

## Wehrlitization processes within the upper mantle beneath the Northern Pannonian basin (Hungary)

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Plio-Pleistocene alkaline basalts have brought upper mantle xenoliths to the surface at five different locations within the Carpathian-Pannonian region.

After a thorough sampling and detailed petrographic examination, in addition to the dominant lherzolite xenoliths, several wehrlite xenoliths were recognized that show unique modal composition and textural characteristics. Based on the major element geochemistry of the rock-forming minerals, significant Fe and Mn enrichment in olivines, Ti, Al and Fe enrichment in clinopyroxenes, and Fe and Ti enrichment in spinels was observed compared to compositions of common lherzolite xenoliths.

Many silicate and sulfide melt inclusions were observed in the clinopyroxene and olivine from the wehrlite xenoliths. The sulfide mineralogy was consistent with other sulfides found in the upper mantle, however, sulfides in these wehrlite xenoliths show higher Fe and lower Cu concentrations relative to the lherzolite hosted sulfides.

Five representative wehrlite xenoliths from different localities have been selected for a detailed silicate melt inclusion analysis using LA-ICP-MS. The results show an incompatible element enrichment compared to the host mineral, especially in LIL elements (e.g. Ba, Sr, Pb) and in HFS elements (e.g. Th, U, Nb, Ta, Zr, and Ti).

Based on this detailed study, wehrlite xenoliths are interpreted to be products of a process called stealth mantle metasomatism, whereby the metasomatizing agent is a mafic melt with high MgO/FeO ratio, which is different from the host alkaline basalt.

## Resolving s- and r-process presolar carriers using Ba-isotope anomalies in FUN CAIs, bulk meteorite samples, and Ivuna acid leaches

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Resolvable nucleosynthetic anomalies are well documented for a number of nuclides (e.g., <sup>54</sup>Cr, <sup>26</sup>Al; <sup>84</sup>Sr; [1,2,3]). Remarkably, correlations exist between a number of these nuclides [1,2], despite originating from different stellar sources and being hosted in multiple presolar carriers. Such correlations are most readily explained by one of two contrasting processes: Variability due to incomplete mixing of differing components, either because of a late injection of anomalous material [4] or physical differences such as grain size; or alternatively a process that unmixed carriers in a previously homogenised disk (e.g., thermal processing) [1]. Understanding the cause of these correlations is thus a necessary step in deciphering the information they preserve.

We have developed protocols for high-precision Ba-isotope measurement on a Triton thermal ionisation mass spectrometer. Barium has the advantage of having pure p-process (130 and 132), pure s-process (134 and 136), and mixed s- and r-process isotopes (135, 137, 138). By using protocols that allow measurement of the p-process isotopes (despite their very low abundances), we are thus able to identify distinct s- and r-process carriers.

Results from an acid-leach of the Ivuna CI chondrite and two newly measured FUN CAIs (KT-1 and STP-1) allow us to clearly distinguish separate s- and r-process carriers. Our leaching experiment indicates an acid resistant host for the s-process (presumably SiC), whereas the r-process carrier is not resolved by leaching, suggesting parent-body alteration of the original carrier. Despite these physical differences, our FUN CAI data indicate an absence of both carriers, which is difficult to reconcile with a late injection scenario. In combination with data from "canonical" CAIs and chondrites it can be shown that these two carriers behaved independently during early solar system formation.

[1] Trinquier *et al* (2009) *Science* **324**, 374–376. [2] Larsen *et al* (2011) *The Astrophysical Journal* **735**, L37. [3] Paton *et al* (2013) *The Astrophysical Journal* **763**, L40. [4] Chen *et al* (2011) *The Astrophysical Journal* **743**, L23.