Tectonic Versus Eustatic Control of Pennsylvanian Cyclical Sedimentation in North-Central Texas[1]

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ABSTRACT

The cyclical character of the Pennsylvanian of north central Texas is not typical of the classic cyclical sedimentation of the Pennsylvanian of the midcontinent area of the United States. The cyclic nature of the Pennsylvanian of north central Texas varies from dominantly terrigenous clastics to dominantly biogenic limestones in regard to both large cycles (series units) and small cycles (groups and formations). The lateral continuity of the cycles is discontinuous to varying degrees both parallel and normal to the margins of the depositional site.

The origin of the cyclic nature of the sediments must take into consideration (1) tectonic activity of the source areas and depositional site, (2) variation in supply of sediment to the depositional site, and (3) eustatic changes in sea level. The evaluation of these factors must be made first on a regional basis including areas adjacent to the area of study, and secondly on a stratigraphic basis including sequences both older and younger than the sequence being studied.

Evaluation of the Pennsylvanian of north central Texas on the above basis indicates (1) no eustatic control of cyclical sedimentation (2) tectonic and possibly climatic control of cyclical sedimentation with varying intensity of influx of terrigenous clastics from the source areas and biologic activity in the depositional sites, (3) shifting of sites of maximum subsidence and cyclical sedimentation from east to west during the Pennsylvanian, and (4) variation in character of cyclical deposits from the classic midcontinent cycles as a result of more intense tectonic activity in the Texas-New Mexico-Oklahoma area.

The above conclusions do not rule out the existence of eustatic changes of sea level due to either glacial or tectonic control. These conclusions indicate a need for continuing study of the cause and effect of transgressions and regressions involved with the interplay of eustatic (glacial or tectonic) and tectonic processes. It is concluded that both processes may be taking place at the same time, with eustatic control dominant in one area while tectonic sedimentation controls another or even adjacent area.

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