Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11061

Genesis of oceanic oxide gabbros and gabbronorites during reactive melt migration at transform walls (Doldrums Megatransform System; 7-8°N Mid-Atlantic Ridge)

VALENTIN BASCH[1], ALESSIO SANFILIPPO[2], SERGEY SKOLOTNEV[3], CARLOTTA FERRANDO[4], FILIPPO MUCCINI[5], CAMILLA PALMIOTTO[6], ALEXANDER PEYVE[7], BORIS VLADIMIROVICH ERMOLAEV[8], OLGA IL'INICHNA OKINA[8] AND MARCO LIGI[9]

[1]CNR-IGG Pavia
[2]Università di Pavia
[3]Russian Academy of Sciences
[4]DISTAV Università degli Studi di Genova
[5]Istituto Nazionale Geofisica e Vulcanologia
[6]Istituto di Scienze Marine – CNR
[7]Geological Institute Russian Academy of Sciences
[8]Geological Institute of the Russian Academy of Science
[9]Istituto di Scienze Marine-CNR

Presenting Author: valentin.basch@gmail.com

The Doldrums Megatransform System (~7-8°N, Mid-Atlantic Ridge) shows a complex architecture including four intra-transform ridge segments bounded by five active transform faults. Basement rocks are exposed along the Doldrums and Vernadsky transform walls, bounding the edges of the northernmost intra-transform ridge segment. The recovered gabbros are characterized by variably evolved chemical compositions, ranging from olivine gabbros to gabbronorites and oxide gabbros, and lack the most primitive gabbroic endmembers (troctolites, dunites). This “excess” in evolved gabbroic lithologies results from melt migration processes involving lateral differentiation at segment edges. Notably, the numerous recovered gabbronorites show up to 20 vol% of coarse-grained orthopyroxene modal contents. Although covariations in mineral and bulk-rock chemical compositions of the olivine and oxide gabbros define trends of crystallization from a common parental melt, the gabbronorites show elevated LREE/HREE ratios in both bulk-rock and mineral compositions. These features are at odds with a petrological evolution driven solely by fractional crystallization, which cannot produce the preferential enrichments in highly incompatible elements documented in the orthopyroxene-bearing lithologies. Rather, we infer that the gabbronorites crystallized from evolved melts invading and partly assimilating a pre-existing olivine gabbro matrix. Saturation in orthopyroxene and selective enrichments in LREE relative to M-HREE are both triggered by an increase in assimilated crystal mass, which ranges from negligible in the oxide-gabbros to abundant in the gabbronorites. We infer that this melt-rock reaction process was concomitant to the lateral migration of melts at the edges of the ridge segment. There, variably evolved melts are injected from the peripheral parts of the ridge segment into the transform walls, interacting with a gabbroic crystal mush to form abundant oxide-bearing gabbronoritic associations.