The North Mountain Basalt: a Walk Through a 201 Million Year Old Volcanological Paradise in the Jurassic Park of Southern Nova Scotia

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The 201 Ma North Mountain Basalt (NMB) of southern Nova Scotia, part of the globally significant Central Atlantic Magmatic Province (CAMP), outcrops as a prominent cuesta along the southern margin of the Bay of Fundy and is conformable with a basin fill sequence of underlying (Triassic) and overlying (Jurassic) terrestrial sedimentary rocks. CAMP formation was coincident with a global mass extinction terminating the Triassic period, hence the significance of these basalts. Eruption of the ca. 400 m thick, subaerial NMB sequence was rapid (few thousand years) and, by analogy with other large basalt provinces, was probably fed by large fissures, now dyke fields (?). Regional mapping of the NMB along its 200 km extent from Cape Split to Brier Island indicates the basalts are easily divisible into three laterally continuous, internally consistent, volcanological flow units referred to as the lower- (LFU), middle- (MFU) and upper- (UFU) flow units. Exceptional volcanological features are displayed along the almost continuous cliff faces bordering the Bay of Fundy and in numerous isolated quarries. The LFU ($\leq$180 m) is a massive, medium-grained, dominantly holocrystalline basalt with well-developed polygonal jointing (i.e. columnar joints $\leq$2 m) of colonnade and complex entablature patterns. However, the upper ca. 10 m is finer grained and rarely intensely vesiculated. The LFU often contains layers of comb-textured, pyroxene-rich ($En_{10}Fs_{78}Wo_{12}$), mafic pegmatite ($\leq$2-5 cm to $\leq$1-3 m) sheets with concordant or discordant rhyolite or granophyre seams ($\leq$3 cm). The MFU ($\leq$165 m) contains multiple ($\leq$15-20), thin ($\leq$15-20 m), geometrically complex flow sheets with abundant, zonally arranged vesicles, now zeolite occluded amygdules. Abundant field evidence (e.g. flow lobes, stacked lobes, vesicle zonation, flow architecture) suggests the MFU consists of inflated pahoehoe flow sheets with emplacement duration of individual flows occurring over weeks to decades. The UFU ($\leq$150 m), apparently absent in some eastern parts of the mapped area, contains $\leq$30-40% mesostasis in a medium-grained, ophitic-textured host. This unit consists of one or two flow sheets and also has colonnade style, polygonal jointing ($\leq$1 m). The lower 10-20 m of the UFU locally contain rhyolitic material (ca. 70-74 wt. % SiO_2) in the form of sills, dykes, amoeboid masses and spectacular segregation pipes (3-60 cm; 10-15/ m^2) that are sometimes cored by agate and crystalline silica. The presence of many petrological oddities in the NMB has implications for magmatic processes (e.g. immiscibility) in basaltic systems, occurrence of granites in anorogenic settings, and even the probable occurrence of metal-rich hydrothermal plumes in once hydrous felsic magma chambers (i.e. porphyry systems), as will be discussed. All these volcanological wonders, exposed so abundantly by nature, makes the Jurassic North Mountain Basalt a paradise for preservation of ancient volcanic processes!