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Structural Model for the Interpretation of the Central Basin and Range Province of Utah and Nevada

During the Mesozoic, the sedimentary rocks of the miogeocline of western Utah and eastern Nevada thrust eastward over the North American continental margin. During the Cenozoic, this folded and thrusted terrain extended westward, essentially opposite to Mesozoic vergence. The miogeocline consists of Eocambrian to Jurassic paraconformable sedimentary rocks over 12 kilometers (40,000 feet) thick in western Utah and eastern Nevada.

Stratigraphic and structural relief across the twenty mile width of Steptoe Valley, between outcrops of the Jurassic Navajo (Aztec) Sandstone at Curry Junction and outcrops of Eocambrian quartzite north of Cherry Creek, is as much as twelve kilometers. Clasts of Prospect Mountain Quartzite in the basal conglomerate of the Cretaceous (?) to Eocene Sheep Pass Formation indicate at least seven and a half kilometers of exposed stratigraphic relief by early Sheep Pass time.

Systematic regional outcrop patterns include linear antiformal structural culminations cored with Cambrian quartzite and older sedimentary rocks, (Fish Springs/ House/Wah Wah Range; Raft River/Pilot/Goshute/Deep Creek Range/ Snake/Highland Range; Ruby/White Pine/Grant/Quinn Canyon/Groom Range; Toiyabe Range). These anticlinoria are separated by synclinoria of structurally dismembered younger sedimentary rocks (Confusion Range; Buttes Range; Sulphur Springs-Monitor Ranges; Pancake, Pahroc, and others). The synclinoria commonly show clear westward structural vergence on their eastern limb. They preserve miogeoclinal sedimentary rocks as young as Jurassic Navajo Sandstone in their cores (Buttes Range Synclinorium near Curry, Nevada). Outcrops of Cretaceous marine sedimentary rocks are absent. Outcrops of pre-miogeocline crystalline basement are not exposed beneath the thick sections of Eocambrian clastic rocks. Structural Models – This presentation presents a series of simplified balanced cross sections illustrating a model of Basin and Range tectonic development in time and space. The model suggests that tectonic denudation of thrust culminations begins as an integral part of the topographic rise of the thrust culminations. The primary accommodation of Basin and Range extension was reactivation of the earlier thrust fault ramps. The model is supported in part by the results from three deep exploratory wells drilled by Hunt Oil Company in eastern Nevada and western Utah. The model demonstrates that the key to understanding Basin and Range tectonic development lies in understanding the style and modification of Mesozoic thrusting.

Biography

Dr. M.C. Erskine has more than 55 years of professional experience as an economic geologist and geophysicist, including nine years as President and chief scientist of Eureka Resource Associates, Inc., a consulting firm specializing in resource exploration and exploration research. Clients have included major mining and oil companies, geothermal companies, banks, other financial institutions, and legal firms, including the U.S. Department of Justice. He graduated from the Colorado School of Mines with a degree in Geological Engineeing, received his Masters of Science in 1964, and a Ph.D. in 1970, both from the University of California, Berkeley. Dr. Erskine has published papers, given seminars, and led field trips on topics that include regional tectonics; geophysical and remote sensing interpretations; exploration economics and philosophy. He has developed geological models for the interpretation of remote sensing, geophysical and geochemical data in mineral exploration, hydrocarbon exploration and geothermal exploration.