Latest Proterozoic and Paleozoic Strata

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Overview

Latest Proterozoic and Paleozoic strata in the East Mojave National Scenic Area (EMNSA) were deposited upon a substrate consisting of Early Proterozoic gneissic and granitoid rocks (Wooden and Miller, 1990) and Middle Proterozoic granite (Anderson and Bender, 1989) as described in the section above entitled "General Geologic Setting." These strata are exposed in small areas of several ranges in the EMNSA: Clark Mountain Range, Ivanpah Mountains, Providence Mountains, New York Mountains, Little Cowhole Mountains, Kelso Mountains, and at Old Dad Mountain (pl. 1). The uncomformity between latest Proterozoic or Cambrian quartz-pebble quartzite and underlying Early Proterozoic rocks is well exposed at some localities in the EMNSA (fig. 25*A*). A few small bodies of metasedimentary rocks, most commonly marble or calc-silicate hornfels, of probable Paleozoic age are scattered throughout the EMNSA (see for example, DeWitt and others, 1984; Miller and others, 1985; Howard and others, 1987). These small bodies typically are roof pendants in Jurassic or Cretaceous plutons or slivers within fault zones (pl. 1).

Two northeast-trending boundaries or transitions between the Late Proterozoic to Paleozoic miogeocline on the west and the North American craton on the east pass through the central part of the Mojave Desert (fig. 3). The boundary that is defined by the presence of Late Proterozoic clastic rocks passes through the EMNSA, and the one defined by the presence of Paleozoic carbonate shelf rocks of Ordovician and Silurian age passes to the west of the EMNSA (Stewart and Poole, 1975; Burchfiel and Davis, 1981). Thus, the latest Proterozoic to Paleozoic strata in the EMNSA are mostly cratonal and relatively thin. Latest Proterozoic strata in the Clark Mountain Range, the Providence Mountains, and at Old Dad Mountain are transitional to the miogeocline, but they are overlain by cratonal early Paleozoic strata. The autochthonous latest Proterozoic rocks in the Clark Mountain Range and the Ivanpah Mountains, thrust to the east by several tens of kilometers, are miogeoclinal (Burchfiel and Davis, 1981). The paleogeographic position of the late Paleozoic rocks is obscure owing to generally incomplete preservation or exposure (Burchfiel and Davis, 1981).

Summary of Rock Sequences

The most complete and best preserved sequences of the latest Proterozoic and Paleozoic rocks are in the Providence Mountains (Hazzard, 1954). These rocks are only locally metamorphosed, notably where they are intruded by Mesozoic plutons. The section, which rests unconformably on Early Proterozoic gneiss, is approximately 2,700 m thick (Hazzard, 1954). The lower part of the section consists of latest Proterozoic to Late Cambrian quartzite, dolomite, limestone, siltstone, and shale. The upper part comprises Devonian to Permian units that contain limestone and subordinate chert, sandstone, and shale. Ordovician and Silurian strata are absent, making this section similar to those defined as cratonal in the Southwest. Latest Proterozoic and Paleozoic stratigraphic units in the Providence Mountains (fig. 25*B*) have been correlated with units both in the Death Valley region 35 km to the north and in the western Grand Canyon region 75 km to the east (Stewart, 1970; Stone and others, 1983; Goldfarb and others, 1988).

At Old Dad Mountain and in the Cowhole Mountains, Paleozoic rocks and conformably underlying latest Proterozoic strata are strongly disrupted structurally but are not highly metamorphosed. The section is generally similar to that in the Providence Mountains (Dunne, 1977). Similar rocks also crop out in the Kelso Mountains but do not form a complete section there.

Paleozoic rocks in the central New York Mountains are preserved as wallrocks to a batholith of Cretaceous granitic rocks. Most strata have been converted to marbles, calc-silicate hornfels, or pelitic hornfels. They also have been affected by multiple episodes of Mesozoic folding and faulting. Despite the metamorphism and deformation these rocks have undergone, a stratigraphic section generally similar to that in the Providence Mountains can be reconstructed (Burchfiel and Davis, 1977). The chief difference is that latest Proterozoic strata are absent; the lowest Cambrian unit rests unconformably on Early Proterozoic gneiss.

In the area of the Clark Mountain Range, miogeoclinal stratigraphic sequences were thrust eastward over a cratonal sequence (Burchfiel and Davis, 1971). The autochthonous and parautochthonous Paleozoic strata are cratonal, whereas the overlying thrust sheets carry latest Proterozoic and Paleozoic rocks of transitional to miogeoclinal facies. Low-grade metamorphism is locally developed in the south, close to the extensive, informally named, Jurassic Ivanpah granite of Beckerman and others (1982).

Latest Proterozoic and Paleozoic strata in the central part of the Ivanpah Mountains are included in the generalized regional descriptions given by Hewett (1956), and subsequent detailed information shows that they are similar to and continuous with rocks in the Clark Mountain Range and the Mescal Range (Burchfiel and Davis, 1971).

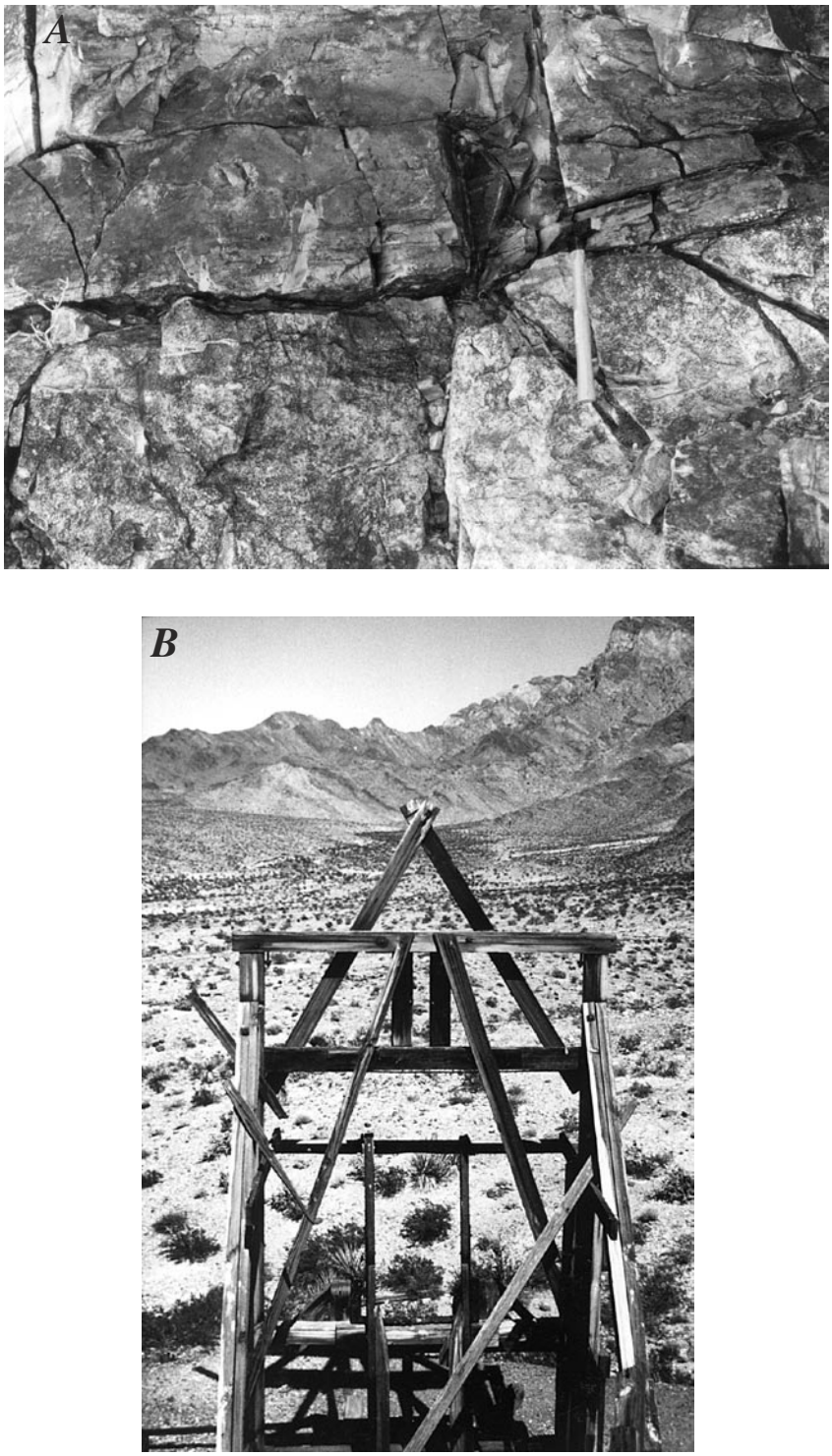

Figure 25. Paleozoic strata in the East Mojave National Scenic Area, Calif. *A*, Latest Proterozoic or Cambrian, undeformed quartz-pebble quartzite in depositional contact (hammer point on contact with underlying, ductilely deformed Proterozoic metaquartzite near Brannigan Mine, approximately 3 km south of Seventeenmile Point). *B*, Light-colored, rugged slopes of eastern Providence Mountains (fig. 2) are underlain by Paleozoic strata, mostly limestone and dolomite. Low slopes below skyline are underlain by Jurassic and Early Proterozoic granitoids. View to northwest from headframe at Bonanza King Mine.