PETROLOGIC EVOLUTION OF THE CLARNO FORMATION, OREGON

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The terrestrial volcanics of the Eocene Clarno formation in north-central Oregon are an excellent example of magmatism related to subduction tectonics. Mapping an area along the John Day river at the mouth of Cherry Creek revealed a mile thick succession of over twenty units. The early lavas are porphyritic plagioclass-two pyroxene basaltic andesites. A group of nonporphyritic quartz-bearing basaltic andesites is the key feature of the middle of the column. These lavas occur as unique flows in several other Clarno locations. The nature of their origin implies that they were erupted nearly simultaneously and may prove to be a key horizon that could be correlated throughout the Clarno. The youngest beds include hornblende andesites and a few basalt flows. These young horizontal upper Clarno rocks are separated from the rest of the Clarno by a thick saprolite and a slight angular unconformity.

Petrography of the porphyritic lavas fits a model of a hydrous melt originating on a subducted slab interacting with overlying mantle peridotite, whereas the nonporphyritic lavas probably resulted from partial melting of anhydrous quartz eclogite followed by rapid adiabatic ascent. New ages on the Clarno (P. Robinson, pers. comm.) suggest that it is older than 42 m.y. Subduction during this time was fairly rapid at about a 30° dip. Estimates of temperatures on the surface of this subducted plate are remarkably close to estimates of andesite liquiduses of Clarno lava types.