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CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Goldschmidt 2000 Conference
20.01402.561

DATE/PLACE: September 3-8, 2000
Oxford, UK

AUTHOR: David Pickett

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PERSONS PRESENT: David Pickett

BACKGROUND AND PURPOSE OF TRIP:

The Goldschmidt Conference, sponsored by the European Association for Geochemistry and the Geochemical Society, is the premier international gathering of geochemists. The author attended Goldschmidt 2000 in order to present a talk on recent Peña Blanca natural analog work, titled "Estimating radionuclide release from a uranium deposit through uranium-series systematics in carbonates and opal," affording exposure for the Center for Nuclear Waste Regulatory Analyses (CNWRA) natural analog and geochemistry programs. The conference, with more than 1,000 attendees, also provided staff an opportunity to be exposed to recent developments in geochemistry, particularly in the author's specialty field of isotope geochemistry.

SUMMARY OF PERTINENT POINTS:

This was an excellent conference. The author's talk and attendance at oral and poster sessions led to numerous discussions regarding uranium geochemistry, natural analogs, and chemistry relevant to nuclear waste disposal. In addition, the conference provided exposure to new analytical developments that make *in situ* isotopic measurements more feasible.

SUMMARY OF ACTIVITIES:

The conference was organized into separate symposia, of which several were attended during the week. Discussed here are symposium highlights that are particularly relevant to nuclear waste disposal and CNWRA geochemistry activities. The abstracts volume was provided on CD-ROM; individual abstracts are therefore available from the author in electronic form, and the entire volume is easily searched.

Symposium C—Subduction Zone Processes
Symposium J—Mantle Dynamics and Melting

These sessions were of interest to the author chiefly due to the use of uranium-series systematics in understanding magmatic history and the application of *in situ* analytical methods in uranium-series and uranium-lead isotopic studies. Selected talks focused on the use of U-Th-Pa systematics to infer the timing of magma and fluid transport beneath volcanic regions. A number of talks demonstrated the potential for

obtaining microscale U, Th, and Pb isotopic data through the use of either laser ablation or an ion microprobe. These methods may be useful at the CNWRA natural analog site, where the fine-grained, intergrown nature of primary uraninite has made accurate dating problematic. The number of laboratories employing these techniques has risen in recent years, particularly in the case of the more affordable laser ablation systems.

Symposium D—Rapid Climate Change

The author attended several talks on research into the use of uranium-series systematics, stable isotopes, pollen analysis, and trace elements to decipher Quaternary climate history. Perhaps most remarkable about many of these studies is the increasingly finer time resolution obtained. For example, McDermott et al. used laser ablation to sample an 8,000–9,000 year-old stalagmite sequence for oxygen isotopes at a time resolution of 1 to 3 yr; periods of rapid climate change on the decadal scale were observed. Interesting results were also obtained in studies comparing on-land climate proxies such as pollen with the major climatic changes recorded in marine records.

Symposium G—Flow and Reaction of Fluids in Crust

This symposium covered a wide range of topics, addressing geochemical conditions ranging from metamorphic to surficial. Included were a number of presentations relevant to nuclear waste disposal, such as (i) Wilson et al. (UK) on the effects of iron produced by steel corrosion on stability of backfill clays, (ii) reactive transport modeling under changing Eh-pH conditions at the Oklo natural analog (Salas et al., Spain), (iii) modeling of host rock alteration induced by a repository-derived high-pH plume (Soler, Switzerland), and (iv) experiments on solute transport in mudrock from an ANDRA site (Coleman et al., UK).

Symposium I—Mineral Surfaces and Reactions

Of particular interest in this symposium were posters—some supported under nuclear waste programs—on sorption mechanisms. For example, Moira Ridley of Texas Tech University presented a poster on surface complexation modeling to accompany experiments on sorption of Ca and Nd (as an actinide analog) onto rutile. Also, Tits et al. (Switzerland) studied the negative effect of gluconic acid, which may be derived from repository materials, on Eu and Th sorption onto calcite, and El Aamrani et al. (Spain) reported on U(VI) reduction on magnetite surfaces. U(VI) reduction at mineral surfaces was also reported by Behrends et al. (Netherlands) in Symposium E (Biological Geochemistry); they observed that reduction to U(IV) counteracted the mobilizing effect of dissolved carbonate on U(VI). Other interesting presentations in Symposium I dealt with increasing understanding of the nanoscale structure of mineral surfaces.

Symposium K—Life in Extreme Environments

A poster in this symposium (Nilsson, Sweden) presented evidence suggestive of the presence of microbes at pH over 12 at the Maqarin, Jordan, natural analog for water-cement interaction in a waste repository.

Symposium M—Chemistry and Microbiology of Pollution

The author made his presentation in this symposium, but the overall emphasis was on microbiology. For example, a number of talks and posters addressed effects of bacteria on metal adsorption. Of potential

interest to the CNWRA were presentations on modeling and treatment of mine waste and drainage waters (e.g., Schneider, Germany; Stichbury et al., Canada).

Symposium N—Low Temperature and Metamorphic Geochemistry and Geochronology

Symposium O—Open Symposium

Presentations of interest in these symposia were concerned with analytical techniques for U-Pb and U-series geochronology. Advances were reported in high-resolution plasma-source U and Th isotopic analyses, U-Pb dating of young carbonates, and *in situ* U-Th-Pb analysis by laser ablation and ion microprobe (see also discussion of Symposia C and J in this report).

Plenary Session

The plenary session was devoted to six award presentations and three special lectures. A lecture by E.A. Boyle outlined the history of studies recognizing the extent and nature of marine Pb pollution. The other two lectures, by J. Banfield and G. Eglinton, reflected the strong presence of biogeochemical content throughout the conference. Banfield described detailed studies of ongoing biomineralization in flooded mine tunnels, pointing to the potential importance of microorganisms in ore formation. Eglinton's more general talk discussed how biosynthetic organic compounds can act as markers for understanding geochemical systems.

CONCLUSIONS:

The conference was of high quality and great breadth, and provided an excellent opportunity to remain familiar with the most recent technical and theoretical advances in geochemistry. The presence of a number of nuclear waste-related presentations—in areas such as water-rock interaction and sorption—reflected the vigor of geochemical studies in European waste programs. The fields of U-Pb and U-series geochemistry and geochronology were well-represented, and it was evident that geochemical applications of these isotopic systems are increasing as advanced analytical techniques become more accessible.

PROBLEMS ENCOUNTERED:

None

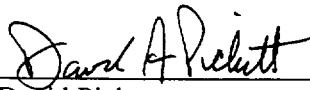
PENDING ACTIONS:

Contact will be initiated with potential collaborators on *in situ* U-Pb and U-series measurements of Nopal uranium minerals.

RECOMMENDATIONS:

None

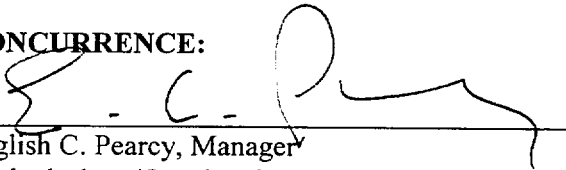
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David Pickett
Research Scientist

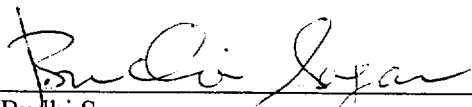
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