Mafic volcaniclastic deposits in the Oslo Rift

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The basaltic volcanism in flood volcanic provinces and rift settings is generally considered to be typified by extensive lava flows. However, it is becoming apparent that mafic volcaniclastic deposits are often present, although these deposits remain a comparatively understudied component of volcanism in most settings. In the case of the Oslo Rift, substantial work over the last ca. 100 years defined the mappable extents of rift related deposits and established a broad stratigraphic and temporal framework, and examined the petrological and geochemical aspects of deposits. That notwithstanding, detailed textural and stratigraphic examination of most rift related deposits is absent. Broadly, the basaltic activity in the Oslo Rift is grouped in three phases: extensive fissure-fed flows in the initial rift phase (B1); sporadic thin compound flows intercalated within the rhomb-porphyry lavas in the main rifting phase (B2); and small volume flows in the late-stage central-volcano phase (B3). Examples of the late-stage basaltic deposits are found at the base of a volcano-sedimentary succession north of Oslo city in an area around Grefsenkollen. Previous workers mapped and briefly described these basaltic deposits as a single basalt flows with localised areas of agglomerate. Detailed mapping and stratigraphic analysis has identified the presence of several basaltic units, including distinct mafic volcaniclastic units. We present preliminary findings from detailed outcrop and thin-section observations of one of these mafic volcaniclastic deposits. Characteristic features are typically dense (non- to incipiently-vesicular) clasts, large clast size distribution (fine lapilli to blocks/bombs), ash and crystal rich groundmass, and sparse spatter clasts. Features such as cuspate margins, glassy quench rinds, fragmental groundmass, and spatter clasts are all evidence for the explosive volcanic origin of this unit, but we find no evidence to support phreatomagmatic origins as is often found for mafic volcaniclastic deposits in other regions. An eruptive mechanism involving explosive ejection from moderate to large scoria cones with ash jetting, flank collapse, and minor fire fountaining is proposed. Substantial further work and characterisation of basaltic rift deposits, especially those associated with the late-stage rift is required to understand the extent and prevalence of this activity across the Oslo Rift.