Isotopic studies of vein type graphite from ultramafic massifs of Ronda (Spain) and Beni Bousera (Morocco)

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Vein graphite occurrences in the lherzolite rocks of the Serranía de Ronda (Málaga, southern Spain) and Beni Bousera (northern Morocco) have been studied. These rocks are part of high-temperature alpine-type peridotite massifs located in the internal zones of the Betic-Rifean orogen around the western end of the Alboran Sea. The ultramafic bodies display the typical tectonite textures of mantle rocks, and they include minor amounts of mafic layers (garnet pyroxenites to olivine gabbros). Mineral facies zoning within the peridotites and the composition of the mafic layers reflect decreasing pressures from the marginal zones to the inner parts of the massifs. Closely related to the mineral facies zoning in the enclosing lherzolites, three types of magmatic mineralizations has been distinguished (Gervilla & Leblanc, 1990). Graphite is related to the so-called S-G ores consisting of Fe-Ni-Cu sulfides and graphite in varying proportions and minor chromite, plagioclase, and/or phlogopite.

The graphite mineralization displays two types of morphologies: randomly oriented flakes and small nodules composed of thin lamellar crystals surrounding thicker crystals with random orientation (Luque et al., 1992). There is a large isotopic zoning within the nodules (from -3.3 to -12.1 ‰ in the core to -14.5 to -17.2 ‰ in the rim); graphite flakes are fairly homogeneous (from -17.5 to -18.3 ‰). The morphology of the nodules and the $\delta^{13}C$ values of the cores make us think these graphite crystals represents a first generation in which C would be mainly mantle-derived (pseudomorphic after diamonds?; Pearson et al., 1989; Davies et al., 1993). In a following stage, C in these magmatic fluids would be mixed with biogenic C of crustal origin giving rise to a second generation of isotopically lighter, fluid-deposited flake graphite.

References

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