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Title: OLIGOCENE VOLCANIC ROCKS, THE BEAR CANYON CONGLOMERATE, AND THE CHOCOLATE MOUNTAINS ANTICLINORIUM, SE CALIFORNIA: EVIDENCE FOR NEOGENE REACTIVATION OF A REGIONAL SCALE LONG-LIVED FOLD AND ITS TECTONIC IMPLICATIONS

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Abstract: The following models have been proposed to explain the tectonic evolution of the Chocolate Mountains anticlinorium: (1) the anticlinorium is a fault-bend-fold that formed during the Paleogene low-angle subduction of the Farallon plate, (2) the anticlinorium formed during Neogene extensional exhumation, and (3) the anticlinorium is a long-lived feature that may have been reactivated during Neogene exhumation and strike-slip faulting related to the Eastern California Shear Zone. At Picacho State Recreation Area, Oligocene volcanics and an unconformably overlying sequence of Neogene alluvial sediments referred to as the Bear Canyon conglomerate lie on the north limb of the anticlinorium. Our mapping of the volcanic section suggests the following stratigraphic hierarchy: Quechan volcanics (33 - 27 Ma), trachyte of Marcus Wash, trachyte of Rojo Grande, bedded pyroclastic deposits, trachyte of White Wash, ignimbrite of Ferguson Wash (27 - 25 Ma), and Walker andesite (the probable youngest unit). In order to assess the reliability of our stratigraphic framework we and other students at SDSU analyzed a total of 104 samples representative of the volcanic section. On a Zr/TiO_2 vs Nb/Y diagram, samples from each unit cluster and do not overlap with other mapped units, a relationship that supports our stratigraphic subdivisions. Textural analysis of the youngest dated Oligocene unit, the ignimbrite of Ferguson Wash, shows that it is a welded vitric lapilli tuff. Chemical analyses of the ignimbrite, and samples from the underlying bedded pyroclastic sequence, indicate that both units have a similar trachytic composition that is distinctive relative to other Oligocene volcanic units mapped

at Picacho. The lower member of the Bear Canyon conglomerate unconformably overlies the ignimbrite of Ferguson Wash, and is tilted more steeply to the NW (~21°) than is the middle member (~15°), while the upper member is flat lying and may be interstratified with the 13.4 - 9.6 Ma basalts of Black Mountain. Chemical and petrological data show that clasts in the lower member were derived from the unroofing of the underlying Oligocene volcanic section, while the middle member contains abundant clasts derived from mylonitic dioritic granitoids that may have been exposed in the core of the Chocolate Mountains anticlinorium. Map relationships show structural blocks of the ignimbrite off set ~1 km in a dextral sense along the main branch of the Taylor Lake fault system. In addition, a major splay off the fault system deflects foliation defined by flattened pumice into the trend of the splay in a manner that is consistent with ~ 500 m of dextral slip. We interpret the above relationships to indicate Neogene reactivation (between ~27-25 and ~13-9 Ma) of the anticlinorium during formation of the Taylor Lake fault system, and suggest that reactivation and distributed dextral shear may reflect early NS shortening associated with the development of the Eastern California Shear Zone.