

Syngenetic nanometer-size fluid/glass inclusions in metamorphic microdiamond: Implication to genesis of metamorphic microdiamond from potassic fluid/melt

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Analytical electron microscopic (AEM) study of microdiamonds as inclusions in garnet from several diamondiferous rocks of Kokchetav and Erzgebirge massifs, including dolomitic marbles [1], garnet-clinopyroxene (grt-cpx) rocks and gneissic rocks [2], was performed in order to better understand the chemical characteristics of the microdiamond formation media. Such microdiamonds were found to contain {111}_{dia} faceted nano-size potassium-rich inclusions, which could be categorized as (1) Si-poor and Ca-rich ultrapotassic fluid inclusions (5-300 nm) in marbles and grt-cpx rocks from Kokchetav or (2) K-, P-rich silica glass inclusions (1-30 nm) in gneissic rocks from both Kokchetav and Erzgebirge. The volatile-free semi-quantitative compositions of these inclusions vary within the following ranges (wt%): SiO₂=3-13; Al₂O₃=1-3; FeO=1-4; MgO=3-8; CaO=14-24; K₂O=45-62; P₂O₅=2-6 for marbles [1]; SiO₂=4-20; Al₂O₃=1-8; FeO=3-8; MgO=2-13; CaO=27-41; K₂O=34-52; P₂O₅=bdl for grt-cpx rocks; SiO₂=39-64; Al₂O₃=bdl-15; FeO=bdl-3; MgO=bdl-9; CaO=bdl-10; K₂O=8-24; P₂O₅=11-31 for gneissic rocks [2] where bdl means below detection limit of AEM-EDX. All these fluid/glass inclusions show chemical characteristics broadly mimicking their host-rocks, suggesting that the microdiamond formation media might have been generated within their respective host rocks or have been buffered by the hosting rocks, resulting in the observed diversities as reported here.

[1] Hwang *et al.* (2005) *Earth Planet. Sci. Lett.* **231**, 295-306.

[2] Hwang *et al.* (2006) *Earth Planet. Sci. Lett.* **243**, 94-106.

In situ U-Pb, O, and Hf isotope measurements in zircon from I- and S-type granites from SE Australia

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Despite decades of research there is still controversy over the nature and origin of the diverse Paleozoic granites of SE Australia. In part, this stems from differing interpretations of their whole-rock chemical and isotopic compositions. This work takes a different approach, and uses *in situ* measurements of U/Pb, $\delta^{18}\text{O}$, and $^{176}\text{Hf}/^{177}\text{Hf}$ from zircon from these granites and related rocks to study the processes of magma genesis.

We report new *SHRIMP II* U-Pb zircon ages from the granites and show the granites previously designated as S- and I-type [1] represent discrete, not synchronous or continuous, phases of igneous activity. As a result, it is difficult to envisage their being a related compositional continuum.

Oxygen isotope ratios have been measured on *SHRIMP II* using newly developed techniques. By employing a solid-state Cs ion primary source, an oblique incidence, moderate energy electron gun, and a multi-collector, oxygen isotope ratios can be measured in insulating targets with an internal precision of <0.1‰ (1 σ_{SE}) and an external reproducibility of 0.3-0.4‰ (1 σ_{SD}). Hafnium isotope ratios on many of the same zircon analysed for U/Pb and oxygen have been analysed by LA-MC-ICPMS using previously established techniques [2].

Melt-precipitated zircon from single rock samples are in isotope disequilibrium in some cases, but this effect is rarely pronounced and is not ubiquitous. The presence of zircon crystals precipitated from isotopically distinct melts is evidence for open system processes in the generation of some granites or a lack of homogenisation during the partial melting of heterogeneous source rocks. I- and S-type granites can be clearly differentiated on the basis of zircon isotopic composition, suggesting distinct sources. Calculation of juvenile input into granites based on isotopic systematics of zircon is difficult and often leads to non-unique solutions.

[1] Chappell & White (1992) *Trans. R. Soc. Edinburgh* **83**, 1-26. [2] Woodhead *et al.* (2004) *Chem. Geol.* **209**, 121-135.