



# I A V C E I CANBERRA 1993

## ABSTRACTS



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**ANCIENT VOLCANISM  
& MODERN ANALOGUES**

3 Resumes

### Formation of the 500 y - old Kuwae caldera (Vanuatu - New Hebrides arc)

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The island of Tongoa once formed part of a larger landmass, Kuwae, partly destroyed during a scismo-volcanic crisis reported by oral tradition. From new <sup>14</sup>C data, it appears that this cataclysm took place in the mid-Fifteenth century. The eruption led to the formation of a large oval-shaped caldera between Epi and Tongoa islands. This caldera is a NW-SE elongated basin, 12 km-long and 6 km-wide, with a floor 250-470 m below sealevel. The steep inner wall has a height of about 200-700 m. Its area is 58 km<sup>2</sup> and its volume 31 km<sup>3</sup>. Collapse near the caldera edge ranges from 650-950 m in a minimum estimate, and may range from 800-1100 m. The lost volume is 32-39 km<sup>3</sup> (DRE), calculated with a topography extrapolated from the adjacent islands. Post-caldera activity includes the development of the basaltic Karua cone on the floor of the caldera.

Detailed field sections of the whole pyroclastic sequence related to the caldera are presented. Although they alternate hydromagmatic and Plinian eruptive styles, evidence is given that these pyroclastics form a coherent evolutive volcanic series, the climatic terminal stage of which provoked the caldera collapse. In a 143 m synthetic log, the lower tuff series exposes alternating hydromagmatic deposits (HD 1-4) and Plinian fallout deposits, whereas the upper tuff series mainly consists of thick welded or unwelded pumice flow deposits (PFD 1-7), minor ash flow deposits and two additional sequences of hydromagmatic deposits (HD 5-6).

33 wholerock and 291 micropobe analyses of juvenile glasses were carried out on the caldera deposits. In the lower hydromagmatic (HD 1-4), SiO<sub>2</sub>% ranges from 48-61, with one peak at 53.8 and a second at 55.6. In the upper hydromagmatic deposits (HD 5-6) and in the unwelded and welded ignimbrites (PFD 1-7), SiO<sub>2</sub>% ranges from 60-78, the rocks being mainly dacitic. All tuffs related to the caldera event can be readily interpreted in terms of fractional crystallization, juvenile vitric clasts in the rocks representing variable compositions from an early differentiated magma chamber.

Thus, Kuwae caldera is characterized by (i) a large compositional range of magmas and (ii) the intimate association of hydromagmatic and Plinian products. This unusual succession of deposits and the evolution from one type of volcanism to the other are evidenced in both lower and upper parts of the pyroclastic series. This strongly argues for triggering the Plinian eruption by magma-water interaction. In addition, the numerous volcanic episodes that precede the ignimbrite outpourings suggest months or even years of relatively moderate activity before the collapse paroxysm. A model for the Kuwae cataclysmic eruption is presented which takes into account temporal considerations, eruptive style evolution and petrologic considerations.

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