Melting texture and microdiamonds preserved in graphite pseudomorphs from the Beni Bousser massif, Morocco

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Abstract
Over 30 graphite aggregates that represent pseudomorphs after diamond were manually extracted from the garnet pyroxenite layer in the Beni Boussera peridotitic massif, northern Morocco. The inclusions present in the aggregates were characterized by combining scanning electron microscopy, micro-Raman spectroscopy and cathodoluminescence. Large composite clinoxyenite-orthopyroxenite-garnet inclusions (ca. 500 mm across) are common in the core of the graphite aggregates. Silicate films with a thickness of a few micrometres ubiquitously occur intercalated between graphite flakes. They are of basaltic composition and are interpreted as partial melts formed by in situ melting of the large composite inclusions and, possibly, of the host pyroxenite, during the Beni Boussera massif uplift. In addition, various solid inclusions composed of chlorides, sulphates and carbonates are found to be evenly distributed irrespective of the graphite aggregate texture (core in the core, in some instances fine-grained on the rim). Diamond crystals, 0.5–2 mm in size, were also observed in several aggregates, apparently included in large graphite flakes, and were characterized using cathodoluminescence and Raman micro-spectroscopy. They are interpreted as relics of large mantle-stage diamonds, now heavily graphitized. This finding confirms earlier propositions that the graphite aggregates in Beni Boussera and the Ronda garnet pyroxenites are pseudomorphs after diamond and raises questions on the kinetics of graphitization.

Introduction

The graphite pyroxenite (CBO) unit is a layered metasedimentary protolith of the Beni Boussera massif, Morocco. The occurrence of exogenous graphite pyroxenite in the ultramafic rocks of Beni Boussera, Morocco, suggests that the Beni Boussera massif is a complex assemblage of tectonically derived rocks. The presence of exogenous graphite pyroxenite in the Beni Boussera massif is a significant discovery as it provides evidence for the existence of a tectonically derived assemblage of rocks. The occurrence of exogenous graphite pyroxenite in the Beni Boussera massif suggests that the Beni Boussera massif is a complex assemblage of tectonically derived rocks.

Conclusions

Micro-diamonds are included in large graphite flakes from the core of the aggregates. They are interpreted as relics of the original diamond, which survived to graphitization. The presence of these microdiamonds confirms that the graphite aggregates in Beni Boussera (and probably Ronda) garnet pyroxenites are indeed pseudomorphs after diamond.

Graphite aggregates in garnet pyroxenite from Beni Boussera reveal (1) deep-seated origin of the host rock and (2) a partial melting event. The preservation of microdiamonds under such conditions raises questions on the graphitization kinetics of large diamonds.

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