

EGU2020 Sharing Geoscience Online

TS6.2 Tectono-magmatic-sedimentary processes of the
marginal basins in the West Pacific: from convergent to divergent

**Remote predictive geological mapping as
a tool for the reconstruction of the complex
geodynamic evolution of Melanesia**

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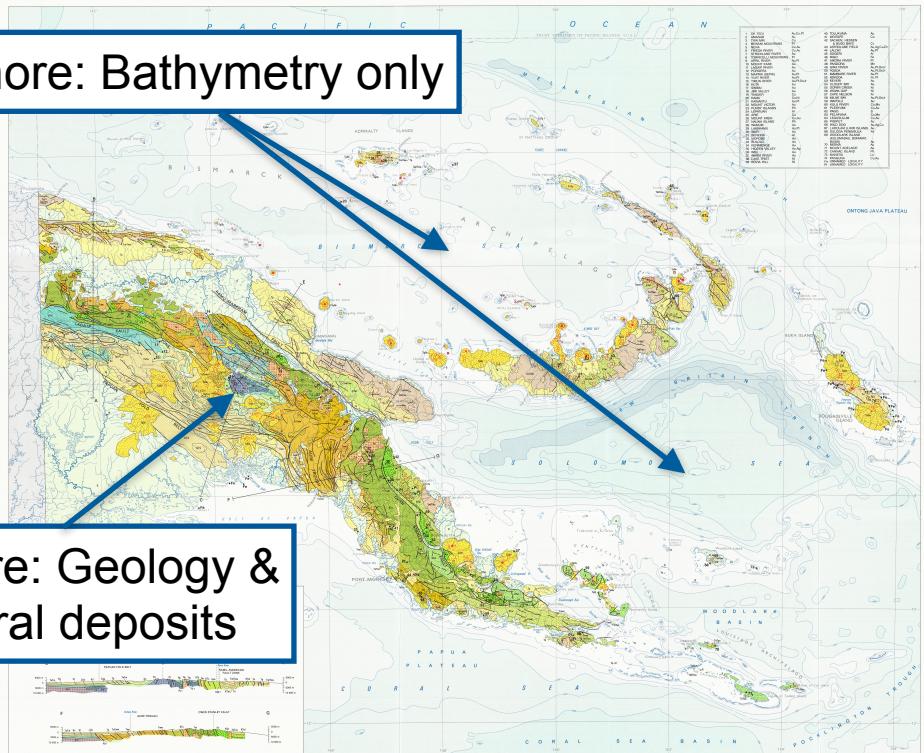
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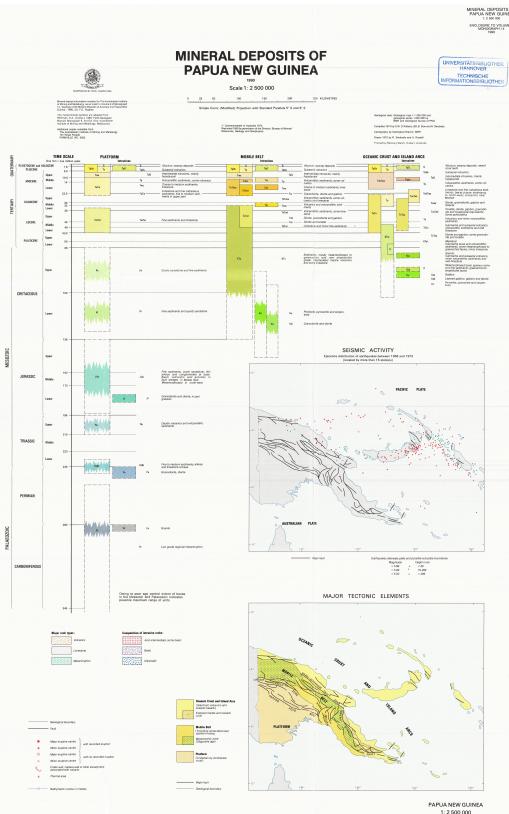
- Geological maps play an important role not only for **mineral exploration targeting** but also for the further **understanding of the regional tectonic evolution**, especially when combined with remote sensing techniques to cover large areas (e.g., Goetz and Rowan, 1981; Brimhall et al., 2006)
- To date, no regional-scale (i.e. scale of 1:1 mio. or similar) geological maps **combining on- and offshore areas** have been published because of the scarcity of data used for conventional geological mapping
- Remote predictive mapping allows to create **first-order geological maps in highly remote or largely underexplored areas** (cf. Schetselaar et al., 2007)

Limited knowledge of the offshore

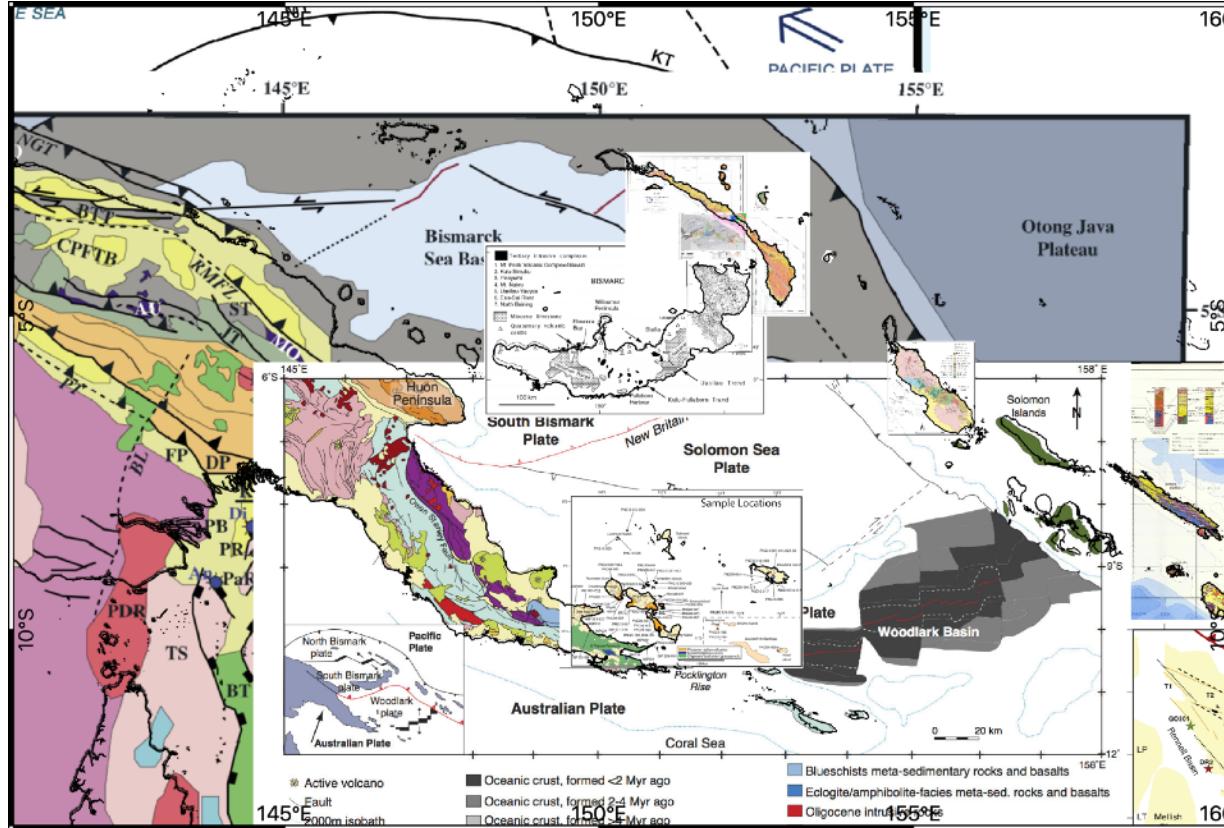
Offshore: Bathymetry only



Onshore: Geology & Mineral deposits



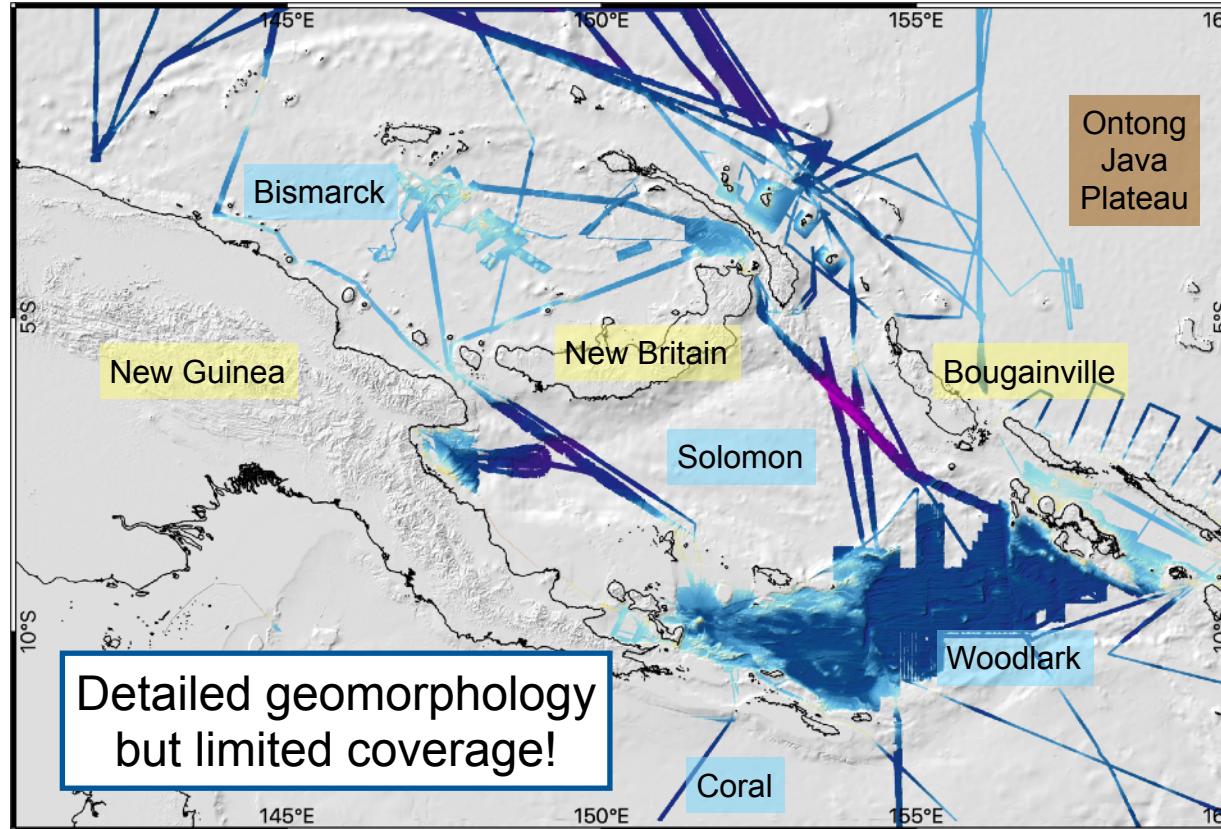
Stack of geological maps



Used for the creation of a simplified regional geological map (onshore)

Used for the informed geological interpretation of submarine features

Integrating global and ship-based bathymetry



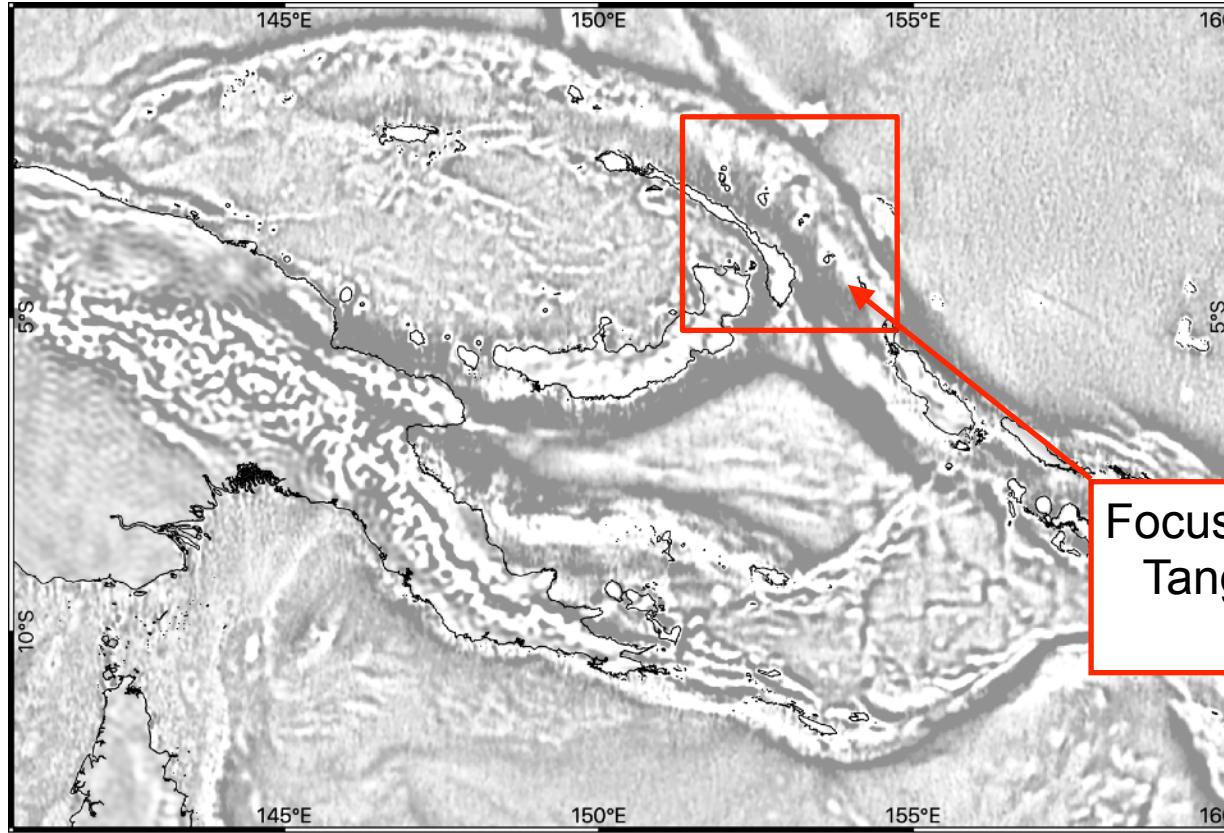
Compilation of
ship-based
bathymetry

US, Japanese,
Australian, French
and German
research cruises

Fused with GMRT

400,000 km² at
35-50 m resolution

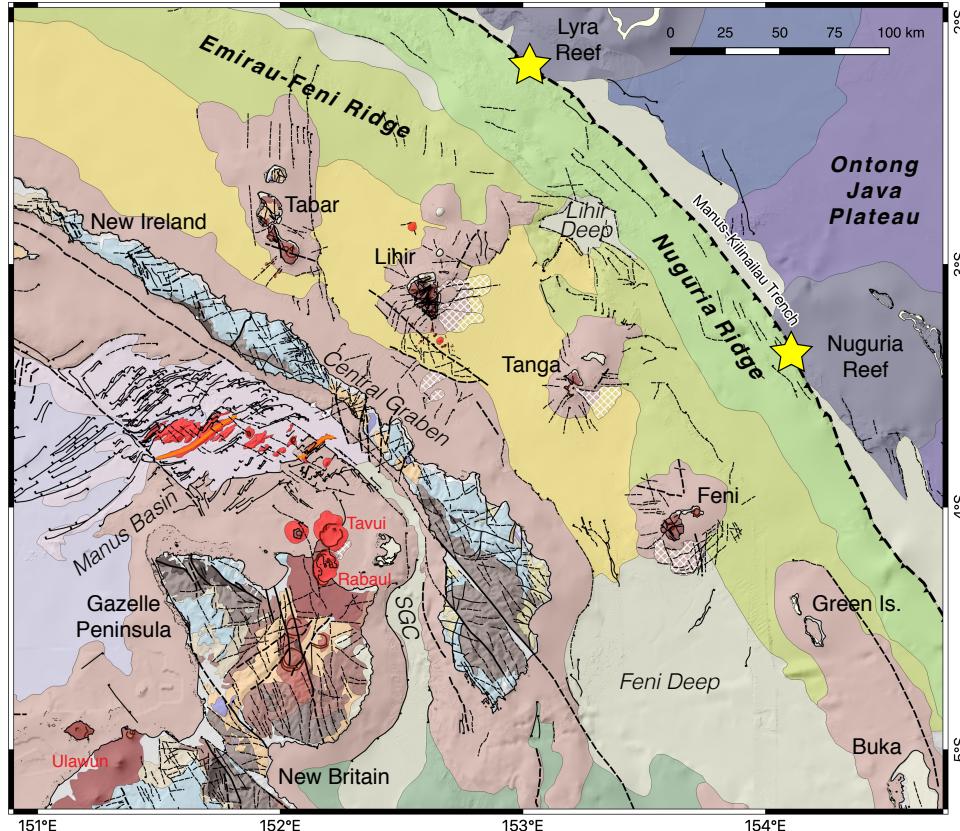
Vertical gravity gradient (VGG): guiding RPM



VGG: Important for the interpretation of tectonic elements and geological units (bedrock) under cover

Focus site: The Tabar-Lihir-Tanga-Feni island chain (next slide)

One step forward: Geomorphological maps



Tectonics

- - - Trench (inactive)
- Spreading Center
- Major Fault
- Major Fault (inferred)
- Minor Fault
- Minor Fault (inferred)
- Normal Fault
- Normal Fault (inferred)
- Ring Fault/Crater

Geology (onland)

- Raised Reef
- Intrusive Diorite
- Quaternary Volcanics
- Maton Conglomerate
- Rataman Formation
- Punam Limestone
- Nengmutka Volcanics (GP)
- Lelet Limestone
- Bergberg Formation (GP)
- Merai Volcanics (GP)
- Jaulu Volcanics

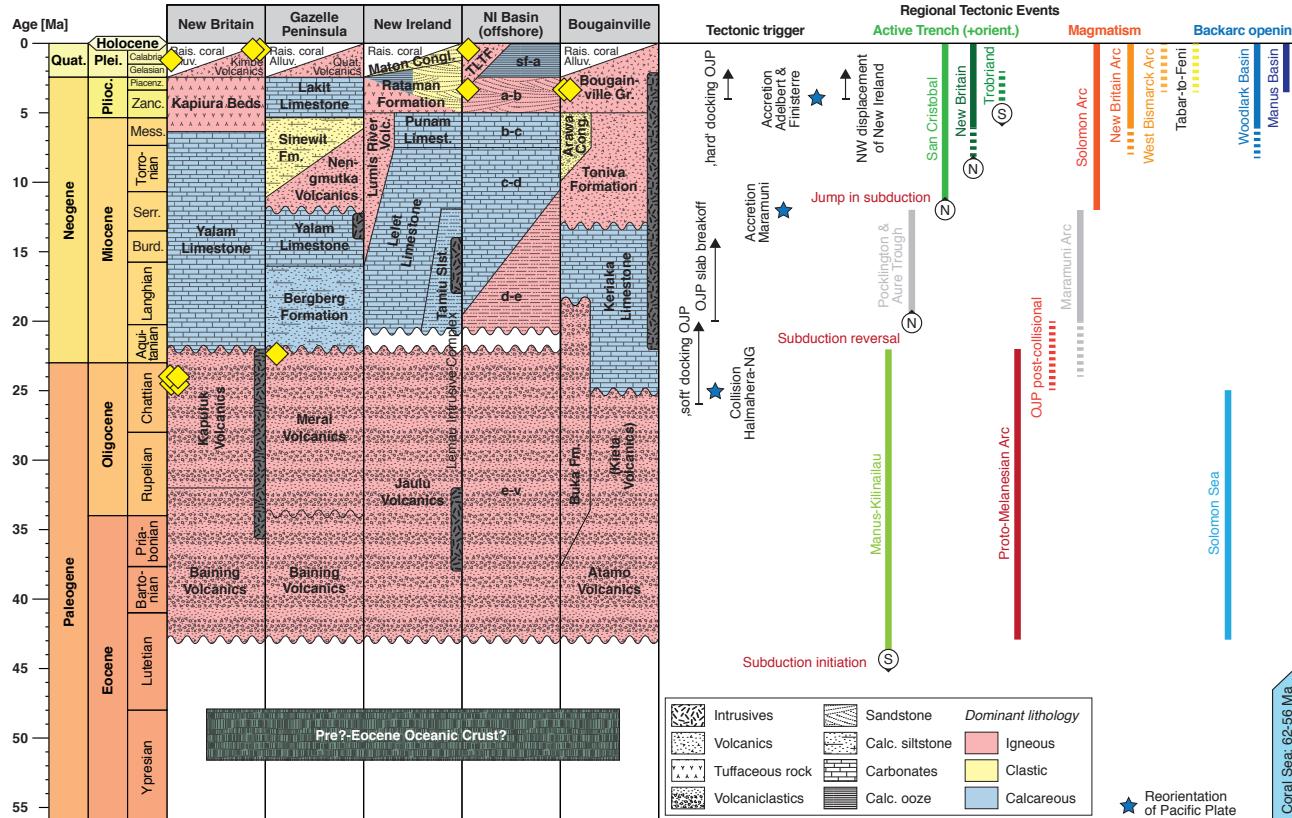
Geology (offshore)

- Mass Wasting Deposit
- Coral Reef
- Sedimentary Basin
- Relict New Ireland Basin
- Quaternary Volcanics
- New Britain Forearc
- Nuguria Ridge
- Emirau-Feni Ridge
- Shelf/Pedestal
- Extended Shelf
- Rifted Crust
- Lyra Basin
- Seamount
- Ontong Java Plateau



Brandl et al., 2020

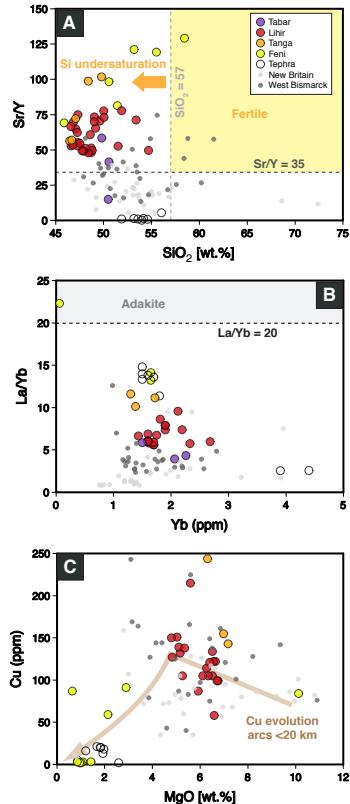
Reconstruction of the geodynamic evolution



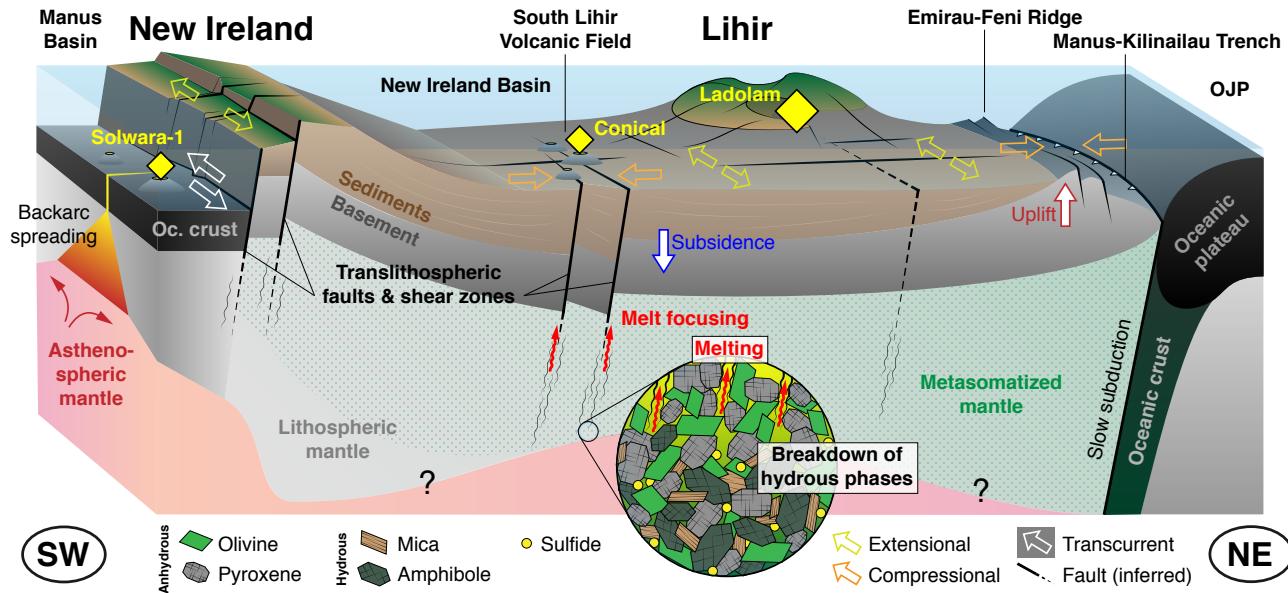
Lithostratigraphy is used for the creation of lithotectonic assemblages:

Regions that share a common geological and geodynamic history

Brandl et al., 2020



Development of an ore deposit model:



Brandl et al., 2020



Brandl et al., 2020 Ore Geology Reviews, 121 (open access)

<https://www.sciencedirect.com/science/article/pii/S0169136819306067>

P.A. Brandl: Remote predictive mapping of PNG's marginal seas

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

Summary

- Remote predictive geological mapping is a powerful tool for the **geological understanding of largely underexplored areas** (e.g., the deep sea)
- Based on existing knowledge and geophysical data
- **Iterative process** that will require future ground-truthing and revision
- Reconstruction of the geodynamic evolution using lithostratigraphy
- Integration of petrology & geochemistry helps to **develop ore deposits models** and may help to delineate future exploration targeting



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