

**APPLICATION OF RECENT SEDIMENT STUDIES
TO THE INTERPRETATION OF ANCIENT DEPOSITS***by*TJEERD H. VAN ANDEL¹

Abstract

The importance of studies of Recent sediments for the interpretation of facies, paleogeography and depositional history of ancient basins can be discussed under two headings; (1) regional paleogeographic investigations of basinwide extent; and (2) local studies of a detailed nature (for example oil field scale) of sediment characteristics and trends of sedimentary bodies. This paper is concerned exclusively with the first of these objectives. Various aspects of the study of ancient sedimentary facies and of paleogeography are discussed in connection with the results of modern regional studies of Recent depositional basins, as for example, the Gulf of Mexico, Orinoco shelf, and the Rhone and Rhine deltas.

Principal aspects of paleogeographic research are: (1) The recognition and mapping of facies units and the position of shore lines; (2) the location and nature of sediment sources and the pattern and rate of sediment supply; (3) the degree and type of tectonic control, tectofacies distribution and the rate of subsidence; and (4) the study of transgressions and regressions and the depositional history of the basin. The results are of interest, both geologically and also economically, since they, for example, permit the identification of zones of potential oil source and reservoir rocks and the evaluation of the time, direction and efficiency of oil migration.

As a consequence of the principle of uniformitarianism, if accepted with reservations, the study of Recent sediments is one of the key methods leading to the interpretation of ancient deposits. Close correlation between these two types of research, however, is required, since many techniques applied to Recent sediments are not applicable in the study of ancient deposits, and time and the vertical sequence of beds so important in ancient deposits are not readily studied in modern sedimentary basins.

In a regional approach as discussed here, where control points are widely spaced, both vertically and horizontally, broad facies units have to be used. By simple techniques a number of such units have been distinguished and described for various modern basins, as for example, the Gulf of Mexico and the Orinoco shelf. Their patterns and characteristics are outlined briefly. Very similar facies and facies patterns can be distinguished in many ancient basins, of which the older Tertiary of western Venezuela may be cited as an example. Basic techniques in such a study are isopach, lithofacies, biofacies and simple petrographic analysis.

Studies of the mineralogical composition of Recent sediments based on heavy and light minerals have shown that far-reaching conclusions can be drawn concerning the nature of the source areas and the patterns of distribution of the sediments. Good examples are the Gulf of Mexico and the Gulf of Paria-Trinidad. Occasionally, severe limitations are imposed by the presence of strong facies control of mineral assemblages as shown by a study of the Rhone delta. Interesting examples of the application of mineralogical analysis

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to the investigation of the depositional history of sedimentary basins are provided by the Tertiary Molasse Basin in Bavaria, Germany, and by the Cretaceous and early Tertiary of western Venezuela.

In Recent sediments the approach so far has been very largely descriptive. Hence, the application to the investigation of ancient basins is restricted to direct comparison rather than based on the understanding of fundamental physical and chemical processes of sedimentation. Consequently, detailed applications have been successful primarily in Tertiary basins where physical and biological conditions were reasonably close to those prevailing today. Considerably more difficulty is encountered in the interpretation of Mesozoic and Paleozoic sediments because of the great differences in fauna, vegetation cover, source areas, climate and partly also general tectonic conditions. Moreover, the study of Recent sediments has been restricted largely to clastic terrigenous deposits in just one type of tectonic and physiographic setting which is best typified by the Gulf of Mexico. Narrow basins with strong tectonism, fault grabens and intracratonic troughs, and calcareous, siliceous, phosphatic or ferruginous sediments have not received comparable attention. Great advances in our understanding of ancient basins may be expected when these blank spots obtain adequate coverage. Nevertheless, it is the author's conviction that much time and energy will be lost if ancient basins do not, simultaneously, receive similar attention, so that the results of both types of research may mutually influence each other.