

Several of the reefs of the Rainbow area have relatively steep sides, arising sharply above the floor of the earlier "foundation sediments." Some rise to a height of approximately 800 feet (Langton, 1968, p. 1,930-1,942). The different forms (shapes) of these structures are significant as evidence of their similarity to modern reefs. In order to determine the forms, Langton and his associates combined the results of extensive seismic (earth-shock) studies of the area which had been previously made, with their own investigations of the well cores and drilling records. (The well cores are of course carefully cataloged as to the exact position and depth from which each was taken from the well.) As a result of this study the team was able to classify the reefs into four types, namely, "large atoll," "crescent atoll," "small pinnacle," and "large pinnacle." The term "pinnacle" is perhaps somewhat misleading, as the sides are not nearly so steep as what we usually think of as a pinnacle. Their name is derived from the fact that they are in the shape of a practically symmetric cone with a circular base, tapering toward the top. Since they do arise to nearly 800 feet above the surrounding sediment layers, the name is perhaps permissible. These could not properly be called atolls as they have no lagoon in the center. With a diameter of often less than 2,000 feet near the top, there was not room for a lagoon to form there.

The fact that the pinnacle and atoll reefs grew in a normal marine environment, and were not disturbed by unusual catastrophic conditions is indicated, not only by their normal, reef-like form, but also by the distribution of the fragments which lie around them. The deposits of fragments which wore off the reefs (often called "reef debris") during the time they were growing are found near the bases of the reefs, not scattered widely over the bottom of the basin. This shows that each reef grew as a distinct entity and retained its position and shape until it was later covered over and became an oil reservoir (Barss, 1970, p. 35).

Perhaps of the greatest interest are the large atoll and crescent atoll types, which resemble some of their modern counterparts north of Australia, as mentioned above. One typical large atoll of the Rainbow oil-bearing strata is four miles long and two and one-half miles wide. A lagoon, with typical fine-grained, lagoonal-type reef sediments, is present in the center. The total vertical thickness of this atoll at its rim is 800 feet, which indicates that many thousands of years were required for its development.

We must now briefly describe the main types of sediment layers which lie beneath and above the reefs of the Rainbow area of Alberta. A very high proportion of these strata are of types which can be laid down only very slowly by marine waters, and during a number of distinct and differing environmental conditions.

The total thickness of the sediments which lie beneath the reefs of the Rainbow area (designated "foundation sediments" in Fig. 1) ranges from about 600 feet in some places to less than 100 feet in others. Some parts of this deposit contain an abundance of marine fossils. The arrangement and nature of these foundation sediments give unmistakable evidence that they represent a long period when a shallow sea covered the area. The entire 600-foot thick series consists of many alternating layers of shale, siltstone, anhydrite (calcium sulfate), limestone, and dolomite (Barss, 1970, p. 23-25). All of these, except perhaps the siltstone, represent kinds of sediments which require a considerable period of time for the laying down of even a thin layer. In the lower