Eocene plutonic rocks of North-Central Idaho

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Two distinct suites of Tertiary granitoid plutons are present between the drainages of the Salmon and North Fork of the Clearwater Rivers. The plutons are widely distributed and have sharp intrusive contacts with rocks of the Cretaceous Idaho batholith. The few published U-Pb age dates range from 57 to 46 Ma. Many of the most silicic plutons are part of the well-known "pink granites" that commonly are resistant to erosion and form prominent tors in the otherwise subdued landscape of the batholith. A second suite of Eocene granodiorite and granite plutons, some of which had been mapped as part of the Cretaceous biotite granodiorite of the Idaho batholith, are far more common than previously recognized.

Plutons of the Eocene pink granite suite are epizonal and range from very coarse- to fine-grained with prominent miarolitic cavities. Potassium feldspar commonly is bright pink, subhedral to euhedral perthite, while plagioclase is fine grained and interstitial. Biotite with or without hornblende is commonly present at a few percent. Silica contents are above 74%, the rocks are potassic with $K_2O/Na_2O>1$, Rb/Sr is >1.2. Rb is 140-300 ppm, and Sr is <130 ppm. Flat REE (La/Lu is 2-10) and large negative Eu anomalies are common (Eu/Eu* = 0.05-0.3).

In the Eocene granodiorite to granite suite biotite, with or without hornblende, is the common mafic mineral. The K-feldspar content is variable and the crystals commonly, but not always, are pink. In addition to variable amounts of K-feldspar, the granodiorites are distinguished from the Cretaceous biotite granodiorites by being finer grained and having strongly zoned plagioclase. The Eocene granodiorite to granite suite has from 65-74% SiO_2, Rb/Sr <1.2, and Rb <180 ppm. Strontium is 180-550 ppm and contrasts with otherwise similar rocks south of the Salmon River that have Sr of 400-850 ppm. The north-central Idaho rocks have higher REE and have steeper patterns than the pink granites with La/Lu of 10-30 and most have Eu/Eu* of 0.4-1.0. In contrast, despite similar silica contents (67-74%) the Cretaceous biotite granodiorites of the Bitterroot lobe of the Idaho batholith have Rb/Sr <0.2, Sr >500 ppm, Rb <100 ppm, and the rocks have a higher Na_2O/K_2O ratio than the Tertiary granodiorite-granite suite.

Basement influence on Phanerozoic tectono-magmatic history of the northern Rocky Mountains

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The distribution of Precambrian structures and lithosphere strongly influenced the Phanerozoic evolution of the crust-mantle system of western North America. In particular, accretion of primivite elements and magmatism between 2.4 and 1.6 Ga is indicated in the western Great Falls tectonic zone (GFTZ) by: geochronologic and isotopic data from exposures of pre-Belt basement, isotopic (Nd, Pb, & Sr) signatures of Precambrian and Phanerozoic rocks, xenocrystic zircons from Cretaceous-Eocene granitoids, and detrital zircon ages in Mesoproterozoic metasedimentary rocks. These data suggest that this Paleoproterozoic lithosphere extends west to the Neoproterozoic rifted margin and consists largely of accreted, juvenile, Paleoproterozoic arcs, possibly combined with a Proterozoic mafic underplate. The Idaho batholith, for example, formed mainly over these Paleoproterozoic arc terranes, suggesting that the lithosphere was chemically enriched and more fertile for partial melting compared to areas underlain by Archean lithosphere. Similarly, the Cretaceous SW Montana granitic province (e.g., Boulder and Pioneer batholiths), and Eocene Challis volcanics, Absaroka volcanics, and Montana alkaline province are mainly restricted to the GFTZ or parts of the Wyoming province known to contain Paleoproterozoic lower crust. Spatial (e.g., orogen-orthogonal), temporal (Cretaceous and Tertiary), and compositional (ore-bearing and non ore-bearing) variations in magmatism, therefore, were related to the compositions of mantle-derived melts, depth of melting, and the relative fertility of the lithosphere, a characterisitic which was established during the Proterozoic and modified during the Mesozoic and Tertiary.