RICHARD ARCULUS

is a Professor of Geology at the ANU. The role of magmatic processes in the evolution of the Earth are Richard's main research interests. Over the past 30 years, he has explored many volcanoes, both subaerial and submarine, of the Pacific "Rim of Fire".

richard.arculus@anu.edu.au

CHARLES TAMBIAH

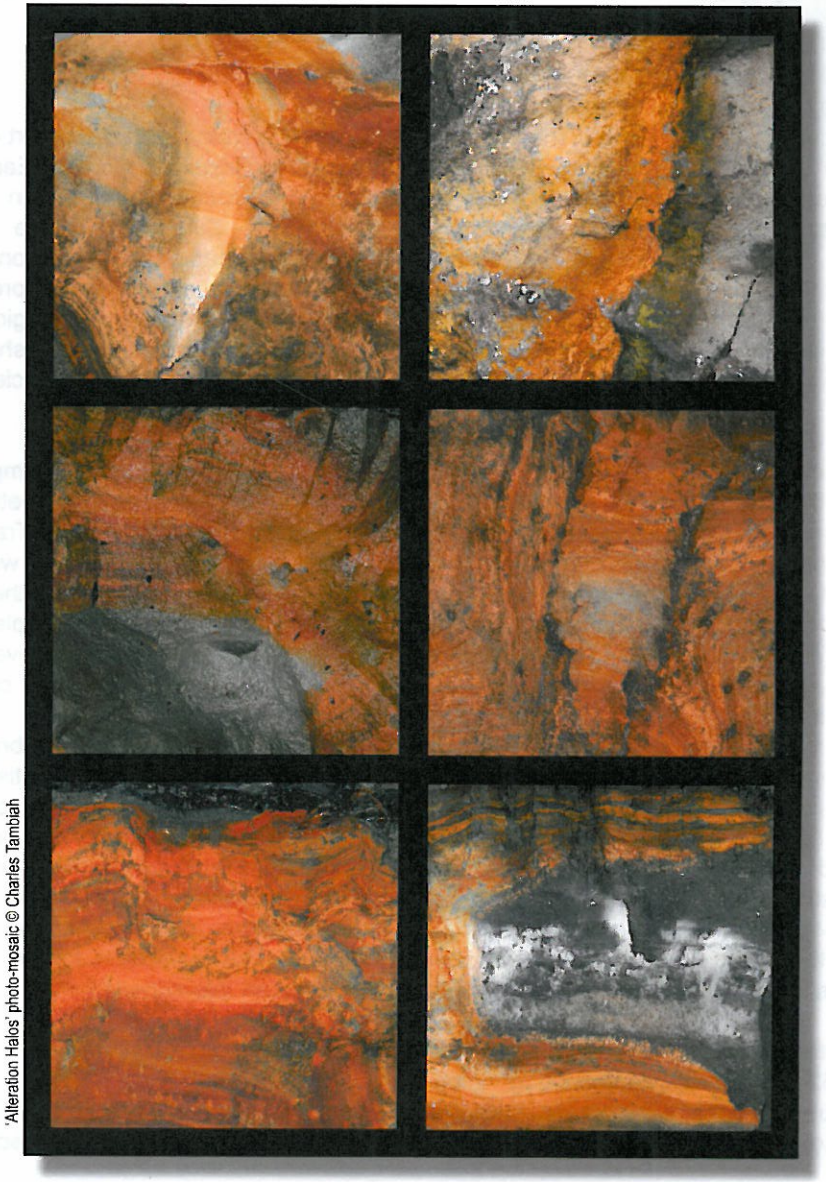
is a freelance science photographer and a researcher at the ANU. Charles has used photography in marine conservation and socio-environmental research, and to collaborate with scientists and communities in over 15 countries. His photographs are used in research, education and science communication.

charles.tambiah@anu.edu.au

DISCOVERY

THE AUSTRALIAN NATIONAL UNIVERSITY

Alteration Halos



'Alteration Halos' photo-mosaic © Charles Tambiah

Charles Tambiah § Richard Arculus

The Expedition

In 2008, a 39 day research voyage on board the Research Vessel *Southern Surveyor* took place between New Caledonia, Fiji and Samoa. The primary target area of the voyage was the northern Lau Backarc Basin, one of the fastest zones of sea floor spreading on Earth. The Pacific Plate is subducting along the Tonga Trench; it is also rolling back eastwards with concomitant extension of the overriding Australian Plate.

The bathymetry, magnetic characteristics, petrology, and hydrothermal activity of several rifting and spreading centres were studied by multi-beam sonar swath mapping, ship-towed magnetometer, water column observations and sampling with remotely operated conductivity-temperature-depth apparatus, and sea floor dredging.

Numerous new volcanoes, spreading ridges and rift zones, and hydrothermal vent centres were discovered. Shore-based studies have identified new terrestrial magma types, ingress of a deep-sourced mantle plume (Samoa) from the North, and the evolution of the ridges and rifts of the Basin.

An international science team and crew of 32 onboard, representing nine institutions, contributed to the success of the expedition. Their collaboration and contributions are gratefully acknowledged.

The Exhibition

Alteration Halos is a science-art display-exhibition inspired by this Earth and marine sciences expedition on the RV *Southern Surveyor*. While some scientific papers and conference posters have already been presented from the expedition's geological and hydrochemical research, this showcase is the first articulation of the science-art inspired by the expedition.

It brings together several components that have both an aesthetic and educational value. Traditional photography is combined with the intense colours from maps of the ocean floor, lavas are present in sampled form, while thin-sections of these reveal their hidden crystals and patterns of colour.

Alteration Halos also celebrates a collaboration between a scientist and a photographer in presenting a dialogue between art and science. Science-art is an area of academic exploration that is still considered fringe, but clearly collaboration can occur for mutual benefit. This exhibition further unpack science-art interactions.

The Photographs

During the expedition Charles photographed a variety of aspects both scientific and creative perspectives. Photography on a rocking ship with constant engine vibration is challenging, calling for innovation well beyond fast shutter speeds and good sea legs. The few days when the ocean stood (almost) still was a rare luxury.

Despite these factors, the opportunity for photography was indeed 24/7. Research activities took place around the clock – dredged rocks and scientists and crew at work, were a few of the themes regularly photographed. Worthy of special mention were the unique, almost unreal, colours of tropical seascapes that can only be found in the middle of the ocean well beyond any sight of land.

Photographing the intense colours of *Alteration Halos* on the rocks sampled was a highlight. Their tendency to fade once the rocks were on deck of the ship was a challenge. The photographs presented in this exhibition were taken within hours after the rocks were brought to the surface. Remnants of *Alteration Halos* can still be seen on some of the rock samples on display.

The Maps

The maps presented help us visualise the bathymetry as created by the primary research tool on the ship, the multibeam sonar swath mapper. The colours selected by Richard are standard for bathymetric visualisation, critical for interpreting the subtle changes in elevation, shape, and geology of the ocean floor. Additionally, the patterns revealed of a dynamic, ephemeral landscape dominated by a variety of linear, curved and 3D shapes leave the viewer in awe of this hidden world.

The Rocks

The challenge with marine volcanoes is they are rarely seen and sparsely sampled. Eventually the sources and evolution of the magmas, the sequence and patterns of their eruptions, and the link with the tectonic environment and evolution of the Lau Basin will be revealed by land-based laboratory analysis.

Rare video footage gives us a brief glimpse of the final moments of transformation of magma into rock – lavas erupted on the seafloor form characteristic "pillow" shapes, with black glassy rinds formed by rapid quenching of the magma against cold seawater. As the pillow cools, a gas phase saturates in the magma, migrating from the core of the pillow towards its rim. It is this special process of gas transfer of metallic sulfides, chlorides, and oxides which deposit to form *Alteration Halos.* This amazing transformation, combination of reactions and counter reactions, timing and opportunity, is why this exhibition came to adopt the name of this natural phenomenon.