

## The ultra-depleted MORB glass in Southwest India Ocean Ridge

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The ultra-depleted melt (UDM) refers to the silicate melt with very depleted light rare earth element (HREE) and highly incompatible elements [1]. The hypotheses for the origin of the UDM include re-melting of hydrous depleted mantle residues in a subduction-related environment or at a ridge axis, melting of trace element poor crustal material, or near-fractional mantle melting and limited magma mixing during transport to the crust [2]. One intriguing thing about UDMs is that they were found only as melt inclusions hosted in primary phenocrysts (olivine, plagioclase, or spinel), while the bulk rock samples show trace element patterns within normal-MORB range.

Here we report the first occurrence of UDM as quenched basaltic glass from the ultraslow spreading Southwest Indian Ridge, which contains abundant plagioclase phenocrysts. The (La/Yb)<sub>n</sub> (n represent primitive mantle normalization) of the glass and bulk rock are consistently as low as 0.23, which are much lower than the matrix glass hosting the Mid-Atlantic Ridge 9°N UDM inclusion. The LA-ICP-MS analysis for the plagioclase phenocrysts shows that the content of HREE are under the detection limit, which indicates their parental melts are even more depleted. If we consider that the phenocrysts represent the early history of magma evolution, then we can conclude that either all the batches of melts came from the fractional melting of the upper part of the melting column beneath the ridge axis, or the whole relevant asthenosphere are much more depleted than the other UDM mantle. The finding of gabbro-bearing plagioclase with An number of >97, which have never been observed in the normal MORB and usually bearing in arc related rocks, may also indicate the latter.

[1] Sobolev, A. V., & Shimizu, N. (1993). *Nature*, 363(6425), 151.

[2] Portnyagin, M., Hoernle, K., & Savelyev, D. (2009). *Earth and Planetary Science Letters*, 287(1-2), 194-204.