A NEW INTERPRETATION OF THE GENESIS OF CARBONATE AGGREGATES FROM LAMPROPHYRES IN HUNGARY: ARE OCELLI OF MAGMATIC OR HYDROTHERMAL ORIGIN?

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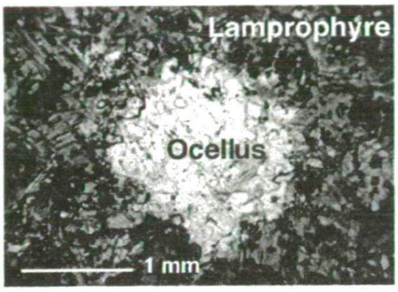

Fig.1: Photomicrograph of a carbonate ocellus (Type-III) in Hungarian (TCR) lamprophyre

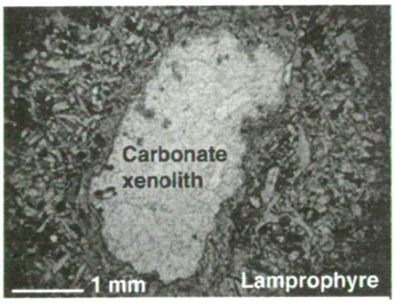

Fig.2: Photomicrograph of a carbonate xenolith (Type-I) in TCR lamprophyre

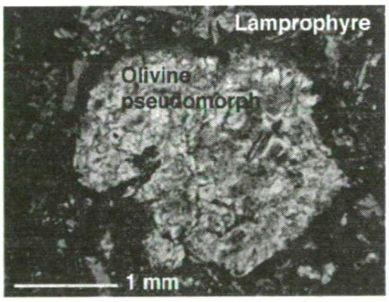

Fig. 3.: Photomicrograph of carbonate pseudomorph after olivine phenocryst (Type-II).

Ocelli composed of felsic, carbonate or silicate aggregates are spectacular petrographic features of lamprophyres and some alkali basalts (Fig 1.) (e.g. Phillpotts & Hodgson, 1968, Rock, 1991). They have been considered as products of silicate–carbonate or silicate–silicate liquid immiscibility for decades (e.g. Philpotts & Hodgson, 1968; Ferguson & Currie, 1971). However, ocelli are not the only textural element in lamprophyres where carbonate minerals occur: they could also be found in the groundmass, as pseudomorphs after olivine, melilite or other minerals, as intergrowths with talc, garnet, etc., and as late veins (Rock, 1991).

Carbonate and silicate ocelli have been described in lamprophyre dike rocks of the Late Cretaceous lamprophyre–carbonatite association, occurring in the Northeastern Transdanubian Central Range (TCR) in Northwest Hungary (e.g. Szabó et al., 1993), and considered to be the result of liquid immiscibility in a volatile-rich mafic melt (Kubovics et al. 1990). After careful petrographic, geochemical, and fluid inclusion studies of carbonate aggregates of the TCR lamprophyres, including ocelli, interpreting the origin of these aggregates by immiscibility becomes questionable. Our results encouraged us to examine the previous model of immiscibility and consider other explanations for the formation of the carbonate aggregates.

We have classified the carbonate aggregates into three genetic groups. We considered carbonate aggregates with irregular to polygonal shape and distinct compositional zonation as Type-I (Fig 2.). These carbonate aggregates contain primary and secondary aqueous fluid inclusions. The sizes of the inclusions do not exceed 15 μm in diameter. Homogenization temperatures measured in fluid inclusions in Type-I carbonate aggregates vary between 72 and 104°C. Formation temperatures based on fluid inclusion data indicate sub-magmatic formation temperatures, and zonation patterns suggest partial recrystallization. This is the only one of the three types that contains secondary fluid inclusions. These carbonate aggregates are most likely xenoliths and xenocrysts and represent the wall rocks of the lamprophyre melt conduits.

Another group of carbonates (Type-II) is characterized by aggregates with a polygonal shape and with no compositional zonation (Fig 3.). Based on their appearance and on petrography of lamprophyres from the same dyke swarm, we suggest that these carbonate aggregates are pseudomorphs after olivine phenocrysts.

Petrographic and geochemical features of the third type of carbonate aggregates (Type-III) are similar to ocelli described by several authors (Fig. 1.) (e.g. Philpotts & Hodgson, 1968; Ferguson & Currie, 1971). Type-III aggregates contain primary aqueous fluid inclusions. The inclusions are smaller then 10 μm in diameter. Homogenization temperatures of the fluid inclusions are between 80 and 210°C, and their salinity is between 5 and 10 wt%. Microthermometric analyses on primary fluid inclusions combined with other geothermometrical methods show that ocelli in the TCR lamprophyres could not have formed at magmatic conditions. On the contrary, geochemical data suggest a lower temperature, hydrothermal origin.

References

FERGUSON, J., & CURRIE, K. L., (1971): J. Petrology. **12**, 561-585.

KUBOVICS, I., SZABÓ, CS., HARANGI, SZ., JÓZSA, S., (1990): Acta Geodaet. Geophys. Mont. Hung. **25**. 345-371.

PHILPOTTS, A. R., & HODGSON, C. J., (1968): XXIII Inter. Geol. Congr. 2, 175-188.

ROCK, N. M. S., (1991): Lamprophyres. 285 p.

SZABÓ, CS., KUBOVICS, I., MOLNÁR, ZS., (1993): Mineral. petrol. **47**, 127-148.