



# Volcanic structures and oral traditions of volcanism of Western Samoa (SW Pacific) and their implications for hazard education

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## ABSTRACT

The Samoan Islands have experienced >2 million years of volcanism, culminating in historic eruptions at both the east and western ends of the chain including a major lava-producing episode on the island of Savai'i from AD 1905–1911. Upolu in Western Samoa has several areas mapped as early Holocene in age (>5 ka), but here we present new evidence for fresh volcanic landforms and deposits, supported by a radiocarbon date of 1915 ± 65 yrs B.P., giving a maximum age to a phreatomagmatic tuff cone offshore of Cape Tapaga, east Upolu. In addition, we report on a parallel investigation of the oral traditions of communities surrounding fresh volcanic landforms that may reflect distant “volcanic memories” passed down over generations. To accommodate Samoan cultural structures, oral traditional knowledge was sought through semi-structured interviews with small groups (3–4) or individuals. Samoan facilitators focused on high-ranking and traditionally respected (particularly elderly) individuals for explanations of the origins of local features, including their genesis, use and any related geo-hazards. Areas targeted were those where young eruptions (<3500 yr BP) were suspected from geological mapping. In stark contrast to communities in Vanuatu, Papua New Guinea or the Solomon Islands, the village communities show extremely limited knowledge of their volcanic heritage. Youthful volcanic landforms are often not recognised as such and appear to play little role in everyday life. Few, if any, legends are attached to any volcanic feature. Instead, oral traditions deal primarily with the origins of Samoans (overlain by strong Christian teachings), and past disputes/battles and wrongdoings between tribes/neighbours. The only exceptions to this were identified in legends from East Upolu, where offshore islands (tuff cones) are associated with late Holocene explosive phreatomagmatic volcanism. Maps drawn by individuals and groups interviewed, highlighted the resources and landscapes important in their lives. The majority of these were prepared as 3D oblique-view sketches, rather than plan-views, showing little in common with typical hazard maps used in the area. In addition, maps were commonly restricted strictly to boundaries of local communities, ignoring major features (such as fresh volcanic cones) that were in the territory of “next door” villages. These perspectives need to be focused upon in future iterations of hazard maps and hazard-education programmes for Samoa and similar Polynesian communities.

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## 1. Introduction

Traditional knowledge about natural hazards, disasters, and hazard management in indigenous communities has recently been recognised as a useful information that could be combined with modern western science to develop a better understanding of natural hazards and their management (Mercer et al., 2007). Such traditional knowledge not only includes practical information about the way the community would act in the event of a natural disaster, but also detailed legends, myths, and stories that could be linked to various natural phenomena or disasters, and stories how the community managed to cope with such events (Cashman and Cronin, 2008). People living with volcanoes commonly

have great diversity of legends and myths about them (Elson et al., 2007; Alvarado and Soto, 2008; Viramonte and Incer-Barquero, 2008). Such stories are also vivid in communities where the transmission of information through generations is only orally. The Samoan community, a Polynesian society maintains its strong cultural and oral traditions alongside increasing levels of development. Western Samoa last experienced volcanic eruptions around 100 years ago, and the volcanic origins of the nation's major islands are evident. Therefore legends and myths around volcanoes are expected to exist in communities in Western Samoa. To test this, a combined research project was carried out to gather geological information on the volcanic history of the older parts of the Western Samoan islands, and legends, myths and stories, if they exist, from the rural communities.

The hypothesis of this study was based upon experience in neighbouring Tonga and Fiji (Taylor, 1995; Cronin and Neall, 2001; Cronin et al., 2004a) that volcanic eruptions up to a few thousand years

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old often leave traces within oral traditions, place names, artistic views, motives, patterns of dance, and legends. Such cultural records are also known from North-American tribes affected by volcanism (c.f. Ort et al., 2008). In general, Polynesian culture is strongly reinforced by oral traditions concerning origins, lineage and major developments that may pass through many generations (Nunn, 2001; Mageo, 2002; Nunn, 2003). Due to the uncertainty in both the geological knowledge of Upolu as well as the potential existence of any trace of distant “volcanic memories” of the local communities, this was a reconnaissance study to help build a perspective of how volcanism and other geological hazards are perceived and portrayed by Upolu communities.

Savai'i and Upolu (Fig. 1) are the westernmost and largest islands of the Samoan group (Fig. 2) and have experienced a long period of volcanism (>2 My) (Kear and Wood, 1959). Reliable estimation of recurrence intervals between eruptions and hence an accurate assessment of volcanic hazard for these islands is hindered by a lack of age data on past events. Recent eruptions occurred on Savai'i (Fig. 1) in 1905–1911 (Matavanu) (Sapper, 1906; Anderson, 1910a,b, 1912; Anonym, 1907, 1910), 1902 (Mauga Mu and Mata o le Afi [fire peak]) (Anderson, 1910a,b) and 1760 (Maunga Afi [fire mountain]) (Kear and Wood, 1959). Other evidence for repeated volcanic activity on both islands during human occupation includes fresh tuff/scoria cones such as Tafua Savai'i (possibly as young as  $610 \pm 60$  yrs B.P.), as well as another 5 radiocarbon dates of between 700 and 2500 yrs B.P. for individual lava flows and tephra falls in various locations around

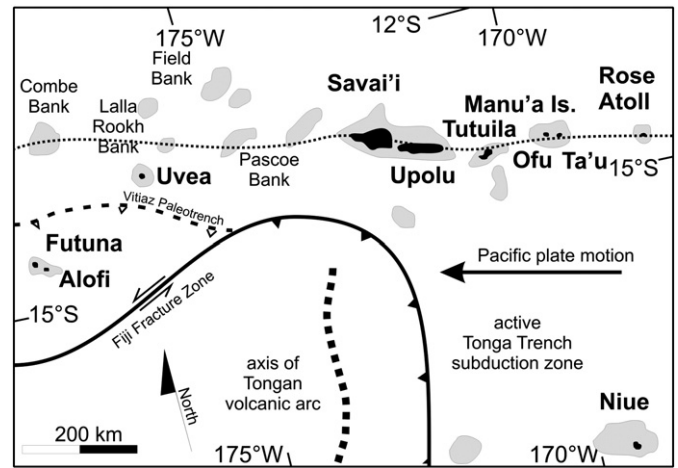


Fig. 2. Geotectonic overview of the Samoan islands. Black fields represent islands while grey fields correspond to submarine platforms.

Savai'i (Cronin et al., 2000). Although Upolu does not have the youngest of the mapped Holocene volcanic rocks, it has several areas mapped as early Holocene in age (>5 ky) and fresh volcanic landforms/deposits (Kear and Wood, 1959). Apparently fresh lava flows (O le Pupu lava field) cover the southern part of Upolu and are

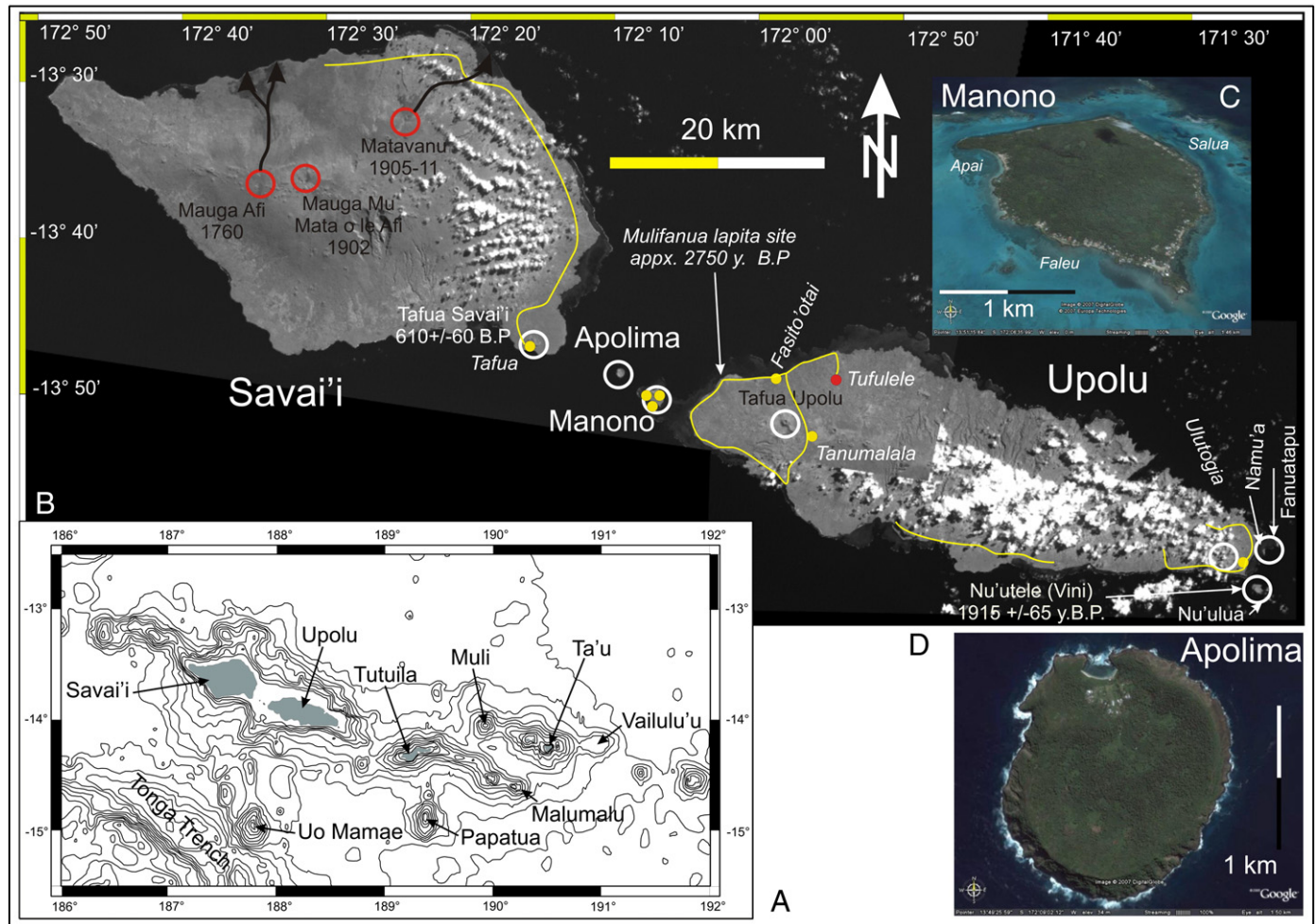


Fig. 1. A) Overview map of the Samoan islands and the associated bathymetry of the seafloor based on Hart et al. (2004). B) Western Samoa shows a NW–SE trending elongated island chain with young volcanoes along the axis of the islands. Red circles in Savai'i mark the youngest known volcanic eruption locations. White circles mark the morphologically young volcanic landforms suspected to be active during the human occupation of the islands. Yellow dots mark the village communities where oral tradition data was collected, while yellow lines mark the routes along informal conversation was taken with locals to find any distant volcanic memory of the communities. C) Oblique satellite image of Manono Island on GoogleEarth 2008 image. D) Apolima Island on GoogleEarth 2008 satellite image.

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