Mantle signature of trace element-poor zircon from the Cabonga Nepheline Syenite Complex (Grenville Province, western Québec)

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Introduction

The Cabonga Nepheline Syenite Complex (CNSC) is one of several alkaline complexes that occur along the northwest margin of the Central Metasedimentary Belt of the Grenville Province. Conflicting models have been proposed for these rocks and involve purely magmatic and (or) metasomatic processes. Here we report new trace element zircon data from a pegmatite of the CNSC that will contribute to understand the genesis of these complexes by allowing comparison with Kuehl Lake (91500), Kipawa, and other zircons from similar rocks.

Results and discussion

Zircons from a pegmatite of the CNSC occur as mm- to cm-scale sub-euhedral grains with distinct crystallographic features interpreted as magmatic (syneusis, sector and oscillatory zoning; BS and CL images, Fig. 1).

Zr/Hf ratios ranging from 57 to 83, are relatively high and plot within the field of mantle derived "alkali syenitic rocks" (Pupin, 2000). Th/U ratios (0.4 to 0.8) are in the upper values for reported magmatic zircons. ΣREE (25 µg/g) and Y (28 µg/g) contents are extremely low, even more than those of kimberlitic zircons. Moreover, the REE content decreases from 25 (core) to 4 µg/g (rim). Slightly negative Eu anomaly (Eu/Eu* = 0.8) and slightly positive Ce anomaly (Ce/Ce* = 3) are less pronounced than those in most igneous zircons. According to these data, zircons from the Cabonga are depleted with respect to those of Kuehl Lake and Kipawa and bear noticeable resemblance to kimberlitic zircons.

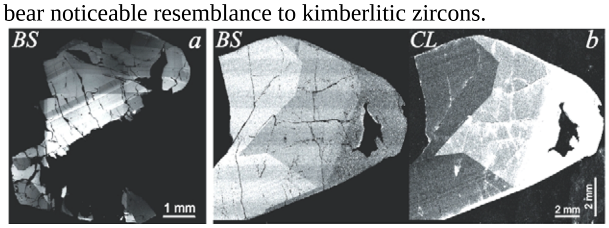

Figure 1: Backscater (BS) and cathodoluminescence (CL) images of Cabonga zircons.

References

Pupin, J.P., (2000), *Trans. Royal Soc. Edinburgh Earth Sci*., **91**, 245-256.

Reactive gases and aerosols: What we did (and didn't) learn from ACE-Asia

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ACE-Asia was a multi-national, multi-platform, research program established both to determine the physical, chemical, and radiative properties of the major aerosol types in the atmosphere over eastern Asia and the western North Pacific and to understand the factors controlling these properties. A primary goal was to provide information on key aerosol properties that could be used for testing chemical transport models developed for use in climate change studies. Our sampling strategy involved studies of dust storms and anthropogenic pollution plumes, two components of the atmosphere that make the East Asia region unique. Part of what made ACE-Asia such an interesting experiment is the complexity of dust/pollution mixtures.

The chemical, optical, and physical properties of aerosols above the surface are controlled to a large degree by the size distributions of chemical species. These data showed that large mineral particles can modify the size distributions of species like nitrate and sulfate that might normally be found in submicron modes. Air pollution changes dust aerosols in many ways, adding black carbon, toxic materials, and acidic gases to the mineral particles. These change its impact on health, climate, and the delivery of nutrient iron to the remote Pacific ocean.

The dust that goes from East Asia to the Pacific does not absorb nearly as much light as the dark aerosol from South Asia or some previous Saharan dust data. Clearly there are dramatic regional differences in the optical properties of aerosols.

The primary reason for studying Asian aerosols was to understand their impact on climate. Combining ACE-Asia suborbital and satellite measurements yielded monthly average (April 2001), cloud-free aerosol radiative forcing at the surface in ACE-Asia exceeding -30 W m^{-2} in a plume downwind of Japan and in the Yellow Sea, East China Sea, and Sea of Japan. While this cooling effect is ten times as large as the warming by greenhouse gases, it is regional rather than global and is considerably smaller in the other seasons.

Many questions remain to be answered. Among these is the impact of dust on gases, for which Lagrangian measurements are needed. The aging of airmasses and removal of aerosols are still only qualitatively understood. The specific absorption of Asian elemental carbon is also an open issue. These and many other issues will provide challenges for future Asian aerosol research programs.