

Geophysical and Isotopic Constraints on Crustal Structure Related to Mineral Trends in North-Central Nevada and Implications for Tectonic History

V. J. S. GRAUCH,[†] BRIAN D. RODRIGUEZ,

U.S. Geological Survey, Mail Stop 964, Denver Federal Center, Denver, Colorado 80225

AND JOSEPH L. WOODEN

U.S. Geological Survey, Mail Stop 937, 345 Middlefield Road, Menlo Park, California 94025

Abstract

We combined information from Sr and Pb isotope data and magnetotelluric models to develop a new magnetic and gravity interpretation of the crustal structure of north-central Nevada to better understand the origin of mineral trends. The new interpretation suggests a crustal structure that is composed of Precambrian continental crust, transitional crust, and primarily oceanic crust that are separated by northwest- and northeast-striking fault zones. The magnetic expression of the buried Precambrian continental crust is recognized for the first time. Low magnetic values primarily reflect magnetite-poor crystalline crust rather than elevated temperatures at depth.

Northwest- and northeast-striking crustal boundaries are defined by isotopic data and abrupt gradients in gravity and magnetic data. The Carlin and Battle Mountain-Eureka mineral trends are associated with two of three northwest-striking boundaries. The Carlin boundary is primarily defined by a change in density and isotopic character of the lower to middle crust. The Battle Mountain-Eureka boundary coincides with a density contrast in the upper crust and a change in isotopic character in the lower to middle crust. Magnetotelluric models suggest that the Battle Mountain-Eureka boundary represents a crustal fault zone for most of its extent, but that deep-rooted faulting is more complex near and northwest of Battle Mountain. Crustal fault zones inferred from the magnetotelluric models near the Carlin trend are oblique to it, suggesting that they may not have been controlled by the deep boundary seen in the gravity and isotopic data. The third northwest-trending boundary is related to the western edge of the buried Precambrian continent in west-central Nevada, but lacks an associated mineral trend. A northeast-striking boundary forms the northern limit of Precambrian continental and transitional crust. The boundaries may have originated as rift or transform faults during Precambrian breakup of Rodinia or as faults accommodating lateral movements or accretion during later Paleozoic tectonic events. Comparing the crustal structure to tectonic elements produced by successively younger events shows that it had a profound influence on subsequent sedimentation, deformation, magmatism, extension, and most important, mineralization.

[†]Corresponding author: e-mail, tien@usgs.gov