ORIGINS OF PHANEROZOIC IGNEOUS ROCKS IN THE SOUTHERN APPALACHIANS AND SOUTHERN CORDILLERA, USA: CRUSTAL GROWTH BY CRYPTIC HYBRIDIZATION PROCESSES

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We have investigated felsic igneous rocks of early to late Phanerozoic age from a variety of settings in North America (extension-related volcanics and shallow to mid-crustal intrusions: Quaternary high-silica rhyolites, Miocene rhyolites, dacites, and gra-nitoids, Calif. and Nevada; orogenic intrusions: Mesozoic granitoids, Calif. and Nevada; Paleozoic granitoids, southern Appalachians). These rocks range widely in geochemical characteristics, from metaluminous to strongly peraluminous, incompatible element depleted to enriched, and isotopically primitive to evolved (eNd +5 to -17, Sri 0.7037-0.719). Nonetheless, all show clear evidence for mixed parentage, with contributions from both juvenile and mature crustal sources. Some intrusions contain outstanding examples of mafic-felsic melt interaction, and the high-silica rhyolites are clearly contaminated by their wall rocks, but there is no geochemical evidence for strong modification of felsic magma by these local processes. However, isotopic data for felsic rocks, regional crust, and coeval mafic rocks, together with zircon inheritance, suggest that all of the rocks are hybrids with substantial amounts (10’s of %) of both crustal and juvenile mantle components; roughly 50-50 seems to be average. The important modifications apparently occurred in the deep crust via two mechanisms: mixing of juvenile mafic magmas with crustal melts and remelting of crust that was (geologically) recently injected by mafic magma. The former mechanism is supported by coexistence of mafic and felsic magma, and the latter by young inherited zircon (~100 m.y. older than grantoids). Whatever the mechanism, it is clear that even very crustal-looking granites generally represent substantial juvenile additions to the continental crust.