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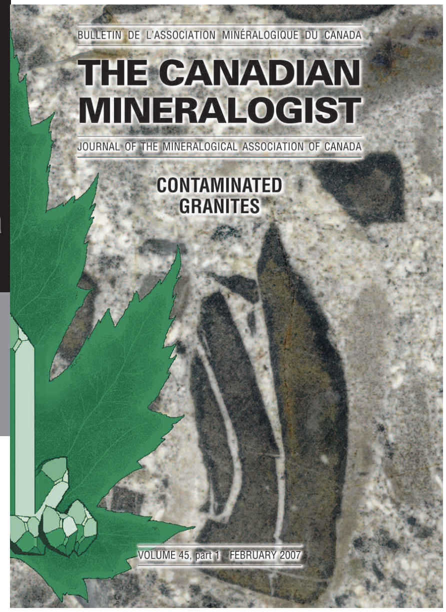
CONTAMINATED GRANITES: LATEST THEMATIC ISSUE OF *THE CANADIAN MINERALOGIST*

In general terms, contamination is the process of making an originally pure material impure. For this to happen, an originally pure material must be open to the influx of foreign materials. In igneous petrology, contamination of magma involves the incorporation of foreign solid materials, normally consisting of the rocks through which the magma passes or in which it comes to reside. It may also involve the incorporation of other molten materials (more commonly known as magma mingling) and even aqueous fluid phases introduced at temperatures above the solidus. From the standpoint of the felsic magma, contamination by a foreign solid removes heat, whereas contamination by a foreign mafic melt adds heat. Because the original magma and the contaminants have different compositions, they almost certainly react. Assimilation is the sum of all the reaction processes that work together to eliminate the physical evidence of contamination, leaving only chemical evidence of its former occurrence, rather like the grin on the Cheshire cat.



The "Contaminated Granites" issue begins with a theoretical overview of the principles governing the assimilation reactions (redox, thermal decomposition, melting, ion exchange, dissolution) that take place between foreign material and the silicate melt. The issue continues with a case study in which textural and chemical criteria are established for the recognition of ilmenite and rutile xenocrysts in granites: this task is easy if the xenocrysts are minerals that do not crystallize from granitic magma, but extremely difficult if they do.

One of the problems associated with studying the reaction history of foreign materials in the field is that we are never certain whether, for any given set of xenoliths, the protoliths were the same. One paper tackles this particular problem experimentally, with controlled magma and contaminant compositions, and demonstrates that some of the enigmatic variations in mineral assemblages and textures in natural rocks have their origins in contamination by country rock.

Three papers address the physical mechanisms and consequences of incorporation of country-rock xenoliths. One draws parallels between style of granite emplacement and the endogenous and exogenous growth of volcanoes, and assesses the probability of incorporation of xenoliths as a function of the style of intrusion. Two others look in detail at the mechanisms by which country rocks become included in the granitic magma, how foreign fragments are distributed in the plutonic body, and what we can learn from their shapes and sizes about the processes of disintegration of country rock and emplacement of granitic magma.

Two papers deal with the added complication of contamination by mafic magma. Not only do many granites undergo reactions with the wallrocks and roofrocks, but they also receive an influx of mafic material and a thermal boost to enable them to conduct these reactions more effectively. The path to chemical equilibrium in such systems is complex, and retention of mingling textures demonstrates that many granitic magmas do not achieve that equilibrium.

The issue concludes with a detailed review of enclaves in the S-type contact-aureole granites of southeastern Australia and a reclassification of most of the enclaves as foreign contaminants. This paper suggests that large, high-level S-type granites may originate in deep, low-pressure–high-temperature granulite facies sources (possibly varieties of "MASH" zones), rather than in typical mid-crustal migmatite complexes. A possible example of the upper part of such a melting zone may be the Hidaka Metamorphic Belt, Hokkaido, Japan.

Petrogenetic investigations should always consider granites not so much as the products of crystallization of pristine melts but as mixtures of such melts and a variety of other components that have contaminated them. Only when we can confidently determine the magnitude of contamination and substract its effects, will we be able to understand what the granitic magma has to say. This issue of *The Canadian Mineralogist* was edited by Barrie Clarke, Scott Paterson, Ron Vernon, and Robert F. Martin. Copies of thematic issue 45-1 may be ordered from the MAC business office (www.mineralogicalassociation.ca).

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