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**THE MINERALOGICAL ASSOCIATION OF CANADA,  
50<sup>th</sup> ANNIVERSARY SYMPOSIUM VOLUME****PREFACE**

This issue of *The Canadian Mineralogist* contains a series of invited papers, the subjects of which formed the core of the Mineralogical Association of Canada's 50<sup>th</sup> Anniversary Symposium held in May 2005 at the joint Annual Meeting of the Geological Association of Canada and Mineralogical Association of Canada in Halifax, Nova Scotia. The topics were chosen partly to span the range of disciplines covered by the Association and its journal, *The Canadian Mineralogist*, and partly to reflect current areas of interest within those subject areas.

Mike Fleet shows how the oxidation state of S in both inorganic and organic species (from S<sup>2-</sup> to S<sup>6+</sup>) can be characterized by the shift in energy of the absorption-edge feature of S K- and L-edge features in XANES (X-ray Absorption Near-Edge Structure) spectra. This work has a wide variety of applications, for example identifying the speciation of S in basaltic glasses and such minerals as lazurite and haiyue, identifying the organic functional groups of S in coals, kerogens and humic substances, and characterizing the association of sulfated sugars with calcification of coral aragonite skeletons. Peter Burns expands upon his earlier structural hierarchy of U<sup>6+</sup> minerals and inorganic compounds, arranging over 350 inorganic hexavalent-U compounds into five classes on the basis of the topological details of their structural units. He goes on to emphasize the importance of this structural hierarchy in understanding the behavior of U<sup>6+</sup> under surface and near-surface conditions: the genesis of uranium deposits, the behavior of U mine and mill tailings in the environment, transport of actinides in soils and in the vadose zone, and the performance of geological repositories for nuclear waste. Frank Hawthorne,

Giancarlo Della Ventura, Roberta Oberti, Jean-Louis Robert and Gianluca Iezzi outline the meaning of LRO (Long-Range Order) and SRO (Short-Range Order) for complex structures involving heterovalent cation and anion substitutions, and summarize their recent experimental work on SRO in amphiboles. They show that SRO involving heterovalent cations and anions is extensive in both natural and synthetic amphiboles, and propose that such SRO is driven by local bond-valence requirements of both cations and anions in the amphibole structure. Furthermore, they suggest that such SRO needs to be incorporated into thermodynamic models of amphiboles. Grant Henderson uses the results from recent work on glass to derive information on the structure, properties and behavior of silicate magmas. Their structure is strongly affected by the presence of alkali or alkaline-earth cations, and more than one type of alkali cation present can cause non-linear behavior. Moreover, recent theoretical work suggests that several glass phenomena, and probably melt phenomena as well, are related to stress through rigid-to-floppy transitions. Ian Parsons and Martin Lee contrast the behavior of gemmy and "garden variety" feldspar with regard to microtextures and their effect on dissolution of feldspar. They show that microtextures, in particular misfit dislocations on regular exsolution-lamellae of albite, are crucially important in chemical dissolution and mechanical degradation during natural weathering in acid peat soils at the Shap granite. However, natural defects are less important than steps and edges produced by sample grinding in laboratory dissolution-rate experiments done far from equilibrium. Their message is that microtextures are of critical importance in the interaction of feldspar with aqueous fluids. Fred Wicks

and Eric Chatfield report on their discovery of scrolls of lizardite in beneficiated vermiculite from Ontario. Thin crystals of lizardite have a tendency to exfoliate with the foliae rolling up to form scrolls. The pseudo-hexagonal symmetry of the lizardite structure results in a flat surface that is decorated by many scrolls at 60° to each other. It is important to be able to distinguish between fibers of chrysotile and scrolls of lizardite in the evaluation of vermiculite, and this may be done by their relative stability in an electron beam and the relative ease of obtaining an electron-diffraction pattern (lizardite >> chrysotile).

Petr Černý and Scott Ercit provide us with a more comprehensive classification of granitic pegmatites based on earlier work of Černý. The classification is approached from two distinct directions: (1) geological location and geochemical characteristics, and (2) petrogenesis. Geological location leads to classes, subclasses, types and subtypes based on geochemical characteristics or pressure–temperature conditions of solidification. Petrogenesis involves pegmatites derived by igneous differentiation from plutonic parents, which are divided into three families, NYF (rich in Nb, Y and F) and derived from sub- to metaluminous A- and I-type granites, LCT (rich in Li, Cs, Ta) and derived mainly from S-type granites, and mixed NYF–LCT of diverse origins. Bob Martin and Caterina De Vito propose a different scheme for the classification of felsic pegmatites based on petrogenetic processes. LCT pegmatites are classed as members of orogenic (calc-alkaline suites) formed in a subduction or collision setting, whereas NYF pegmatites are affiliated with anorogenic suites, formed in an extensional setting. NYF pegmatites have affinities with suites in silica-undersaturated systems (including carbonatites). A new type of is also recognized, a corundum-bearing anatectic felsic pegmatite formed in mantle peridotite earlier subjected to a metasomatic overprint by an H<sub>2</sub>O + CO<sub>2</sub> fluid. Both LCT and NYF types involve magmas containing crust and mantle components, but in the case of anorogenic magmatism, prior metasomatic overprint by an H<sub>2</sub>O + CO<sub>2</sub> fluid is required to produce alkaline tendencies. Mixed NYF and LCT signals can arise by superimposition of processes at the source or at the site of emplacement. Roger Mitchell has redefined carbonatites (and carbonatites and carbonatites) using mineralogical and genetic criteria, and has divided them into two groups: (1) primary carbonatites, and (2) carbothermal residues. *Bona fide* magmatic carbonatites formed from diverse genetically different magmas formed at different depths

in the mantle by different degrees of partial melting. Carbonate-rich rocks associated with diverse sodic or potassic peralkaline saturated to undersaturated magmas derived predominantly from metasomatized lithospheric mantle, together with REE-carbonate-rich rocks of undetermined genesis, are best termed carbothermal residues rather than carbonatite.

Tony Naldrett reviews the history of our understanding of magmatic nickel-sulfide deposits and identifies five distinct themes that have emerged from research over the last forty years. Progress has been stimulated by new thinking about the Sudbury Igneous Complex, and by work on the very different contexts of ore deposition observed at Noril'sk and Kambalda. Recent observations at Voisey's Bay in the past ten years have confirmed the relevance and importance of these five themes. Rod Ewing examines and compares the nuclear-fuel cycle with the carbon cycle. Analysis suggests that in order to have a significant impact on carbon emissions, carbon-free sources, such as nuclear power, would have to expand in total energy production by a factor of three to ten. This emphasizes the importance of dealing with spent nuclear fuel, but Rod also emphasizes the flexibility of the nuclear cycle, particularly with respect to the generation of energy with minimum production of plutonium. The latter can be sequestered into pyrochlore-type structures, providing a more efficient way of dealing with waste than is the case for carbon-based fuels. John Jambor, Mati Raudsepp and Keith Mountjoy examine the mineralogy of permeable reactive barriers, focusing on zero-valent iron and organic compost waste as barrier materials. At a barrier at an industrial site, secondary sulfides and metals are volumetrically small and unlikely to impede the permeability of the treatment medium, but it is not yet known if the formation of iron oxyhydroxides and secondary carbonates in the presence of zero-valent iron will lessen the effectiveness of such barriers through consumption of zero-valent iron over the long term.

The breadth and depth of these contributions attest both to the health of the mineralogical sciences in general, and to the health and vitality of the Mineralogical Association of Canada in particular. Minerals are the stuff of the Earth, and in virtually any consideration of Earth processes, one need to consider minerals as part of the system.

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