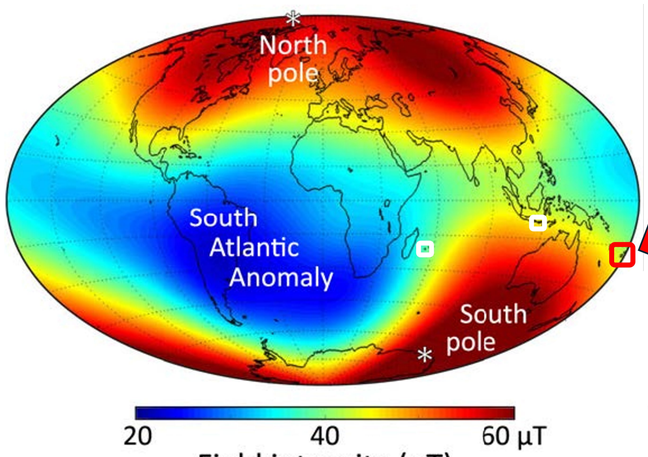
Paleodirections for SW Pacific for the last 3 millennia: Records from Taveuni, Fiji

m.vandenbosch1@uu.nl

Maureen van den Bosch, Liz van Grinsven, Romy Meyer, Lennart de Groot

Utrecht University, Department of Earth Sciences, Paleomagnetic Laboratory Fort Hoofddijk



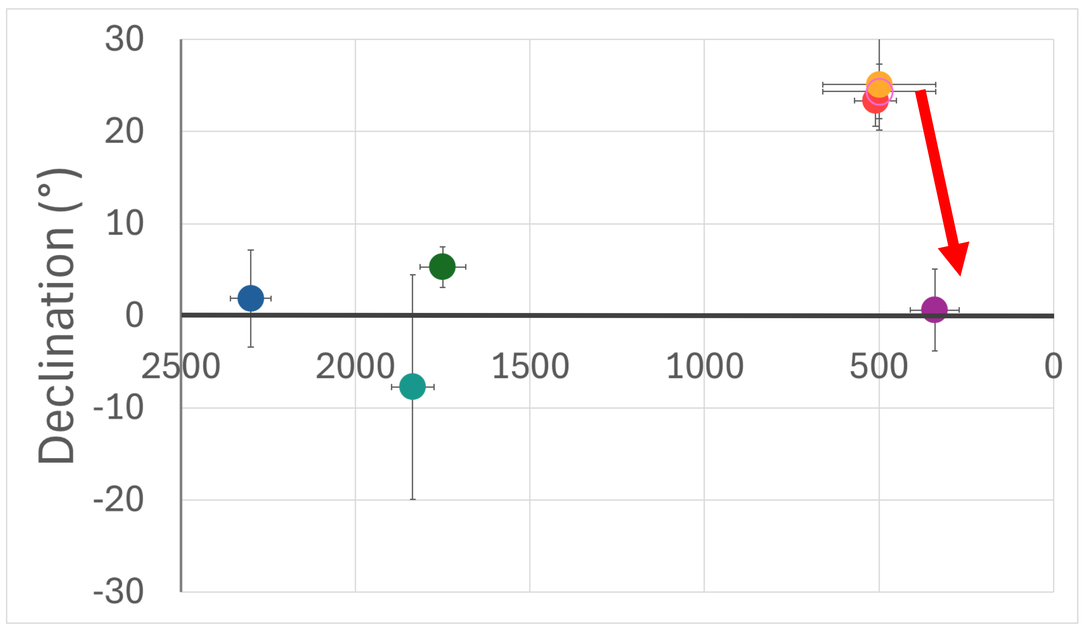
Taveuni, Fiji

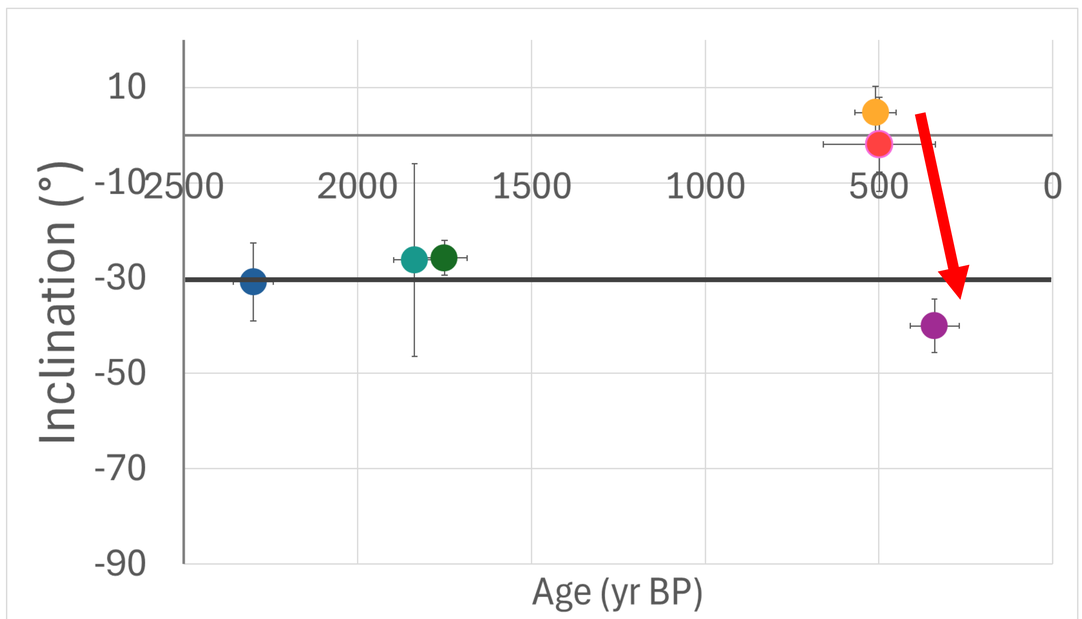
Introduction

The South Atlantic Anomaly (SAA) is a region where the Earth's magnetic field strength is much lower than expected based on the global dipole moment (figure inset). In this area of weak magnetic field, sun particles pose a greater threat to satellites and wireless communications. To trace the evolution of the SAA, the volcanic regions of Réunion Island, Indonesia, and the Southwest Pacific, are studied. This study focuses on the SW Pacific, with a fieldwork on Taveuni, Fiji. Volcanically active regions provide an archive of the Earth's magnetic field. Iron-bearing minerals in lava record the state of the Earth's magnetic field when they cool. Sampling and measuring lava flows of the last 3000 years allows the reconstruction of the temporal evolution of the paleodirection for the SW Pacific.

Results

The paleodirections obtained show normal dipole behaviour for the period of 400 BC – AD 400. Unfortunately, no drill cores could be obtained from the succeeding thousand years, leaving a knowledge gap. At AD 1400, the paleodirection shows a declination and inclination deviating from normal dipole behaviour. A lava flow of approx. 200 years younger portrays normal dipole behaviour, resulting in a sweep in paleodirection.





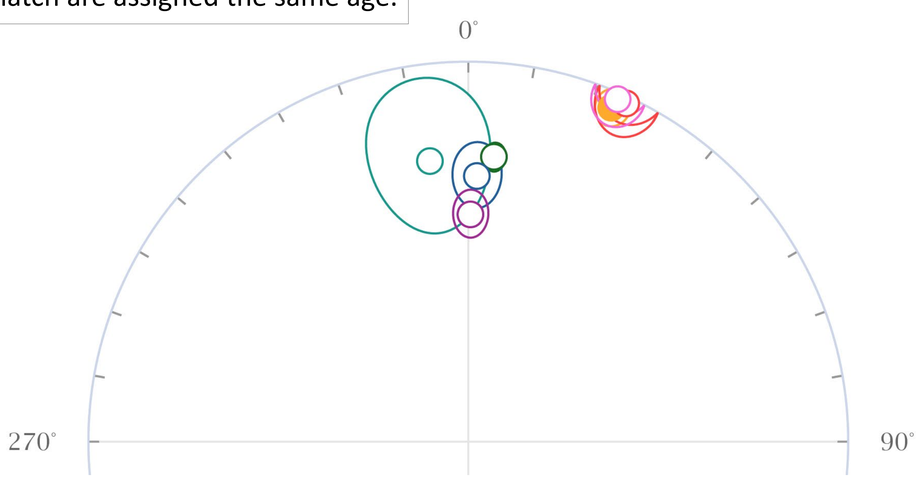
Methods

The paleodirections were determined by taking drill core samples from multiple flows and measuring these with a magnetometer.

- Sampling was done at the locations of radiocarbon sampling sites. When the exact location was unclear, the most logical location(s) were sampled. The resulting directions of presumed coeval flows were compared before assigning them an age.
- Step-wise demagnetization of inch thick-slices in furnace ovens and measuring the magnetic moments with a 2D GC Magnetometer.
- Correlating the paleodirections with ages based on the volcanological map[2] (above) and bootstrap statistical methods (below). Sites overlapping in the equal area plot are tested with the bootstrap statistical method. In case of a match, the same age is assigned to both sampling locations.

Paleodirections of sites sampled in the same lava flow + bootstrap match are assigned the same age.

Mean Directions



Conclusions & Outlook

The temporal evolution of the paleodirections for the location of Taveuni are obtained by sampling and measuring multiple lava flows. The evolution shows a deviant paleodirection around AD 1400, not matching expected normal dipole behaviour.

The paleointensities of the different flows of Taveuni are currently being measured. The paleomagnetic data on Taveuni, Fiji, will be used in global geomagnetic field models studying the Earth's magnetic field and the South Atlantic Anomaly.

References:

1. ESA/DTU, Swarm Level2 product (MCO—L2 DCO Core field model).
2. Cronin, S.J. & Neall, V.E. (2001). Holocene volcanic geology, volcanic hazard, and risk on Taveuni, Fiji.

Acknowledgments:

Local support, University of the South Pacific

Correspondence to: Maureen van den Bosch (m.vandenbosch1@uu.nl)