International Symposium on Uranium Raw Material for the Nuclear Fuel Cycle: Exploration, Mining, Production, Supply and Demand, Economics and Environmental Issues - IAEA CN-216

Contribution ID: **87** Type: **Oral**

Felsic magmatism and uranium deposits

Tuesday, 24 June 2014 09:00 (30 minutes)

Uranium strongly incompatible behavior in silicate magmas results in its concentration in the most felsic melts and a prevalence of granites and rhyolites as primary U sources for the formation of U deposits. Despite its incompatible behavior, U deposits resulting directly from magmatic processes are quite rare. In most deposits, U is mobilized by hydrothermal fluids or ground water well after the emplacement of the igneous rocks. Of the broad range of granite types, only a few have have U contents and physico-chemical properties that permit the crystallization of accessory minerals from which uranium can be leached for the formation of U deposits.

The first granites on Earth which crystallized uraninite appeared at 3.1 Ga, are the potassic granites from the Kaapval craton (South Africa) which were also the source of the detrital uraninite for the Dominion Reef and Witwatersrand quartz pebble conglomerate deposits.

Four types of granites or rhyolites can be sufficiently enriched in U to represent a significant source for the genesis of U deposits: peralkaline, high-K metaluminous calc-alkaline, L-type peraluminous ones and anatectic pegmatoids.

L-type peraluminous plutonic rocks in which U is dominantly hosted in uraninite or in the glass in their volcanic equivalents represent the best U source.

Peralkaline granites or syenites represent the only magmatic U-deposits formed by extreme fractional crystallization. The refractory character of the U-bearing minerals does not permit their extraction at the present economic conditions and make them unfavorable U sources for other deposit types. By contrast, felsic peralkaline volcanic rocks, in which U is dominantly hosted in the glassy matrix, represent an excellent source for many deposit types.

High-K calc-alkaline plutonic rocks only represent a significant U source when the U-bearing accessory minerals [U-thorite, allanite, Nb oxides] become metamict. The volcanic rocks of the same geochemistry may be also a favorable uranium source if a large part of the U is hosted in the glassy matrix. The largest U deposit in the world, Olympic Dam in South Australia is hosted by highly fractionated high-K plutonic and volcanic rocks, but the origin of the U mineralization is still unclear.

Anatectic pegmatoids containing disseminated uraninite which results from the partial melting of uranium-rich metasediments and/or metavolcanic felsic rocks, host large low grade U deposits such as the Rössing and Husab deposits in Namibia.

The evaluation of the potentiality for igneous rocks to represent an efficient U source represents a critical step to consider during the early stages of exploration for most U deposit types. In particular a wider use of the magmatic inclusions to determine the parent magma chemistry and its U content is relevant to evaluating the U source potential of sedimentary basins that contain felsic volcanic acidic tuffs.

Primary author: Dr CUNEY, Michel (CNRS - GeoRessources - CREGU - Universite de Lorraine)

Presenter: Dr CUNEY, Michel (CNRS - GeoRessources - CREGU - Universite de Lorraine)

Session Classification: Uranium geology

Track Classification: Uranium geology