found a small number of recognizable pieces of foraminifera shells and ostracod skeletons. Then at the top of each such graded layer, the point of contact with the next series of anhydrite laminations is nearly always smooth and conformable, showing that the rapid movements of the water had ceased, allowing quiet periods of precipitation to resume.²⁶

When we take into consideration the total thickness of the many laminated series, and the periods of mild erosion due to turbulence, we will soon see that we here have a clear record of much more than 100,000 years, during which the approximately 650 feet of these anhydrite, calcite, and dolomite covering layers were being applied to the reefs.²⁷ Thus were the fossiliferous carbonate reefs and their fossil-bearing foundation layers sealed off, making valuable storage reservoirs for the petroleum which man would need in the future.

The Upper 4,000 Feet

What have the Canadian oil drillers found in the more than 4,000 feet of rock layers which lie above the evaporite "cap" which covers the ancient reefs? The main kinds of rock layers are shale, siltstone, limestone, dolostone, and hard sandstone (quartz-chert sandstone). The uppermost part of the stratigraphic column in northwest Alberta is composed of glacial gravel, sand, and clay. The amount of each kind of rock layer and glacial layer varies somewhat between wells, but Table 2 gives an average amount as found in several wells in the Rainbow fields and nearby areas. This table does not list the many thin subdivisional layers or beds which make up each section of the local stratigraphic column, but it does give one a general idea of their make-up. It should also be kept in mind that the different wells from which these averages were made vary somewhat in depth, because of the differing amounts of glacial material at different well sites, and because some of the deep layers underwent more subsidence or uplift at one geographic location than at another.

One should realize that the majority of the rock layers listed in Table 2 are of marine origin, indicating that the area remained as a part of the ocean for long periods of time following the burial of the Rainbow reefs. (The presence of many crinoids and other exclusively marine fossils at some depth levels in these upper layers is a part of the evidence for their marine nature.) Some of the siltstones and shales could well have been deposited at times when the water was much deeper than it had been during reef growth.

Desert Cycles in Canada

For several decades oil geologists were puzzled by a strange repeating series of layers which they were finding in some of the evaporite beds. Drilling samples from the series included laminated