mineralization is also hosted by euxinic sedimentary-tuffaceous facies adjacent to the volcanic complexes. The volcanics are generally, though not exclusively, acid in composition, have alkaline affinities, and are typical of the variety developed in continental rift systems. The mineralization within the volcanic and volcaniclastic rocks is generally conformable showing a preference for more clastic permeable units. Structurally controlled mineralization may occur and is sometimes of economic importance. In both places the controlling features have acted as channelways for migrating hydrothermal and ground-water solutions. Alkali, CO_2, and H metasomatism commonly accompany the ore-forming process.

The uranium is considered to be of magmatic origin, transported by F- and CO_2-rich hydrothermal fluids which have percolated through the volcanic pile. Under favorable conditions additional uranium may have been scavenged during transport of the ore fluids, during metasomatism or by ground waters circulating on the flanks of the caldera(s). Subaqueous venting of hydrothermal fluids distal to the volcanic centers may give rise to uranium concentrations within reducing (sulfide-rich) sedimentary facies. Precipitation of uranium in the subaerial or subaqueous environ may have been influenced by H_2S exhalation in the vicinity of fumaroles or by dissolved H_2S provided by a plumbing system. For these deposits in which F is a significant component it is probable that U-F complexes transported by acid solutions have been destabilized by changes in pH (and Eh) due to mixing with mildly acid to alkaline ground waters or due to precipitation of the fluoride ion. Precipitation of any free or clay-absorbed uranyl ion would also be promoted by the presence of H_2S.

Although some later supergene processes may have upgraded the primary uranium concentrations, I interpret the mineralizing episode(s) to be synvolcanic. This does not deny the importance of the intermixing of ground waters and the uranium-rich hydrothermal fluids as a means of inducing uranium precipitation, or the scavenging of uranium by these fluids as they percolate through the volcanic pile.

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Peralkaline Ash-Flow Tuffs in Santa Clara Canyon, North of Chihuahua City, Mexico, Possible Source Rocks for Uranium

A thick sequence of upper Oligocene peralkaline ash-flow tuffs and an associated vent complex are located in Santa Clara Canyon, 91 km north of Chihuahua City, Mexico. The principal unit, the Cryptic Tuff, is a comendite and contains about 1% phenocrysts that include sanidine (Or_{45-55}) quartz, hedenbergite, and magnetite. A complete cooling unit consists of: (1) a basal vitrophyre with associated spherulitic pods; (2) greenish, densely welded tuff that contains stretched pumice lapilli; (3) a banded red and light pink zone that contains flowage features and shear folds; (4) a highly porous zone with abundant quartz and sanidine in cavities; and (5) a thick zone of micropoikilitic sanidine and quartz interspersed with riebeckite and aegirine. Flow breccias that contain fragments of the different Cryptic tuff varieties usually separate micropoikilitic riebeckite tuff units. A north-south-trending vent zone (at least 3 km long) is present in lower Santa Clara Canyon where over 400 m of Cryptic tuff is exposed. Flow foliation is vertical in the vent area. Overlying the Cryptic sequence is the bluish, comenditic Campana tuff. It is densely welded and contains about 10% sanidine and quartz phenocrysts set in a groundmass that includes riebeckite and matted aegirine needles.

A minimum loss of 8 mg U_3O_8 per gram of Cryptic tuff has been calculated using data for glassy and massive riebeckitic phases. These paralkaline tuffs could have been source rocks from which large amounts of uranium were mobilized.

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Icelandite and Aenigmatite-Bearing Pantellerite from McDermitt Caldera Complex, Nevada-Oregon, and Their Petrogenetic Significance

Icelandite, apparently the first to be recognized in the western United States, is a petrographically important component of the volcanic suite of the middle Miocene McDermitt caldera complex. Median major-element composition of seven rocks that both pre-date and post-date the major ash-flow sheets exposed on the northern margin of the Long Ridge caldera have been determined. Very high Fe contents (9.1 to 10.2 wt % FeO) are associated with low to very low MgO (0.4 to 2.0 wt %); FeO/Mg ratios of from 5.4 to 25 are strongly "tholeiitic." Both alumina and total alkali contents are relatively low. With the exception of their significantly higher K_2O contents (3.1 to 4.7 wt %), the rocks are chemically similar to icelandites from hot-spot-related oceanic islands such as Iceland and the Galapagos that are situated near spreading centers. A very thin unit of crystal-rich pentellerite welded tuff containing 1.5 vol % aenigmatite phenocrysts underlies the lower major ash-flow sheet exposed at the northern margin of the Long Ridge caldera. Analyses of progressively Fe-rich intermediate and silicic rocks given by Greene provide evidence for a coherent and continuous rock series from icelandite to peralkaline rhyolite. The high FeO/MgO ratios of the icelandites and the presence of aenigmatite in the tuff support a petrogenetic model for the intermediate and silicic rocks of the McDermitt complex involving extensive high-level differentiation of mantle (diapir?)-derived subalkaline mafic magma under conditions of low f_{O_2} and f_{H_2O}. The K_2O and U (4 to 5 ppm) contents of the icelandites suggest that the parent magmas were moderately rich in these and other lithophile elements.

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Geochemistry of Hydrocarbon Source Rocks, Palo Duro Basin, Texas

The sparsely drilled Palo Duro basin of the Texas Panhandle remains an exploration frontier. An understanding of source rock geochemistry can aid in evaluation of its hydrocarbon potential. To determine whether sediments in the basin contained sufficient organic matter to generate hydrocarbons, samples collected from 20 geographically widespread wells were analyzed for total organic carbon content (TOC). Highest values of TOC, up to 6.9%, occur in Upper Permian San Andres dolomite in the southern part of the basin. Pennsylvanian and Wolfcampian basinal shales contain up to 2.4% of TOC and are fair to very good source rocks.

Source beds in the Palo Duro basin had to reach sufficiently high temperatures to generate hydrocarbons from disseminated organic matter. Kerogen color and vitrinite reflectance, which indicate maximum paleotemperatures, were studied in all samples containing greater than 0.5% TOC.