13. Basic ignimbrites from Tanna, New Hebrides arc

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The island of Tanna, in the southern New Hebrides arc (SW Pacific), is part of a large volcanic complex, presently mainly subsided below sea-level. On-land, the subaerial remains of a basal volcano, dominently effusive, are covered by two voluminous sequences of hydroclastic deposits and ignimbrites :

1- The Old Tanna Ignimbrite (OTI), late Pliocene or lower Pleistocene, consists of phreatoplinian ash and scoria flow deposits associated with fallout tephra layers, and massive, partly indurated and/or welded pumice flow deposits;

2- The Siwi Ignimbrite, late Pleistocene, exibits basal typical phreatoplinian deposits overlain by an ignimbrite sheet divided into a basal welded unit and an upper unwelded ash and pumice flow deposit.

Bulkrock analyses of juvenile clasts from the two sequences (vitric blocks, scoriaceous bombs and pumices) are basic andesite to andesite in composition (SiO_2% = 53-60). 296 glass analyses show a even wider range, with dominant compositions being at 54, 56, 58.5 and 61-62 of SiO_2% for the OTI, 55, 57.5, 61-62 and 64 of SiO_2% for the lower phreatomagmatic member of the Siwi ignimbrite whereas its upper member has a predominant composition at 61-62 of SiO_2%.

For each sequence, mineralogical data and crystal fractionation models suggest that these compositions represent the magmatic signature of a voluminous layered magma chamber, the composition gradient of which is mainly the result of fractional crystallization, with almost no mixing process. The OTI and Siwi sequences represent large outpourrings from this magmatic reservoir, during two major eruptive stages, probably related to caldera collapse located now in the submarine subsided area. Since the overall composition of both their products is andesitic, the mechanics of eruption must differ from that of a potentially self-explosive acidic magma. As in both sequences an intimate association between lower phreatoplinian and upper ignimbrite deposits is observed, the intervention of external-derived water is probaly required, most likely at the top of the magmatic column to initiate the eruption. Furthermore, the presence of phreatoplinian products at the base implies a combination of both explosive and collapse. Taking in accompt the following considerations : 1) phreato-magmatic processes during the earlier stages; 2) welded textures indicating a hot state of emplacement in a subaerial environment for the main deposits; 3) induration and glassy blocks in the upper pumice flow deposits showing also magma-water interaction; 4) simultaneous eruption of mafic and intermediate magma in the OTI and at the begining of the Siwi sequence and 5) homogeneization of the composition during the outpourring of the Siwi ignimbrite; a model of eruption will be presented.

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