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Timescales of Magmatic processes in Eastern Sunda Arc: Rindjani and Tambora in light of new geochemical data including short lived U-Th series isotopes

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Tambora and Rindjani are active volcanoes situated on the neighbouring islands of Lombok and Sumbawa in the Eastern Sunda Arc. Both are stratovolcanoes situated about 300 km north of the Java Trench and between 170 and 200 km above the Benioff seismic zone (Hamilton, 1974; Hutchinson, 1976).

Rindjani's lavas are calc-alkaline ankaramites, hi-Al basalts to andesites, hi-K andesites and dacites.

Tambora's lavas are ne-normative relatively potassium rich trachyandesites and trachybasalts including the intermediate (<57% SiO2) members (Foden, 1979, PhD thesis) which is the main difference to Rindjani's lavas. On a more general scale, Tambora's lavas are intermediate between the Hi-Al basalt-andesite of Rindjani and the highly undersaturated K-rich, leucite bearing lavas of G. Soromundi and G. Sangenges (both extinct volcanoes situated on Sumbawa east and respectively west of Tambora).

There are other important differences however. Tambora's lavas remain ne-normative throughout the entire suite, whereas Rindjani's become Q-normative in the more evolved members (>53%SiO2). The concentrations of K2O, Rb, Sr and P2O5 are also very different between the two suites (Foden, 1979).

Both volcanoes however show minor U-Th series disequilibrium with either Th or U excess but less than 10%, typical of this sector of the Eastern Sunda Arc. Investigating data across the whole arc, (Turner & Foden, 2001) have interpreted that mantle wedge has had a sediment component added as a melt and slab derived fluids added afterwards could not imprint their Th-U disequilibrium over the high Th signature of the sedimentary material. Evidence from volcanoes where the sediment component does not show as markedly (Iya, Werung) in the form of large U238/Th230 and (Ra226/Th230)0 suggests evolutionary timescales for magmatic processes of less than 8000years.

Furthermore, in a 2003 paper, Turner et al., investigate the timescales of magmatic evolution of Sangeang Api, another active volcano just off the northern coast of Sumbawa and found that the residence times of magmas here are in the order of 2000 years and by analogy with the 226Ra/230Th ratio of Tambora's 1815 lava suggest a residence time of 5000 years, figure which correlates with the time lapsed since the previous major eruption at Tambora (Takada et al., 2000).

New data generated shows a wider range of values for Tambora where (238U/232Th) is between .46 and .9 and (230Th/232Th) between .56 and .841 whereas for Rindjani the data is more closely grouped between .692 and .821 for (238U/232Th) and .725 to .833 for (230Th/232Th). An interesting feature of the Rindjani data is that it shows a distinct break between the precaldera samples and the freshly erupted lavas of Anak Rindjani (the newly formed cone inside the caldera) which shows clearly the younger lavas are closer to radioactive equilibrium. The possibility that these two groups represent different batches of magmas is examined and compared to Tambora's data where precaldera lavas and the 1815 pumice are consistent and seem to lie on the same line, suggesting the evolving magma chamber that has discharged in the 1815 eruption were part of the same batch.