

From primitive to mature intraplate volcanism: geochemical evolution of the Cenozoic harrats in Western Saudi Arabia

BEATRICE S. JÄGERUP¹, FROUKJE M. VAN DER ZWAN¹, THOR H. HANSTEEN², EVELYN R. GARCIA PAREDES¹, JÖRG FOLLMANN¹, IVANA ZIVADINOVIC¹ AND MURTADHA YOUSIF AL MALALLAH¹

¹King Abdullah University of Science and Technology

²GEOMAR Helmholtz Centre for Ocean Research

Presenting Author: signebeatrice.jagerup@kaust.edu.sa

The extensive and well-preserved lava fields, “harrats” in Arabic, of western Saudi Arabia stretch for 3000 km south to north and cover an area of more than 120.000 km² in total. The alkalic volcanism initiated at ca. 15 Ma has been more or less continuous since [1], with the youngest eruption recorded in 1256 A.D. next to the city of Medina. Recent dike emplacements in 2009 [2] and 1999 [3] indicate that future eruptions may be possible and further highlight the importance of understanding the nature of these volcanoes.

The harrats show a broad variety in ages, but also a wide compositional spectrum from mildly alkaline basalt to rhyolite and alkaline basanite to phonolite [1], leading to varying eruptive styles and behaviors. This diverse volcanism can offer a unique insight to the evolution of intraplate volcanic fields. However, many magmatic processes in the upper crust are still poorly constrained which in turn may impede adequate assessment of eruption precursors and volcanic hazards in the area.

We have collected an extensive sample suite from harrats of various ages, maturity stage, and composition, covering variations in chemistry and eruptive style from the younger volcanism in Saudi Arabia. This study presents new whole-rock, basaltic glass, and mineral geochemistry, as well as geochemical modelling results, to shed light on the development of intraplate volcanism over time, and to unravel processes such as magma stagnation and crustal underplating.

[1] Camp & Robool (1992), *Journal of Geophysical Research* 97, 255-271.

[2] Baer & Hamiel (2010), *Geophysical Journal International* DOI: 10.1111/j.1365-246X.2010.04627.x

[3] Abdelwahed, El-Masry, Moufti, Lewis Kenedi, Zhao, Zahrán, & Shawali (2016), *Journal of Asian Earth Sciences* 120, 17-28.