oxidizing conditions exist below the depositional interface, or in which the reducing capacity of the bottom sediments is inadequate to destroy the volume of hematite present.

Sediments deposited in normal marine environments (those having normal salinity and open circulation) rarely are red because if hematite is present it normally is altered to non-red ferrous compounds by the reducing action of decaying organic matter in the bottom sediments. However, if sedimentation and subsidence are comparatively rapid, and if the volume of hematite present is large, red sediments can originate even in normal marine environments. Excellent examples of such redbeds are found in certain red shales, red arkoses, and red limestones in the Minturn formation (Des Moines) along the northeastern flank of the central Colorado basin near McCoy, Colorado. These red sediments contain well preserved marine fossils that reflect deposition under normal marine conditions. Mildly reducing conditions existed in the depositional environment causing some bleaching, but the sediments are predominantly red because they were deposited in an area of relatively rapid subsidence in which the volume of hematite was too great to be completely reduced in the time available.

Marine waters with abnormally high salinity, on the other hand, can be highly favorable for hematite preservation, a fact that has been pointed out by earlier writers. Because organisms are scarce in such waters the bottom sediments commonly lack the reducing influence of decaying organic matter. If good mixing of the overlying water is maintained by wave action or by convection currents, oxidizing conditions prevail below the depositional interface; any organic matter present is destroyed by oxidation and any hematite present is preserved. Redbeds originating under these conditions are nonfossiliferous but possess other characteristics of marine sediments, e.g., well sorted texture, uniform bedding, absence of channel structures, and association with primary dolomite and evaporites. Parts of the Pennsylvanian and Permian strata in the central Colorado basin provide convincing examples of redbeds of this origin.

In petroleum exploration, redbeds should be analyzed carefully for possible marine origin. Although such rocks are unfavorable as source beds of petroleum, they may serve as satisfactory reservoir rocks and may be closely associated with other marine sediments that are highly prospective for oil.

SHERMAN A. WENGERD, University of New Mexico, Albuquerque, New Mexico

Pennsylvanian Paleogeology and Search for Oil in Lucero Basin, Central New Mexico

The Lucero basin of central New Mexico was an area of Pennsylvanian sedimentation representing a significant widening of the central New Mexico seaway or accessway from the Paradox geosyncline on the north to the Sonoran geosyncline on the south. Several such basins along this accessway include the Lucero, San Mateo, and Orogrande, all of which have slightly different post-depositional geologic histories. This accessway, of which the Lucero basin is a part, ranged from 50 to 130 miles in width, and received up to 3,000 feet of Pennsylvanian sediments which form the Sandia, Madera, and Red Tanks formations. This seaway was in existence between Atokan and Virgilian time but was widest during Desmoinesian and Missourian time. Pennsylvanian marine sedimentation was limited on the west by the Zuni positive, on the east by a long sinuous platform west of the Estancia basin and the Pedernal positive, and on the northeast by the Penasco positive. Fine clastic sediments from the Zuni and medium to coarse sediments from the Penasco make up less than one-fourth of the Pennsylvanian section which is predominantly limestone. The sharp downwarp of the Estancia basin on the east, as a southerly basin of the central Colorado-Sangre de Cristo seaway, resulted in entrapment of westerly moving coarse clastics from the Pedernal uplift. The Sandia-Manzanita-Manzano-Joyita tectonic alignment (of Tertiary age) was a long narrow platform or "sill" which separated the thick clastic-filled Pennsylvanian section of the Estancia basin from the somewhat thinner but normal basinal and shelf carbonate section of the Lucero basin.

Bioherms grew on the gently shelving east sides of the central New Mexico accessway as indicated by outcrops of calcarenite mounds containing *Chaetetes* sp. corals in the Sandia and Manzano mountains. Inasmuch as the Pennsylvanian outcrops at Monte de Belen and Gray Mesa along the Lucero uplift show basinal lithologic character in Desmoinesian and early Missourian strata and the entire section thins to zero westward onto the Zuni positive, it is likely that similar reefoid masses will be found in the subsurface in the area surrounding the corner common to Catron-Socorro-Valencia counties.

Because of Laramide folding and Tertiary faulting, the eastern two-thirds of the Pennsylvanian Lucero basin is buried deeply beneath the valley fill of the Rio Grande trench, and parts of the platform between the Estancia basin on the east and the Lucero basin on the west now stand high as the Sandia-Manzano block-fault mountains.