NEOGENE BASALTIC VOLCANISM IN THE SOUTHERN OWENS VALLEY, CA: IMPLICATIONS TO TECTONICS OF THE ECSZ

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Neogene basaltic volcanism occurs at four locations in the Owens Valley; the Big Pine field south of Independence, the Darwin field 40 miles to the southeast on the Darwin Plateau, the Coso field north of Ridgecrest, CA and the Ricardo field in the El Paso Mountains. Big Pine basalts range in composition from ne normative alkali basalt to Q normative tholeiitic basalt. Basalts of intermediate composition (olivine tholeiites) are rare. Olivine and its alteration product, iddingsite, are rare phenocrystic phases. Darwin basalts span a similar range in composition, but are characterized by a larger population of olivine tholeiites. Olivine is a common modal mineral, as is iddingsite. The Coso field is characterized by bimodal basalt-rhyolite volcanism. Basalts are primitive ne/ol normative alkali basalts with prominent phenocrysts of olivine. The Ricardo volcanic field is also bimodal, but the basalts are Q normative tholeiites. Iddingsite and calcium siderite have replaced olivine, leaving only scattered remnants of the latter. Owens Valley magmatism spans the transition from the late Miocene-Pliocene “Basin and Range” extension to Pliocene-Recent dextral shear with tectonic setting having a significant influence on basalt composition. Basalts that are the products of extension (Ricardo) are tholeiites while those emplaced in regions of transtension or oblique slip related to dextral shear (Coso) are dominantly alkali basalts. The Big Pine volcanics underwent a compositional change from older tholeiites to Recent alkali basalts. This may be related to changes in the regional stress pattern from Basin and Range extension to the current regime of right-oblique slip. Darwin basalts do not fit the established pattern. Isotopic and trace element data suggest Coso magmas reached the surface quickly utilizing conduits created by transtension and did not interact with continental crust. In contrast, Ricardo volcanics were emplaced during a period of pure extension resulting in tholeiitic basalts. The more evolved and silica-saturated basalts (Ricardo) represent assimilation of crustal rocks during periods of ponding at shallow levels within the crust.