Crustal structure and evolution of the Niuafo'ou Microplate in the northeastern Lau Basin, southwestern Pacific

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HELMHOLTZ

RESEARCH FOR GRAND CHALLENGES



Overview of the Lau Basin tectonic structure





Lau Basin is a unique place:

- No where else do processes of destruction and creation of new crust in such
- proximity happen as fast as here.
- Convergence at Tonga trench, approx. 24 cm/yr
- Opening of Lau Basin, approx. 15 cm/yr



Modified from Schmid et al., in revision at JGR: Solid Earth

Why did we go there?





Lau Basin tectonic structure:

- A complex mosaic of microplates.
- Around 17°S there are even two extension centers, indicated by red arrows.

Main science questions:

- 1. What processes formed the crust in the north Lau Basin?
- 2. Is there seafloor spreading at the Fonualei Rift?

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Our geophysical experiment at 17°20'S





300 km long geophysical transect to investigate crustal structure, acquired in December 2019, during expedition SO-267 of RV Sonne

Acquired datasets include:

- Refraction seismics
- Reflection seismics
- Magnetics
- Gravity





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Results from the Niuafo'ou Microplate





Crust of Niuafo'ou Micrplate resembles a jigsaw of crustal blocks:

- Some blocks are similar to typical ocean crust, see the hatched areas in left map.
- Some blocks are similar to volcanic arc crust, see the perimeters indicated by dashed black lines in left map.

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Results from the Fonualei Rift

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Vp-depth distribution in Fonualei Rift differs from typical oceanic crust but also from rift shoulders on both sides.

We propose that crustal accretion is accomodated by a combination of rifting and magmatism

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