HLWYM HEmails

From: rui chen [rchen95927@yahoo.com]
Sent: Wednesday, August 31, 2005 12:37 AM
To: jprikryl@swri.edu; dpickett@swri.edu
Subject: Nopal
Attachments: Nopal Literature comments.doc

David and Jim,

Attached is a file with some quotes from the classic Nopal literature relating to hydrothermalism and uranyl minerals.

The last page of the attachment is an abstract from the quotes, which I am considering adding as a slide to the GSA talk.

Is the CNWRA team on record in the literature concerning the temperature of uranyl mineralization? I suppose I should know (and add any comments to the slide).

Bill

PS. Please note that Rui and I are migrating to billrui@sbcglobal.net for our email at home.

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Comments on hydrothermalism and weathering related to the origin of uranyl minerals at Nopal I

Translated from Calas, 1977:

Deposition of primary mineralization occurred at the same time as the beginning of hydrothermal alteration by solutions rising along faults. The solutions were apparently stopped at the level of the rhyolitic ignimbrites, the first level of low porosity, which were thus mineralized at their base. The hydrothermal alteration of glass and feldspars produced an increasing concentration in silica, which, on precipitating, trapped the primary mineralization, by encasing the pitchblende in a silica matrix, and prevented its later oxidation and leaching. Later the underlying levels of high porosity pyroclastic tuffs were mineralized by deposits of secondary [uranyl] silicates resulting from leaching of overlying pitchblende by meteoritic water. These silicates were occasionally covered by secondary opal.

Hydrothermal alteration of volcanic rocks occurred at relatively low temperature as indicated by the presence of montmorillonite.

In the case of Nopal I it seems that the pyrite, which is observed in fairly large quantities, is derived from reducing sections of shale found at several levels in the Cretaceous series. Numerous calcite veins are found at this mine, which indicate transport from underlying limestones. This effect is not the case at Las Margaritas even though it is in direct contact with the Cretaceous rocks. U(VI) solutions would have precipitated pitchblende on contact with previously deposited pyrite.

Goodell, 1981

Apparently the deposit has been secondarily oxidized, because rare remnants of primary uraninite occur in the breccia.

Given the epithermal character of the deposits and the lack of any identifiable intrusive rocks, the source of the uranium probably was not magmatic-hydrothermal. The uranium more likely was derived from the alteration and leaching of volcanic glass by geothermal convective groundwater systems.… Mineral deposition was accompanied by rock alteration and possibly was instigated by the presence of reducing waters derived from the organic- and pyrite?-rich basin sediments.

George-Aniel, Leroy, and Poty, 1985

Stage 1: At this stage tetravalent uranium precipitates as oxide in microcracks inside volcanic ilmenites. … Stage 2: The ilmenite-uranium oxide association is no longer stable. It is replaced by the previously known pitchblende-pyrite association which precipitates around ilmenites as a pseudomorph of magnetite or as a dissemination of kaolinized tuff. Structural features indicate that pitchblende precipitation and kaolinization are closely associated in time.

Several remobilization stages, either hydrothermal or supergene, occur after the pitchblende-pyrite stage and lead to current oxidized mineralizations.

Fluid inclusions in the vapour phase of quartz are not purely aqueous; CO_2 and N_2 are present and microthermometric studies indicate a rather high temperature (400ºC). … The first stage of reduced mineralization is considered to be related to such fluids. All other inclusions are purely aqueous, with a low salt content (0 to 4.94 wt% equivalent NaCl). Kaolinization and pitchblende deposition also occur from 250 to 150ºC. … Fluid inclusions from opals associated with uranophane needles give a temperature of 150ºC.

Ildefonse, Muller, Clozel, and Calas, 1990

Concerning the hydrothermal system, uraninite and pyrite constitute a reduced primary mineralization. Kaolinite which is mixed with uraninite is considered as contemporaneous with this mineralization. Subsequently, U was remobilized by oxidizing solutions. Soluble uranyl groups have been trapped as U-silicates which often recut or recover kaolinite fillings in the fractures of the pipe and appear at a remobilization stage of uranium in oxidizing conditions. Ultimate secondary mineral parageneses are made of halloysite and smectitie, β-uranophane and opal. …These secondary alteration minerals may be related to low-temperature alteration (< 100ºC).

Comments on Uranyl Mineralization at Nopal I

High porosity pyroclastic tuffs were mineralized by deposits of secondary [uranyl] silicates resulting from leaching of overlying pitchblende by meteoritic water. (Calas, 1977)

Several remobilization stages, either hydrothermal or supergene, occur after the pitchblende-pyrite stage and lead to current oxidized mineralizations. … Fluid inclusions from opals associated with uranophane needles give a temperature of 150ºC. (George-Aniel, Leroy, and Poty, 1985)

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