Segregation Pipes in the Jurassic North Mountain Basalts, Nova Scotia: Implications for Anorogenic Magmatism[1]

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The Jurassic North Mountain Basalts (NMB) of southern Nova Scotia, part of the Central Atlantic Magmatic Province (CAMP) of Marzoli *et al.* (1999) and one of the world's largest volcanic provinces (4.5 x 10^6 km^2), outcrops for several 100 km along the Bay of Fundy coastline. The ca. ≤400-500 m thick sequence is broken into: (i) a massive lower flow unit (LFU) of ≤170 m, (ii) middle flow unit (MFU) of ≤150 m with several (≤15) thin (≤4-20 m) amygdaloidal flows, and (iii) a massive upper flow unit (UFU) of ≤150 m. The MFU and UFU flow units contain abundant (30-40%) quenched mesostasis, originally residual mafic and felsic melts. Exceptional exposures of segregation pipes occur in the UFU several m above the contact with the MFU. The following features are noted: (i) pipes, of round to oval shape, are 2-4 cm to 1 m width, with size consistent in an area, and vertical dimensions of ≤1 m; (ii) pipe abundance decreases as size increases, (iii) chilled margins occur and internal textures vary from aphanitic to coarse grained, (iv) amygdaloidal texture occurs with infill of silica and zeolites; and (v) pipes may contain fine-grained crystalline quartz or agate (0-90% volume) with replacement textures lacking. Petrographic observations reveal pipes are dominated by basaltic or felsic material with proportions varying, but the felsic type is more abundant. The basaltic type is dominated by calcic plagioclase (An_{50-75})and augitic pyroxene, similar texturally to NMB rock, whereas the felsic type is dominated by granophyre entrained with calcic plagioclase (An_{35-50}), anhedral Fe-rich pyroxene ($Wo_{15-40}En_{10-30}Fs_{50-70}$), felsic glass, and micro-enclaves of mafic melt. Whole rock analysis confirms the nature of the mafic and felsic types, with the former similar in terms of trace (e.g., Zr, Nb, Ba), and REE chemistry to typical NMB, whereas the latter show relative enrichment in the trace and REE elements. We suggest that the pipes represent extraction of immiscible felsic melt, previously documented within the NMB, and therefore may provide evidence of bimodal magmatism on a micro-scale. Extrapolation of these observations to a grander scale offer a means of explaining the association of mafic-felsic magmatism within anorogenic settings, particular intra-continental rift environments.

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