



UNIVERSITÀ DEGLI STUDI
DI MILANO
DIPARTIMENTO DI SCIENZE
DELLA TERRA "ARDITO DESIO"

COSP
CENTRO FUNZIONALE PER
L'ORIENTAMENTO ALLO
STUDIO E ALLE PROFESSIONI



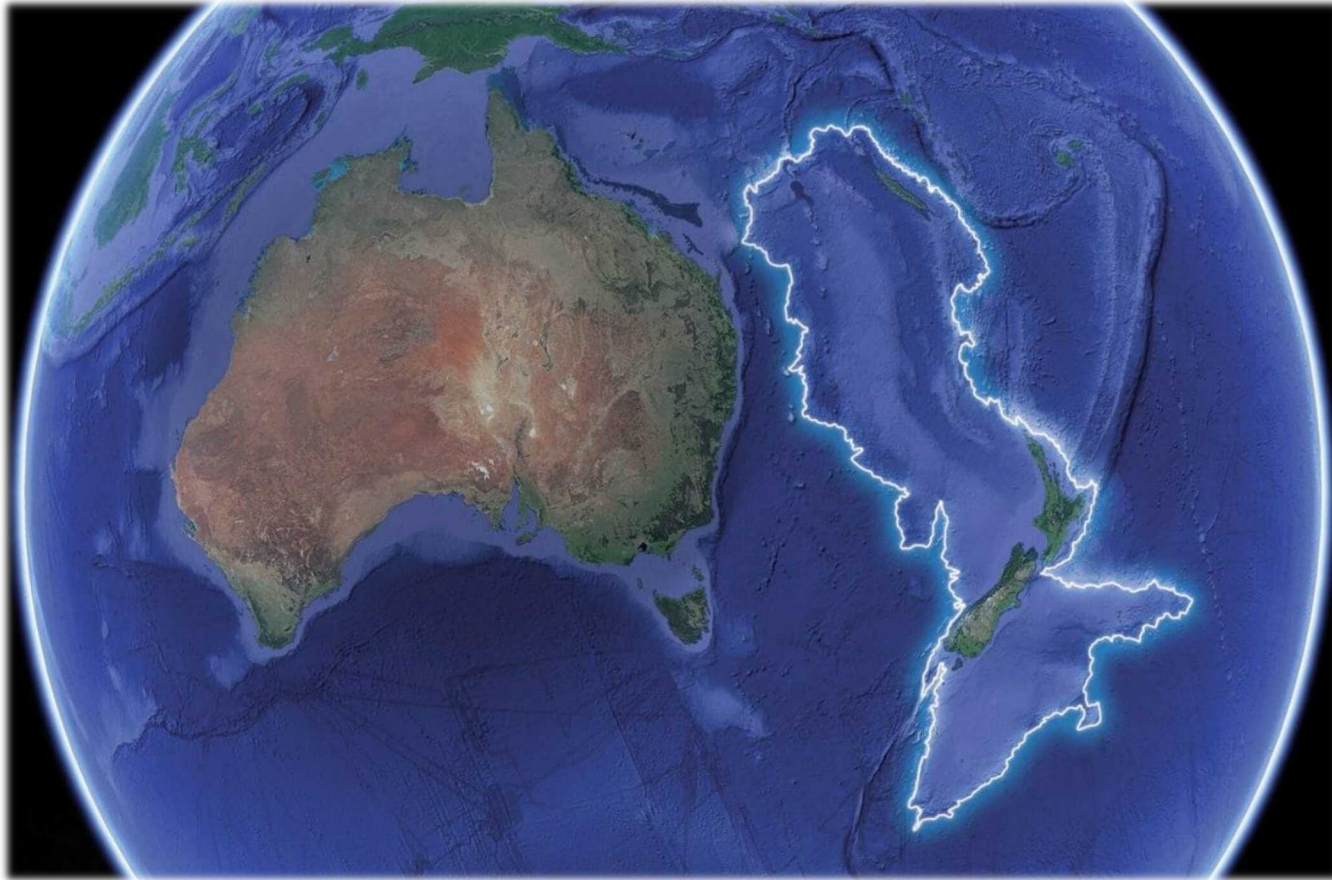
Aperitivi scientifici coi piedi per Terra!

**Zealandia: storia geologica di un
continente sommerso.**



**Edoardo
Dallanave**

apegeo.unimi.it



Zealandia!

Dove?

Continente sommerso per più del 90% sotto le acque dell'Oceano Pacifico meridionale, a causa dello spessore inferiore della sua crosta rispetto agli altri continenti (circa la metà).

Gli arcipelaghi principali di cui ne fanno parte sono Nuova Zelanda e Nuova Caledonia.

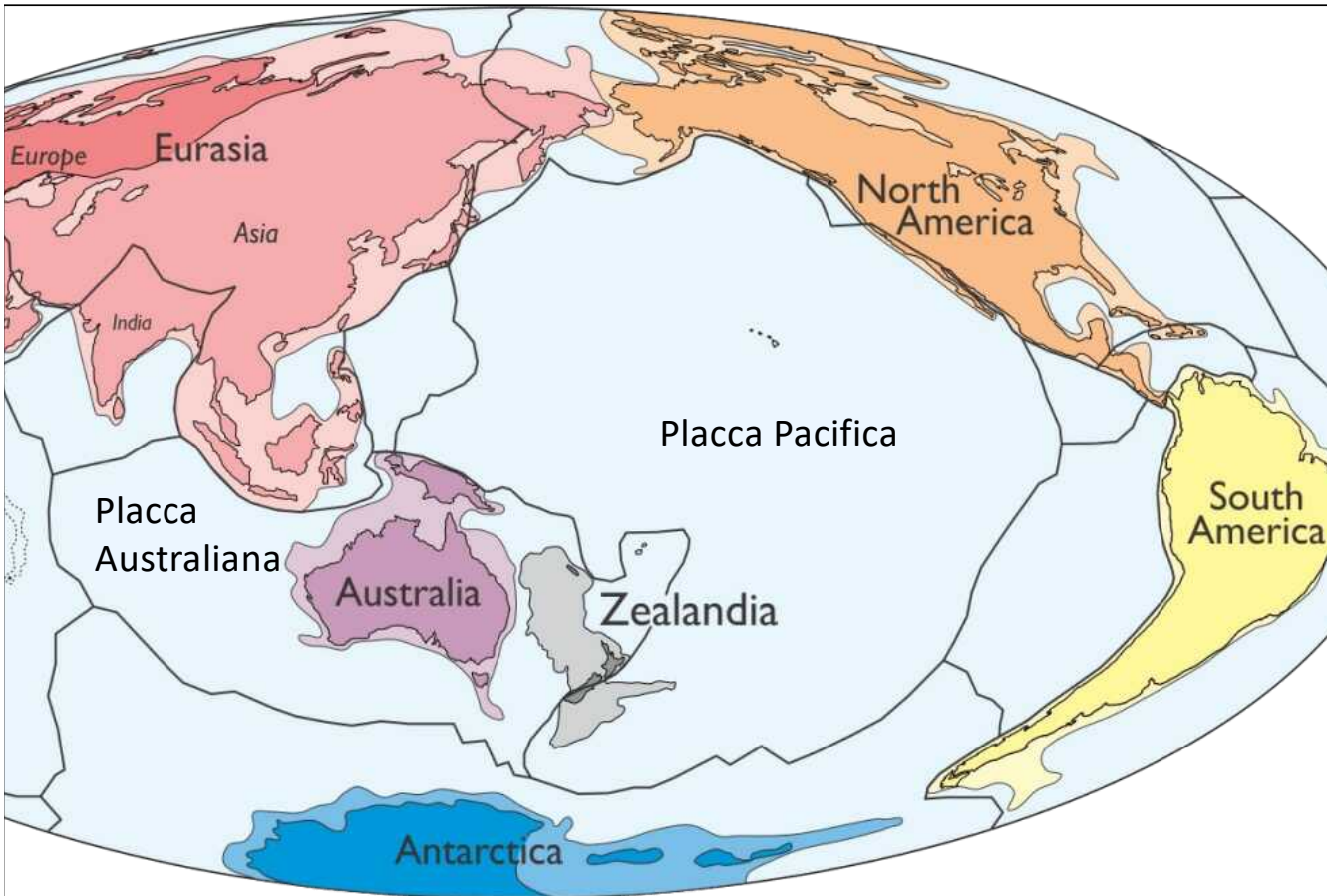
Zealandia!

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Si estende su due placche tettoniche: Pacifica (Zealandia meridionale) e Australiana (Zealandia settentrionale).





...correva l'anno 2017

Zealandia: Earth's Hidden Continent

Nick Mortimer, GNS Science, Private Bag 1930, Dunedin 9054, New Zealand; Hamish J. Campbell, GNS Science, P.O. Box 30368, Lower Hutt 5040, New Zealand; Andy J. Tulloch, GNS Science, Private Bag 1930, Dunedin 9054, New Zealand; Peter R. King, Vaughan M. Stagpoole, Ray A. Wood, Mark S. Rattenbury, GNS Science, P.O. Box 30368, Lower Hutt 5040, New Zealand; Rupert Sutherland, SGEEs, Victoria University of Wellington, P.O. Box 600, Wellington 6140, New Zealand; Chris J. Adams, GNS Science, Private Bag 1930, Dunedin 9054, New Zealand; Julien Collot, Service Géologique de Nouvelle Calédonie, B.P. 465, Nouméa 98845, New Caledonia; and Maria Seton, School of Geosciences, University of Sydney, NSW 2006, Australia

ABSTRACT

A 4.9 Mkm² region of the southwest Pacific Ocean is made up of continental crust. The region has elevated bathymetry relative to surrounding oceanic crust, diverse and silica-rich rocks, and relatively thick and low-velocity crustal structure. Its isolation from Australia and large area support its definition as a continent—Zealandia. Zealandia was formerly part of Gondwana. Today it is 94% submerged, mainly as a result of widespread Late Cretaceous crustal thinning preceding supercontinent breakup and consequent isostatic balance. The identification of Zealandia as a geological continent, rather than a collection of continental islands, fragments, and slices, more correctly represents the geology of this part of Earth. Zealandia provides a fresh context

in which to investigate processes of continental rifting, thinning, and breakup.

INTRODUCTION

Earth's surface is divided into two types of crust, continental and oceanic, and into 14 major tectonic plates (Fig. 1; Holmes, 1965; Bird, 2003). In combination, these divisions provide a powerful descriptive framework in which to understand and investigate Earth's history and processes. In the past 50 years there has been great emphasis and progress in measuring and modeling aspects of plate tectonics at various scales (e.g., Kearey et al., 2009). Simultaneously, there have been advances in our understanding of continental rifting, continent-ocean boundaries (COBs), and the discovery of a number of micro-

continental fragments that were stranded in the ocean basins during supercontinent breakups (e.g., Buck, 1991; Lister et al., 1991; Gaina et al., 2003; Franke, 2013; Eagles et al., 2015). But what about the major continents (Fig. 1)? Continents are Earth's largest surficial solid objects, and it seems unlikely that a new one could ever be proposed.

The *Glossary of Geology* defines a continent as "one of the Earth's major land masses, including both dry land and continental shelves" (Neuendorf et al., 2005). It is generally agreed that continents have all the following attributes: (1) high elevation relative to regions floored by oceanic crust; (2) a broad range of siliceous igneous, metamorphic, and sedimentary rocks; (3) thicker crust and lower seismic velocity

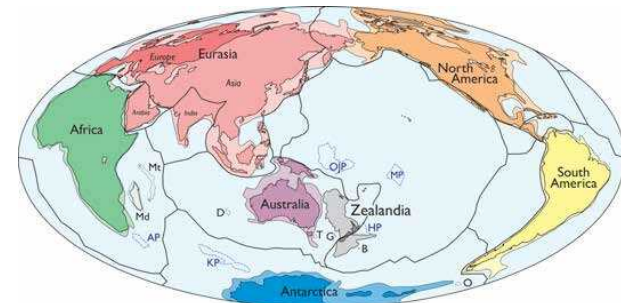


Figure 1. Simplified map of Earth's tectonic plates and continents, including Zealandia. Continental shelf areas shown in pale colors. Large igneous province (LIP) submarine plateaus shown by blue dashed lines: AP—Aguulhas Plateau; KP—Kerguelen Plateau; OJP—Ontong Java Plateau; MP—Manihiki Plateau; HP—Hikurangi Plateau. Selected microcontinents and continental fragments shown by black dotted lines: Md—Madagascar; Mt—Mauritius; D—Gulden Draak; T—East Tasman; G—Gilbert; B—Bollons; O—South Orkney. Hammer equal area projection.

Ciencia / Materia

NUEVO CONTINENTE >

Hallado Zelanda, un enorme continente sumergido en el Pacífico

El territorio cubre un área de 4,9 millones de kilómetros y sus zonas visibles son Nueva Zelanda y Nueva Caledonia

ASTROFÍSICA · MEDIO AMBIENTE · INVESTIGACIÓN MÉDICA · MATEMÁTICAS · PALEONTOLOGÍA · ÚLTIMAS NOTICIAS

Explainers

Explained: What is Zealandia and why is it in news?

What have scientists and researchers uncovered in the earth's lost 8th continent?

Zealandia: Earth's Hidden Continent

1930, Dunedin 9054, New Zealand; **Hamish J. Campbell**, GNS Science, P.O. Box 30368, Lower Hutt 5040, New Zealand; **Peter R. King, Vaughan** ... GNS Science, Private Bag 1930, Dunedin 9054, New Zealand; **Peter R. King, Vaughan** ... GNS Science, P.O. Box 30368, Lower Hutt 5040, New Zealand; **Rupert Sutherland**, ... Wellington 6140, New Zealand; **Chris J. Adams**, GNS Science, Private Bag 1930, ... de Nouvelle Calédonie, B.P. 465, Nouméa 98845, New Caledonia; and ... 2006, Australia

continental fragments that were stranded in the ocean basins during supercontinent breakups (e.g., Buck, 1991; Lister et al., ... 2015). But what about the (Fig. 1)? Continents are solid objects, and it ... could ever

Meet Zealandia: Earth's latest continent



By Randall Potter, CNN
1 minute read · Updated 9:33 PM EDT, Mon June 26, 2017

Zealandia: Scientists discover 8th continent that had been missing for 375 years

TOI Science Desk / TIMESOFINDIA.COM / Nov 7, 2024, 10:00 IST

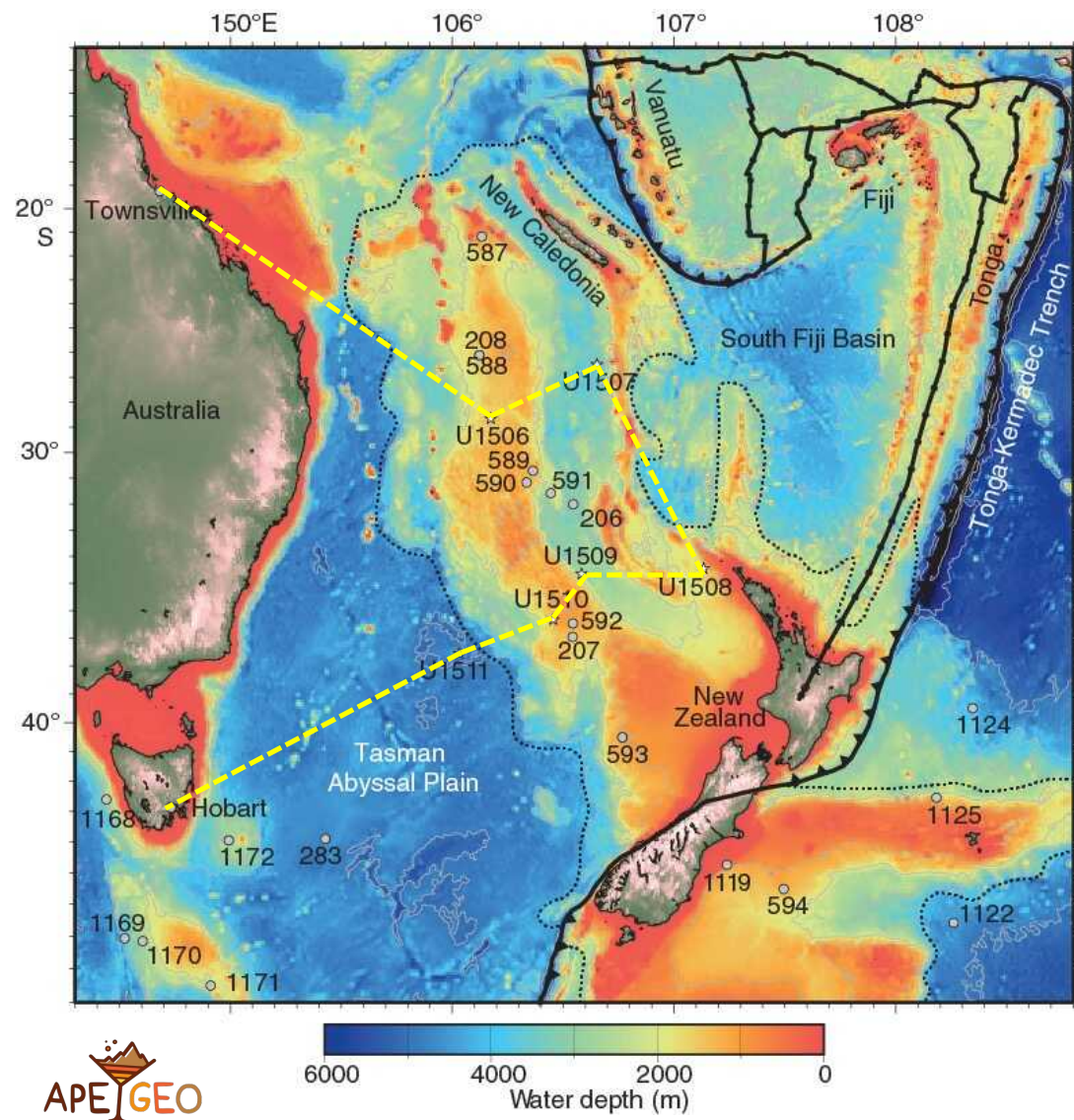
Scientists have unveiled the full geological map of Zealandia, Earth's hidden eighth continent. Analysis of seabed samples revealed a massive volcanic region that contributed to the breakup of the Gondwana supercontinent and a 4,000 km-long granite backbone. These findings provide crucial insights into Zealandia's dynamic ... [Read More](#)



INTERNATIONAL OCEAN DISCOVERY PROGRAM Expedition 371

27 Luglio – 26 Settembre 2017

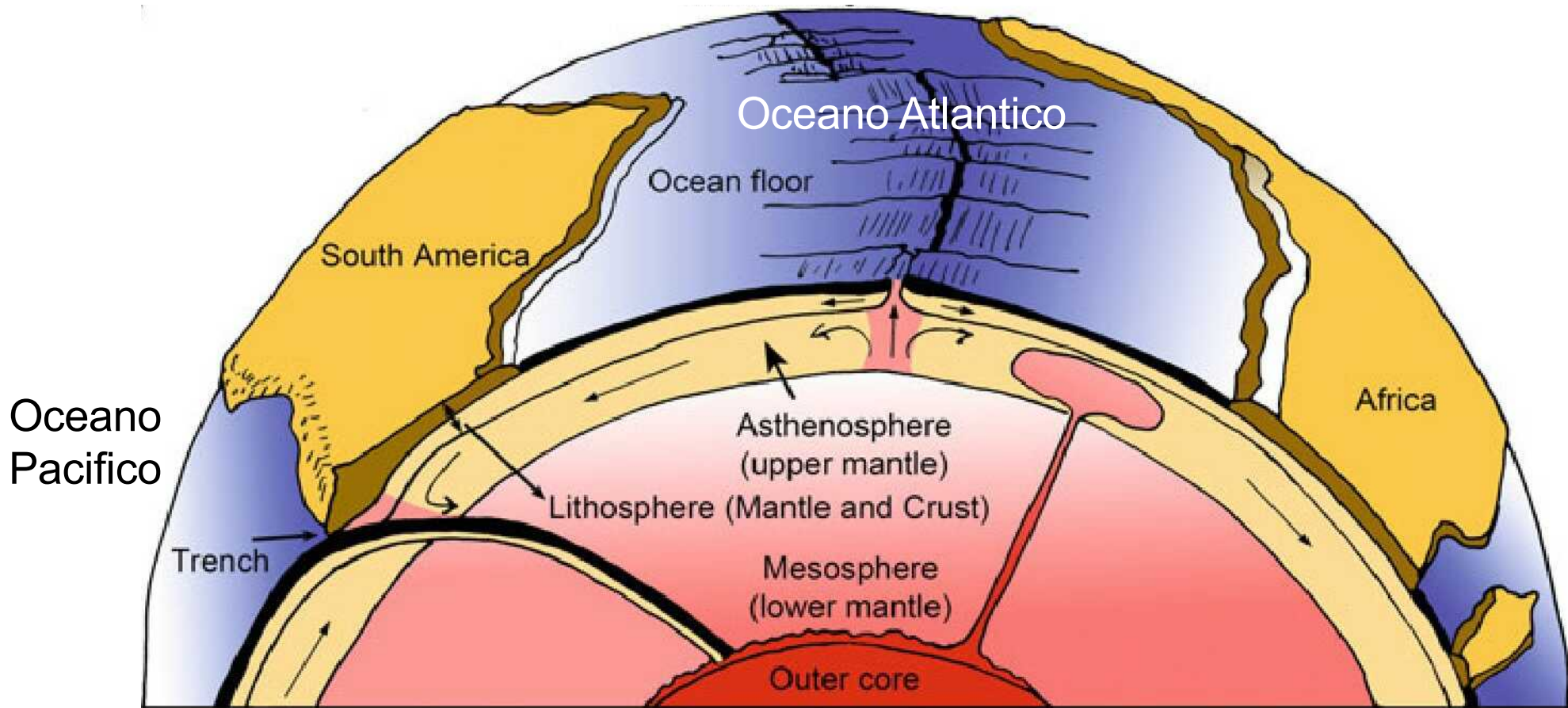




La litosfera terrestre è divisa in placche tettoniche



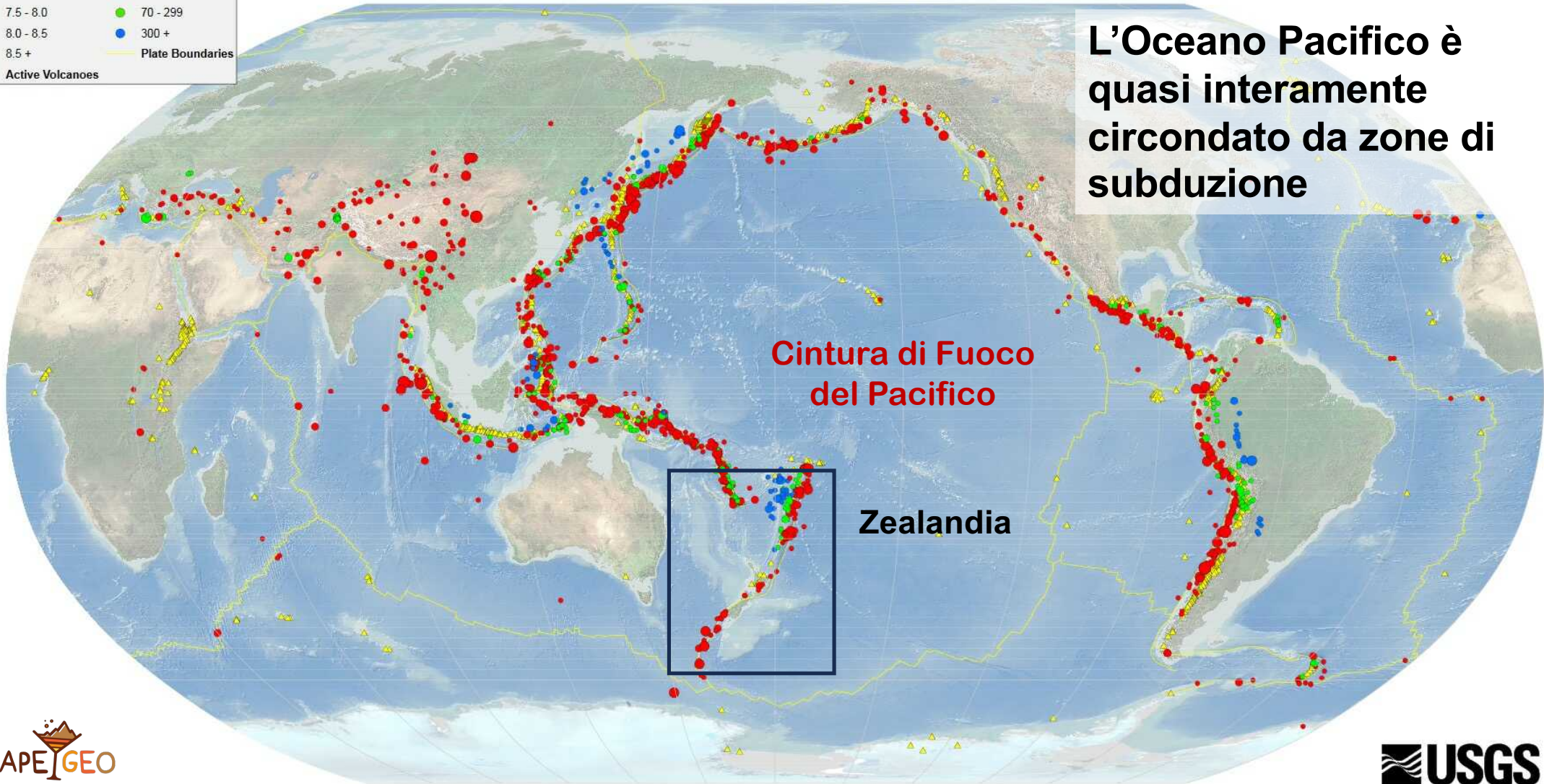
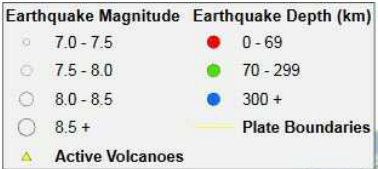
La crosta viene o creata, o subdotta



Fundamental of Physical Geology; DOI 10.1007/978-81-322-1539-4

Global Earthquakes 1900 - 2013

L'Oceano Pacifico è quasi interamente circondato da zone di subduzione

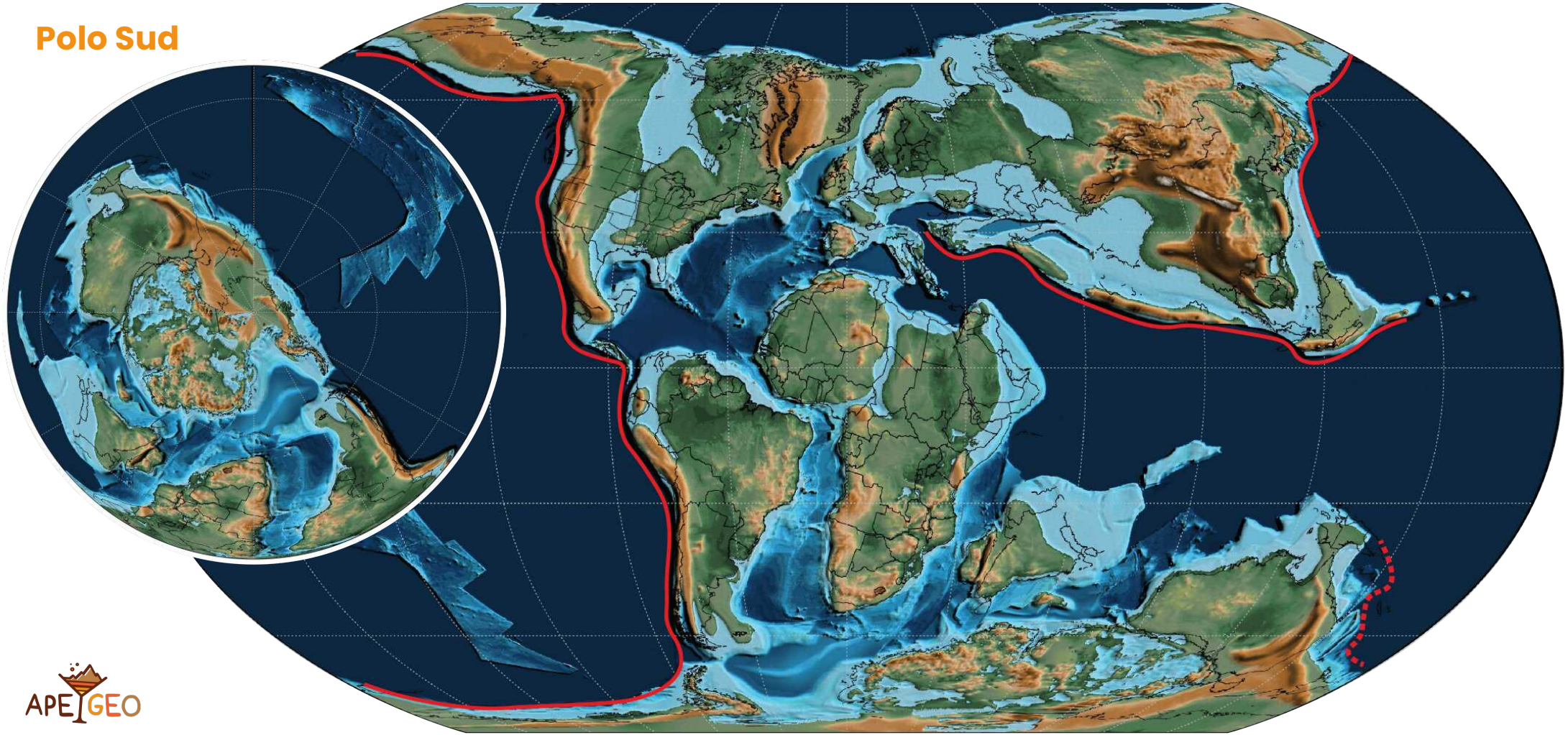


Cintura di Fuoco del Pacifico

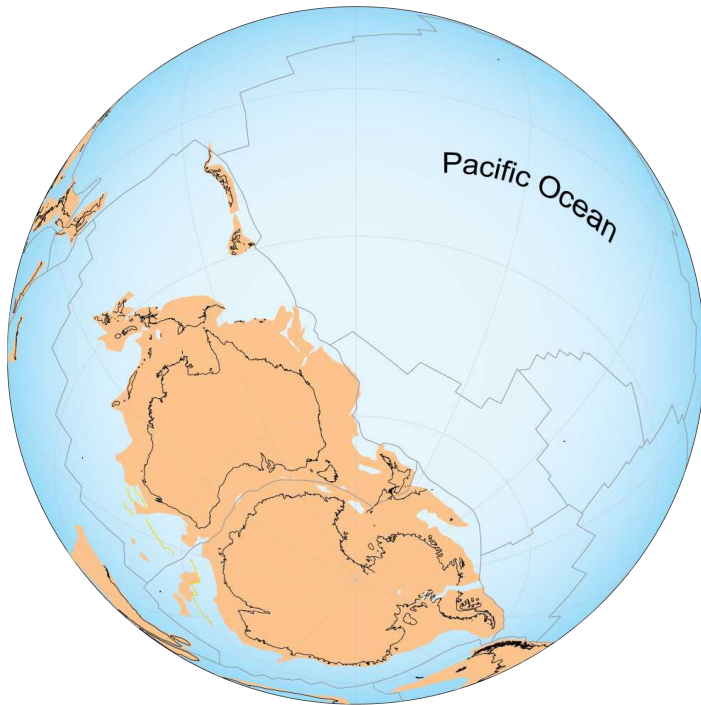
Zealandia

Paleogeografia globale circa 100 Ma

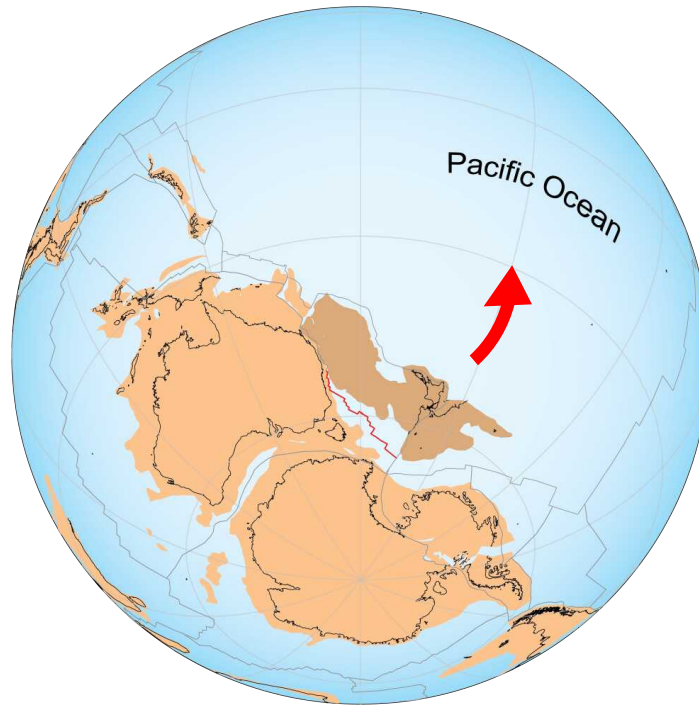
Polo Sud



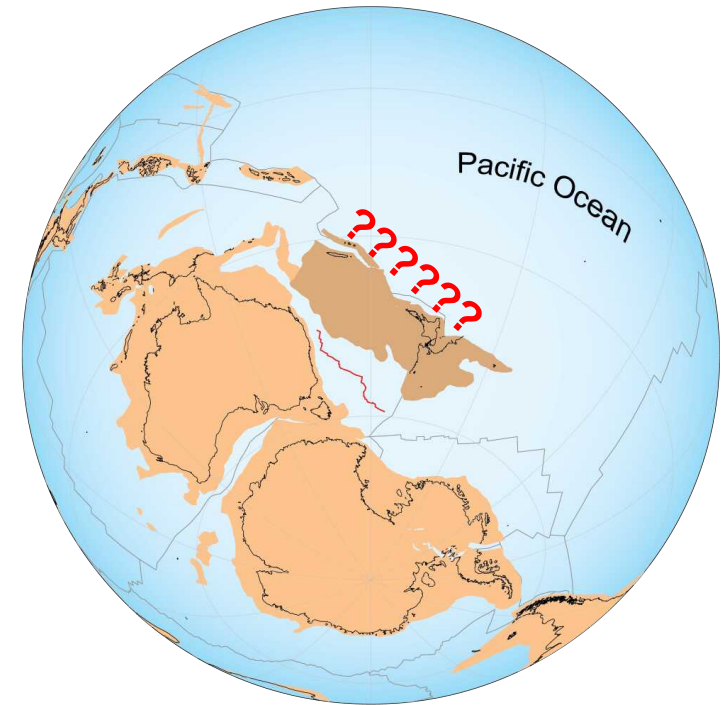
90 Ma



70 Ma



50 Ma



Tra circa 90 e 50 milioni di anni fa, Zealandia si separa dal margine australiano

Cosa succede al margine pacifico durante questo processo?

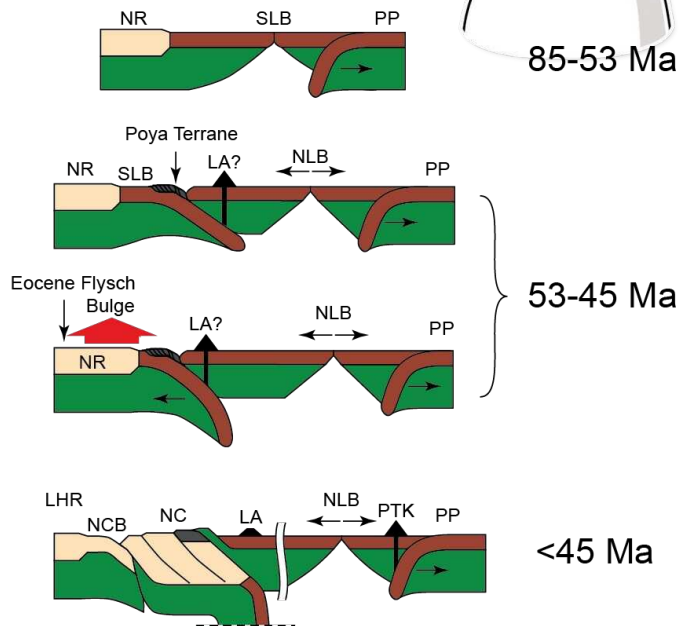


Evoluzione incerta di una grande area del Pacifico meridionale

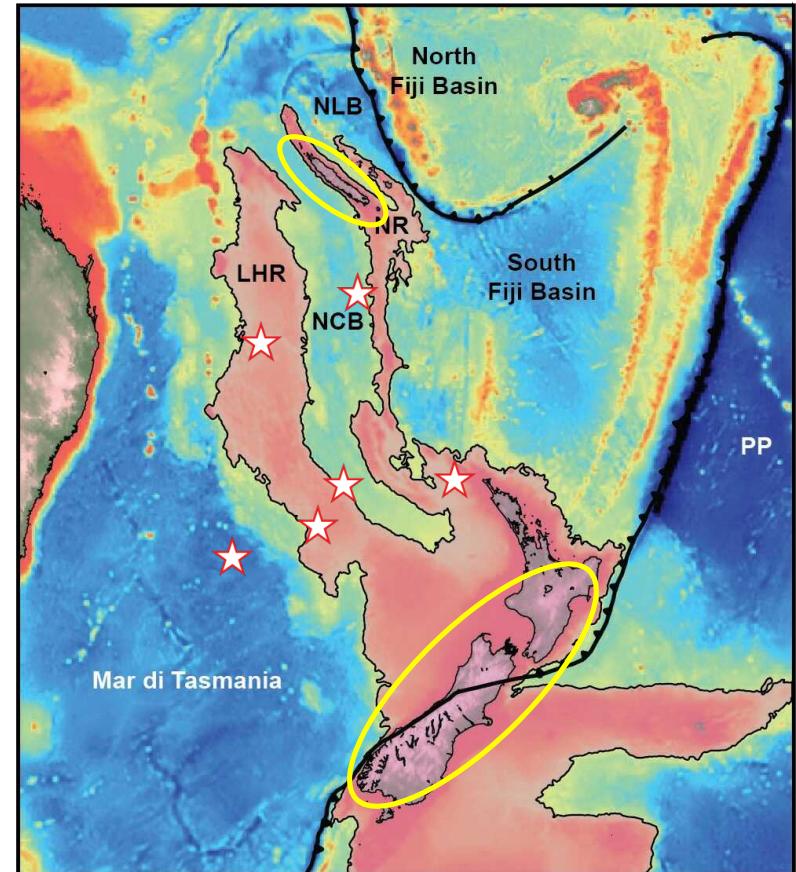
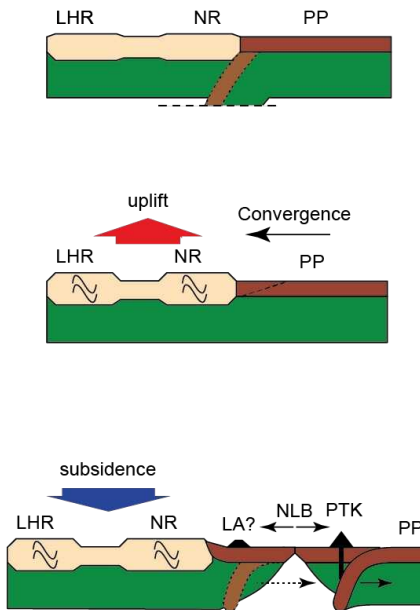


Rocce esposte in Nuova Zelanda e Nuova Caledonia
Sedimenti perforati in vari siti oceanici

**Modello 1
complesso**

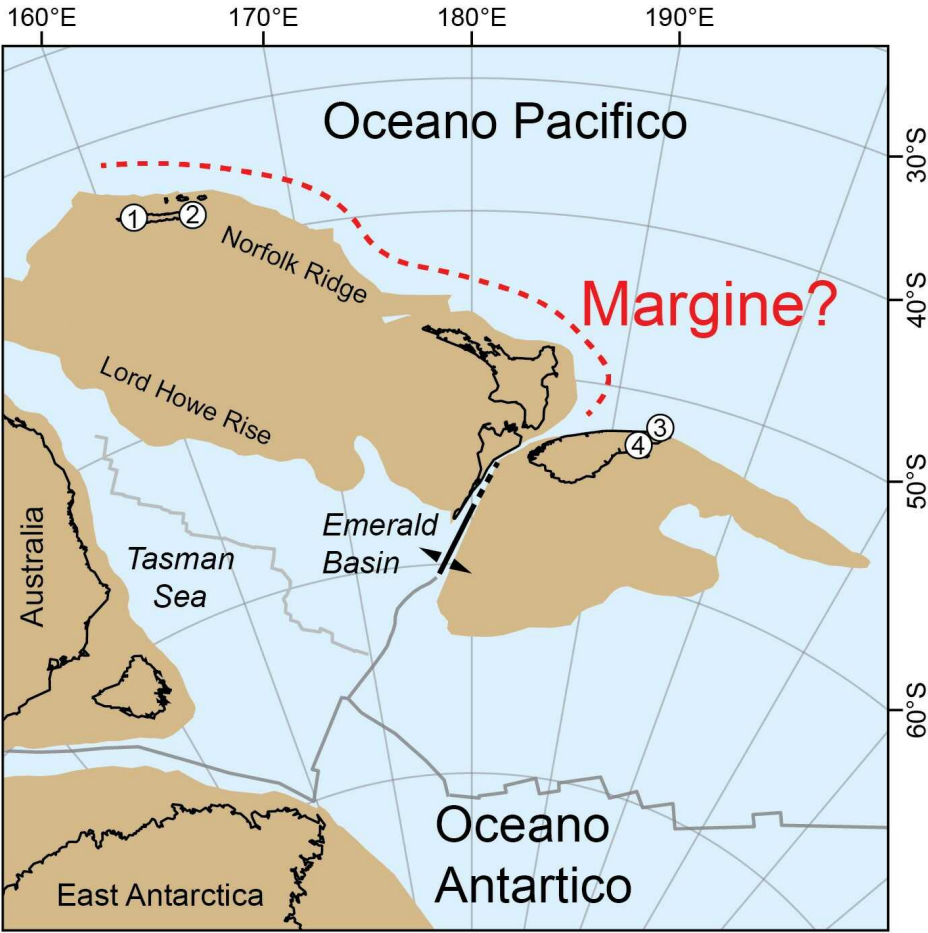


**Modello 2(?)
meno complesso**



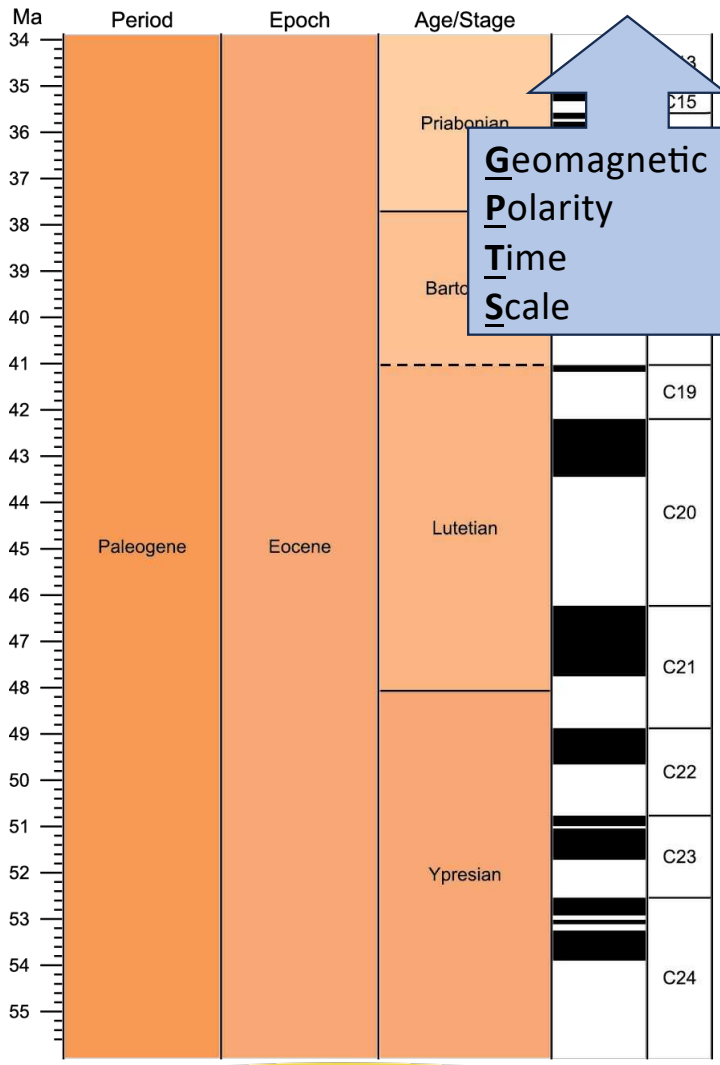
NR= Rorfolk ridge, LHR= Lord Howe Rise, PP= Pacific Plate, SLB and NLB= South and North Loyalty Basin, LA= Loyalty Arc, NC and NCB= New Caledonia and New Caledonia Basin, PTK= Proto-Tonga-Kermadec Arc

Le successioni stratigrafiche Eoceniche di Nuova Zelanda e Nuova Caledonia



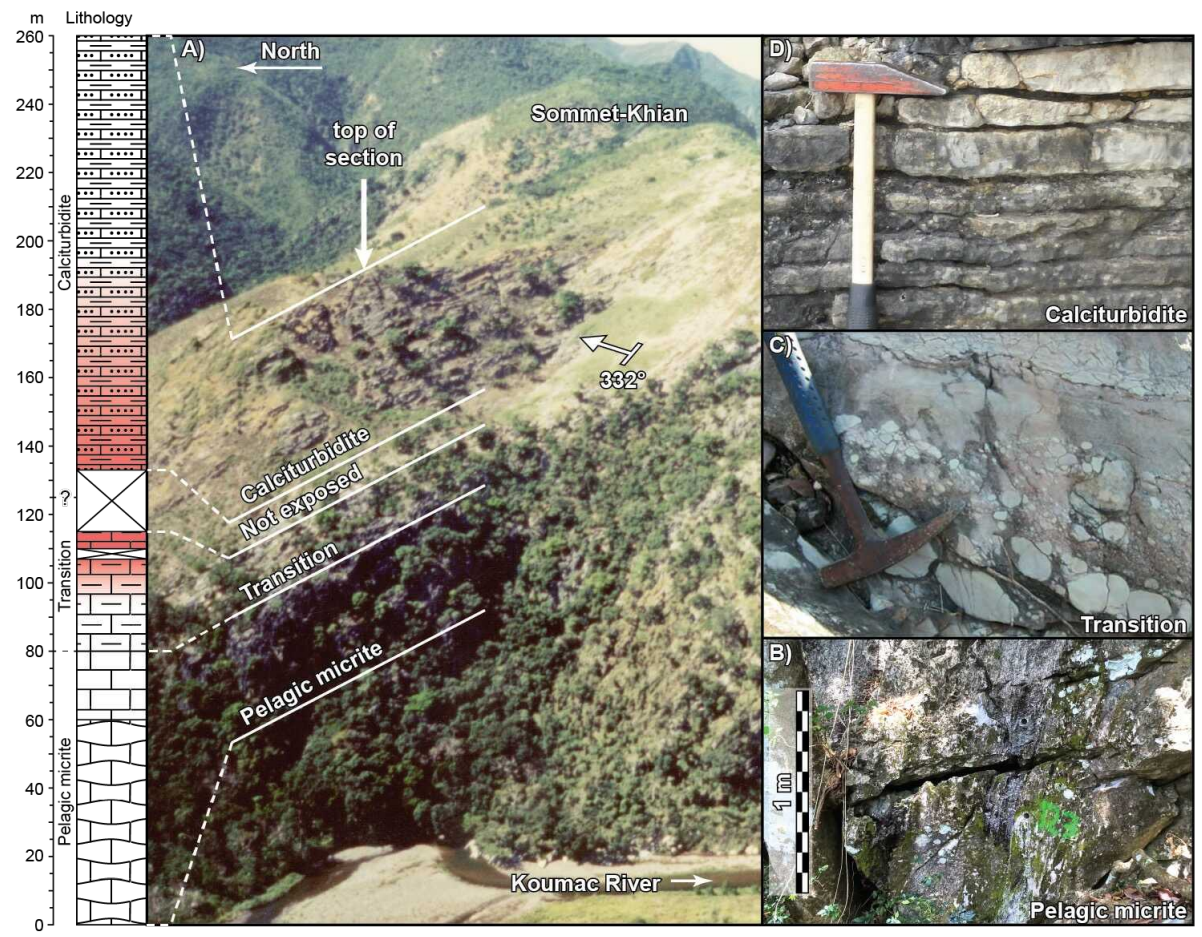
La sezione di Koumac in Nuova Caledonia

Chronostratigraphy



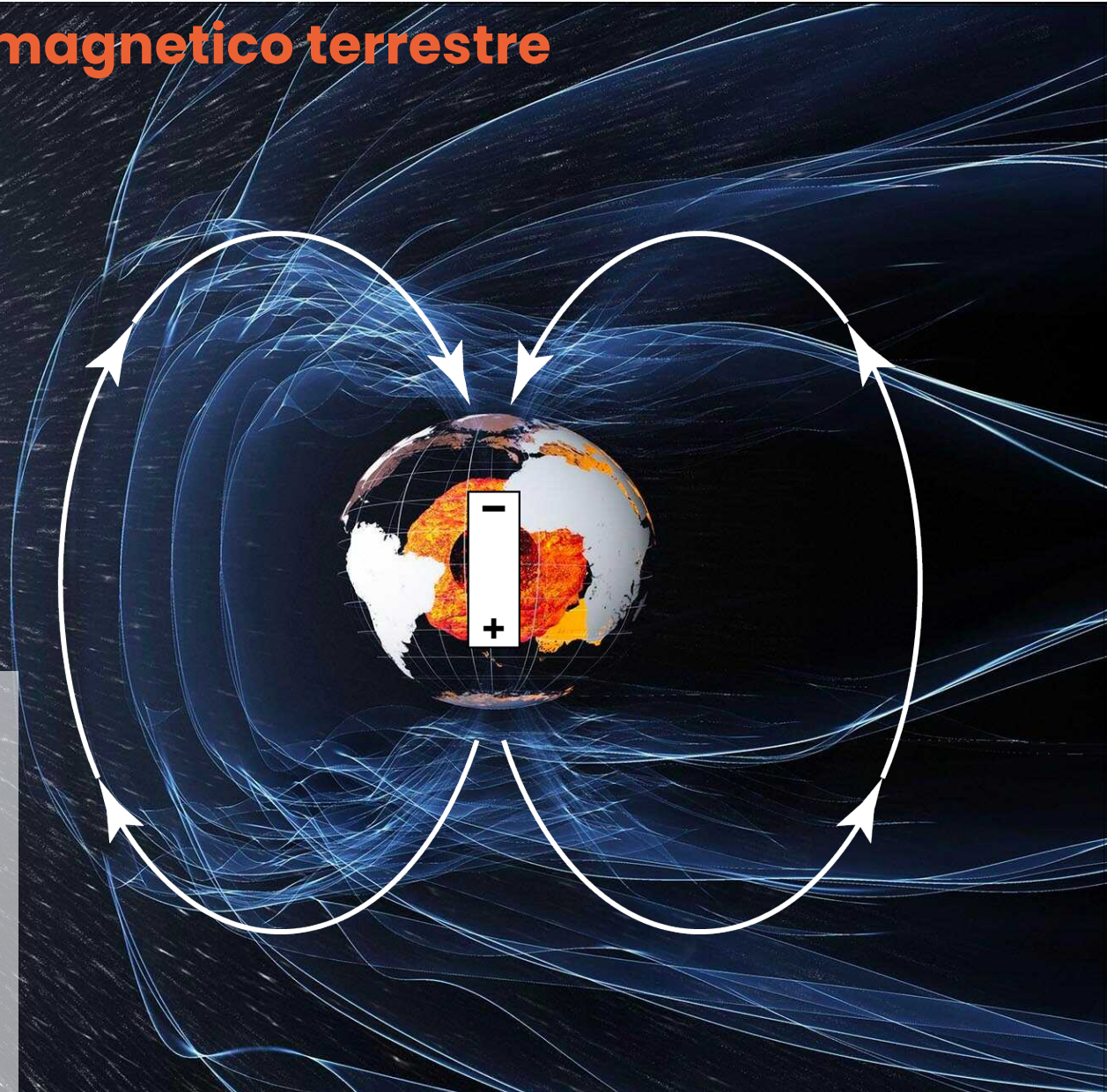
GPTS
Geomagnetic Polarity Time Scale

??
 ??
 ??
 ??
 ??
 ??
 ??



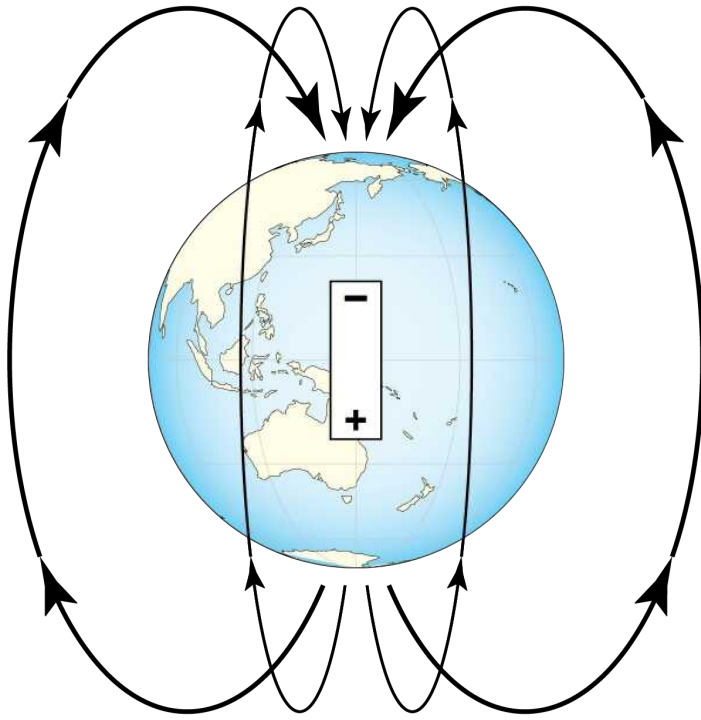
Il campo magnetico terrestre

Il campo magnetico terrestre protegge l'atmosfera dal vento solare. È il risultato delle correnti convettive presenti all'interno del nucleo esterno, fluido. È quindi, per sua natura, un'entità variabile nel tempo.

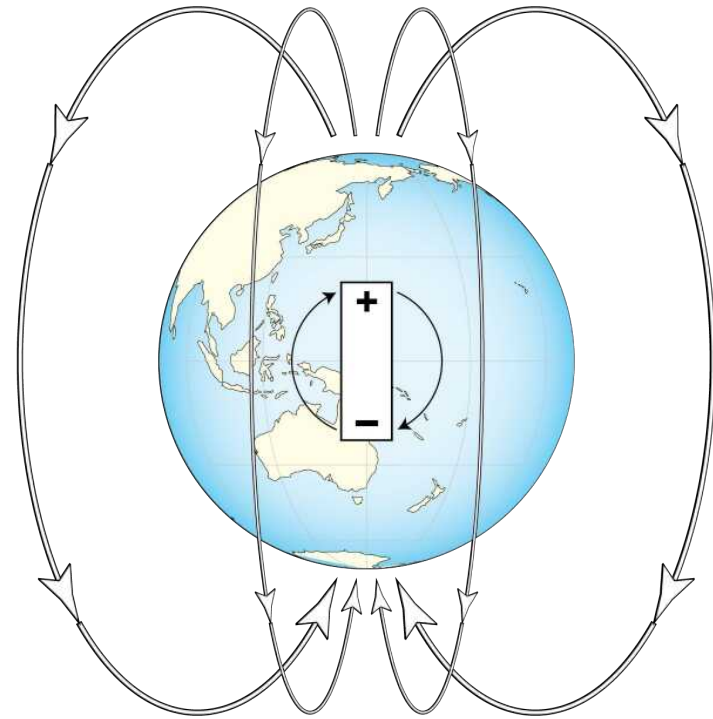


Il campo magnetico si è invertito innumerevoli volte nel passato

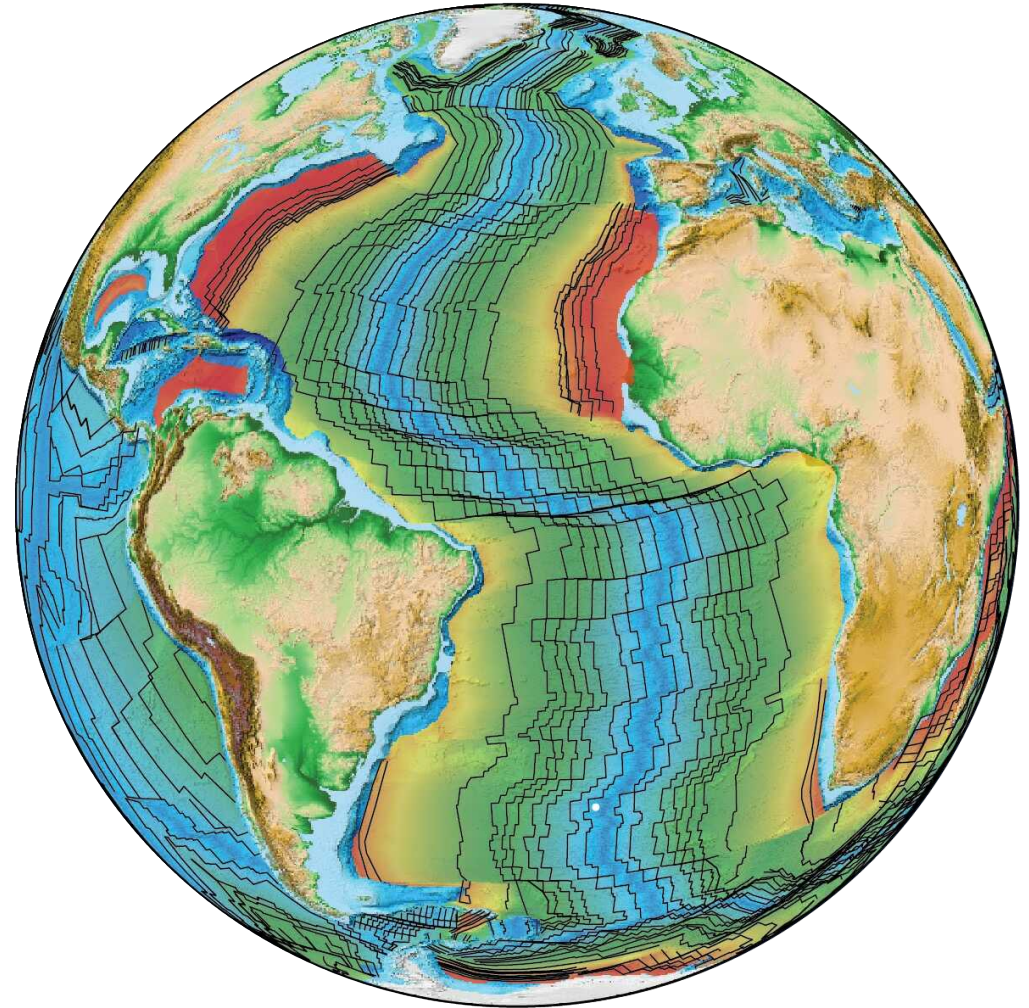
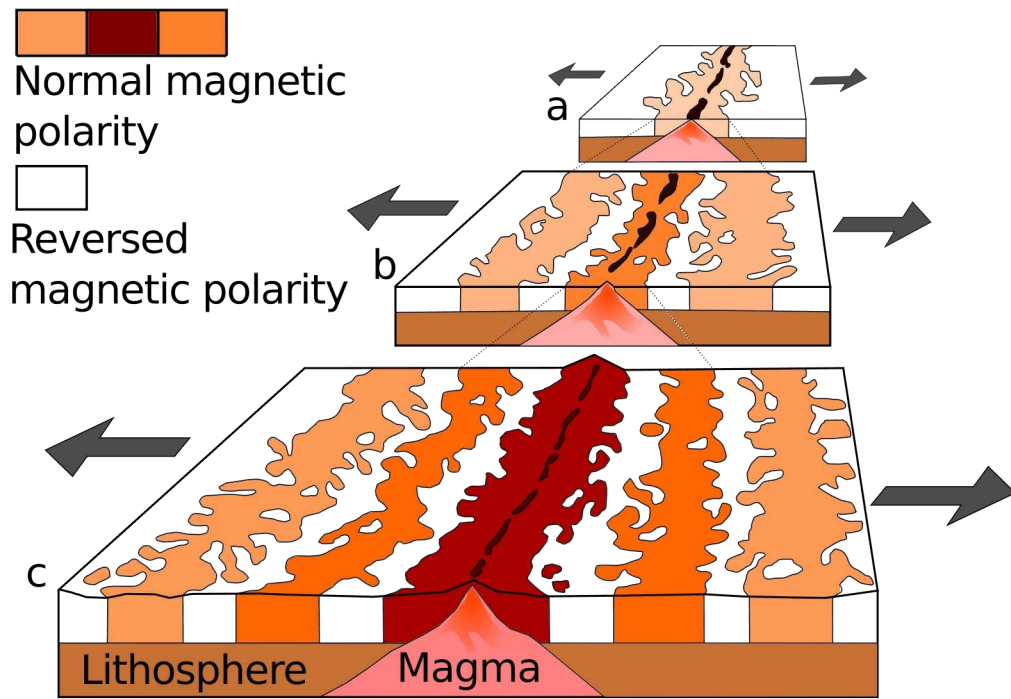
Campo Normale

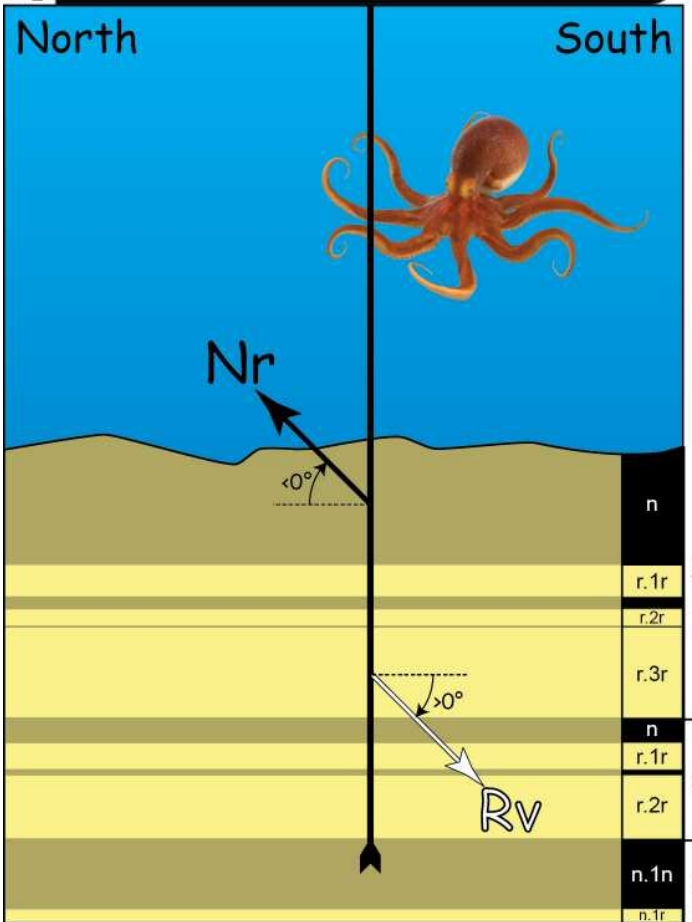


Campo Inverso

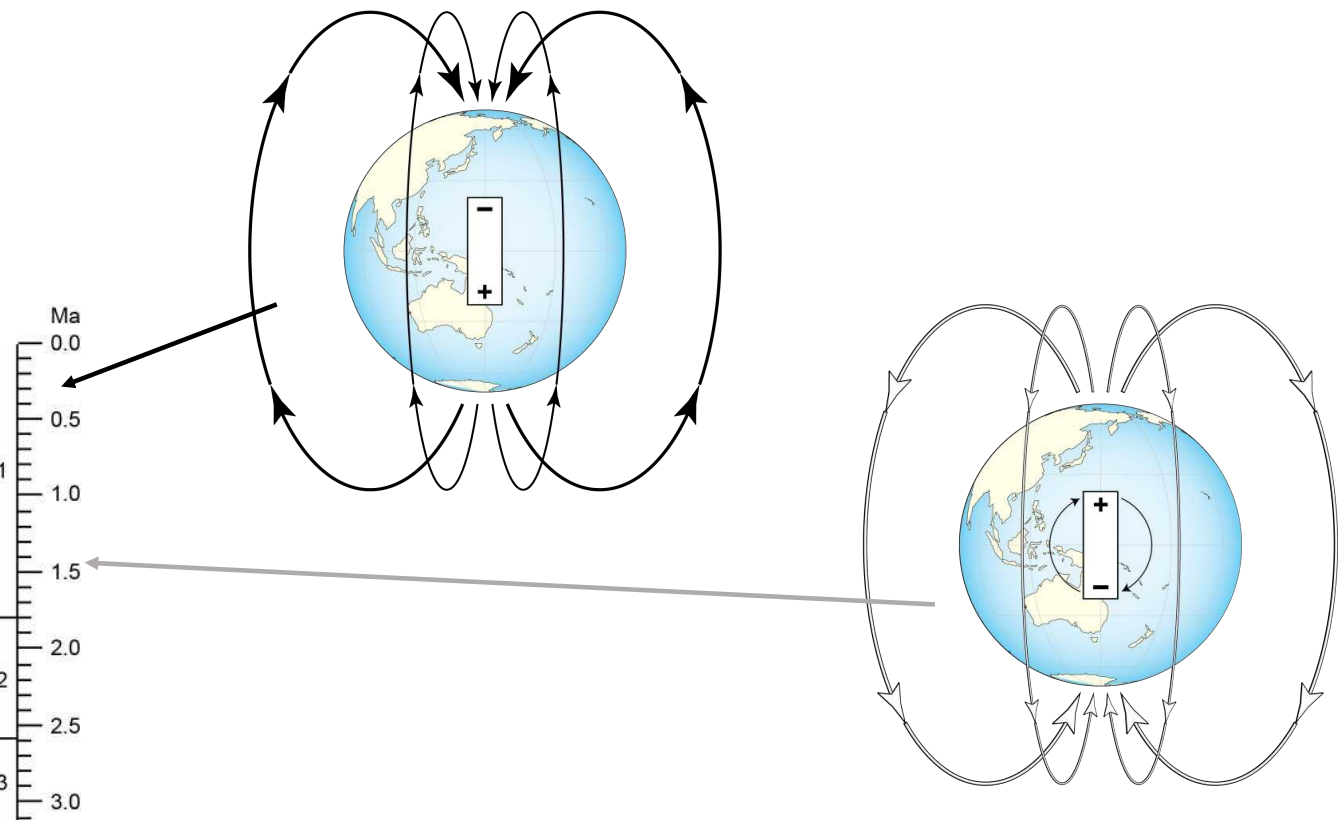


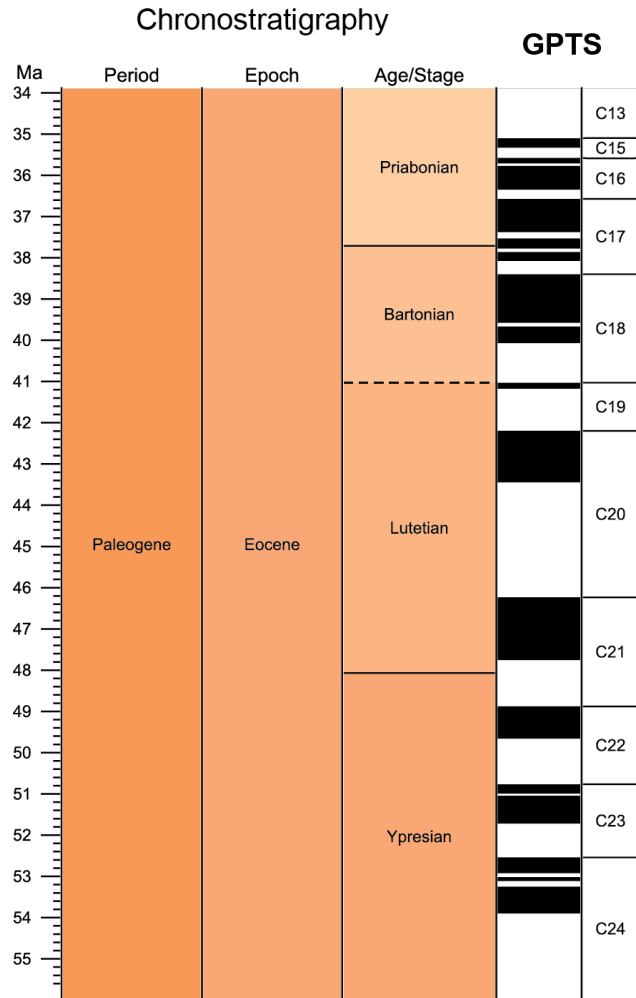
La crosta oceanica si magnetizza quando si forma, e la crosta più vecchia «registra» il campo magnetico del passato.





- Anche i sedimenti marini, che contengono minerali magnetici, «registrano» il campo magnetico della terra.
- Con opportune analisi, si può capire sono sedimentati durante campo normale o campo inverso.

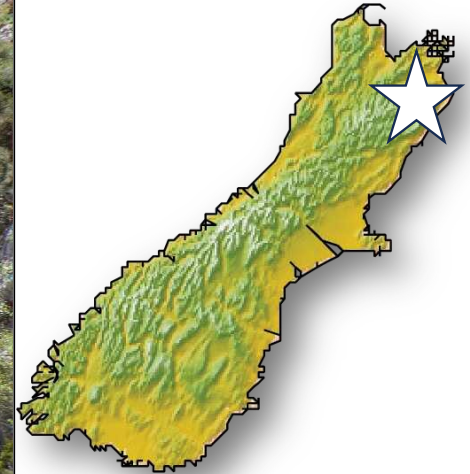




- **La GPTS (Geomagnetic Polarity Time Scale) è la «Mappa» di tutte le inversioni conosciute del campo magnetico terrestre del passato.**
- **L'età delle inversioni geomagnetiche (sono centinaia) è relativamente ben nota fino ad almeno (circa) 120 Milioni di anni fa.**
- **Lo scopo del magnetostratigrafo è di trovarle nei sedimenti, così da poterli datare, esattamente come si fa coi fossili.**

Le sezioni in Nuova Zelanda

Mead Stream
Nuova Zelanda
Isola del Sud



Mead Stream
Nuova Zelanda
Isola del Sud



Ben Slotnick

James Crampton

Chris Hollis

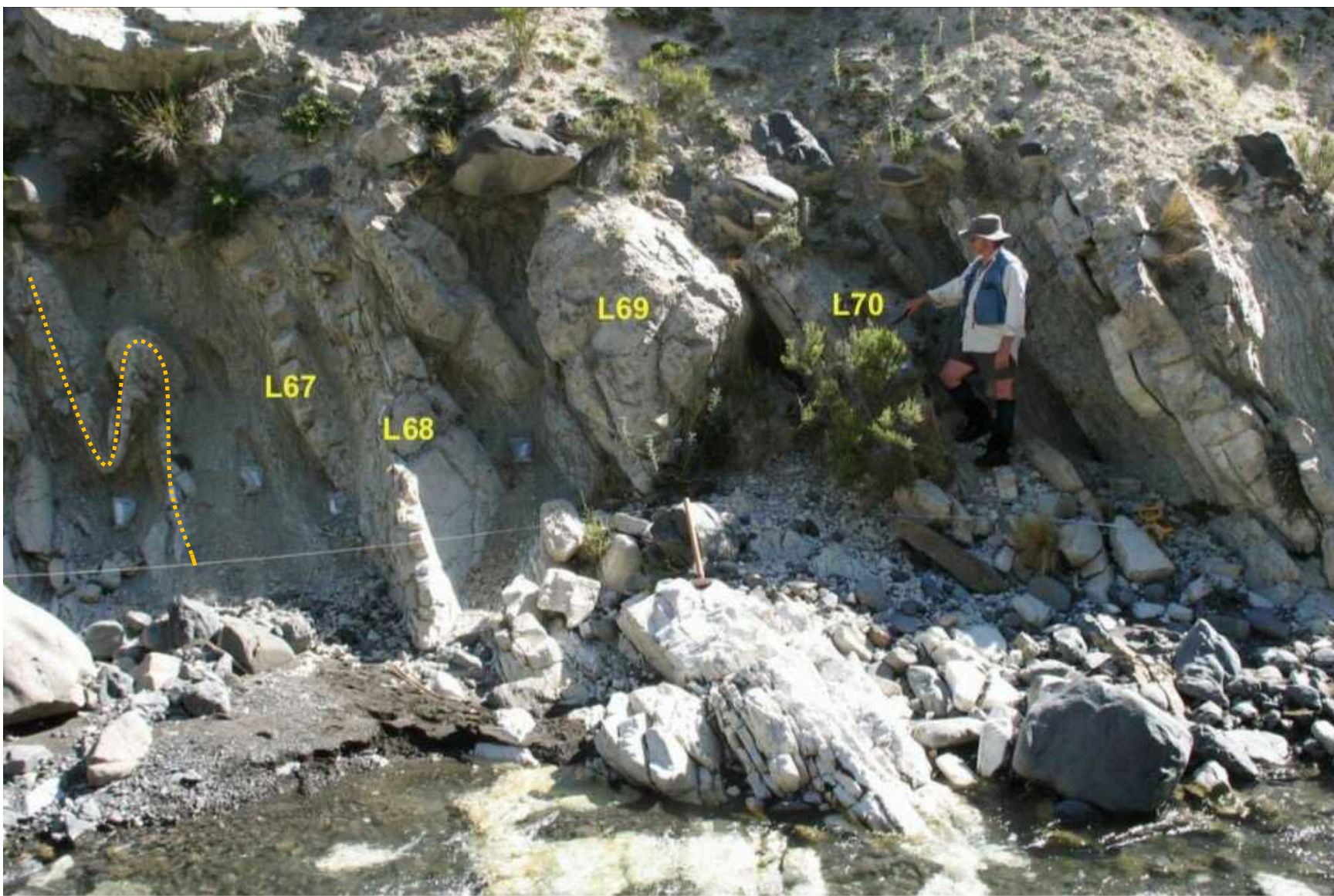
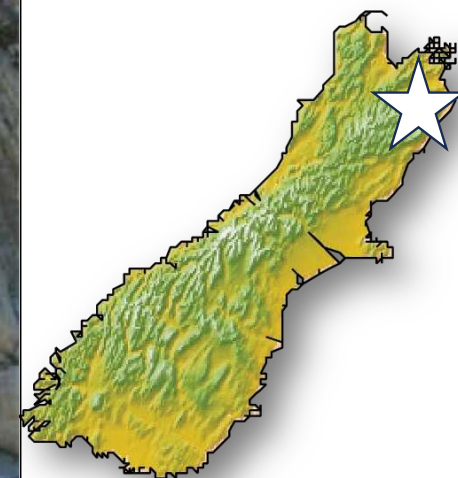
Ben Hines

Percy Strong

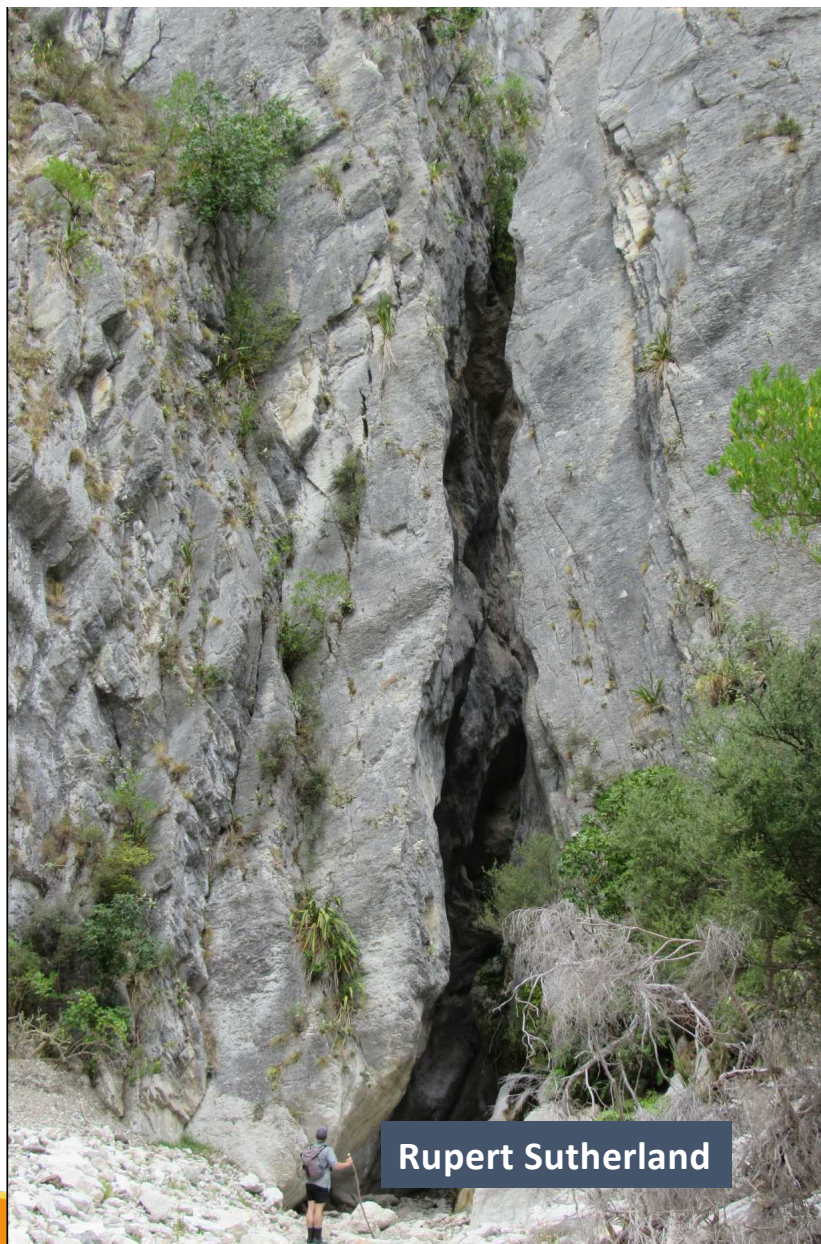
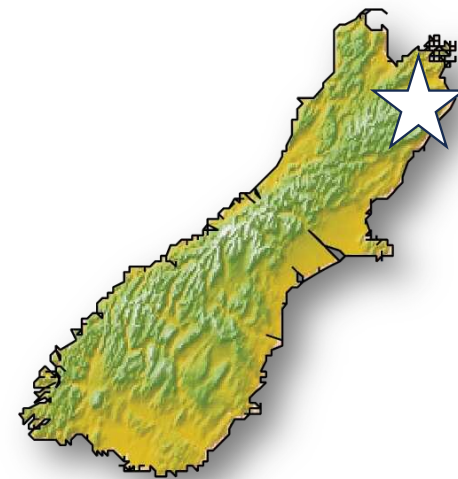
Coltello di dimensioni ragguardevoli →



Mead Stream
Nuova Zelanda
Isola del Sud



Mead Stream
Nuova Zelanda
Isola del Sud



Rupert Sutherland

Spiaggia di Mataikona, Wairarapa (Isola del Nord)

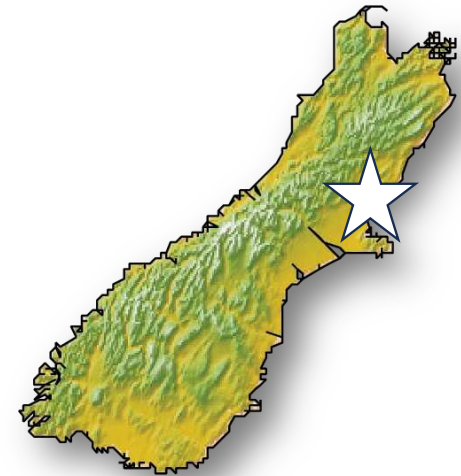


Moeraki boulders





Mid-Waipara
Nuova Zelanda
Isola del Sud

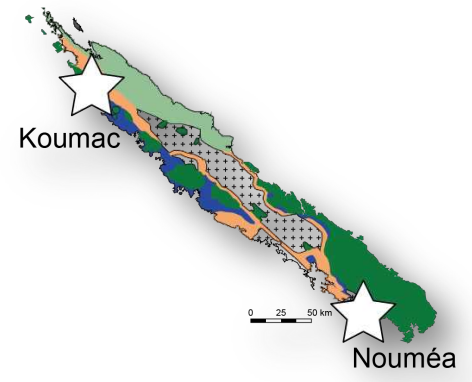


Hugh Morgans

Valerian Bachtadse

Ben Hines

Koumac New Caledonia



APE GEO

Baia delle Tartarughe, Bourail



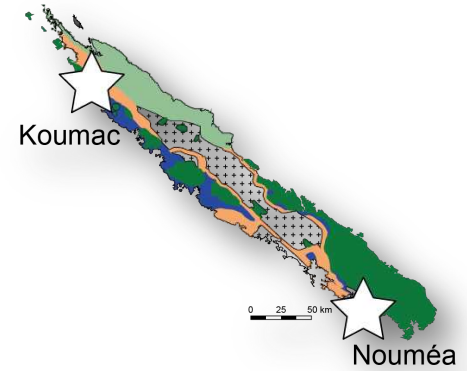
Isola dei Pini



Noumea New Caledonia



A



Koumac

Nouméa

0 25 50 km



C

B



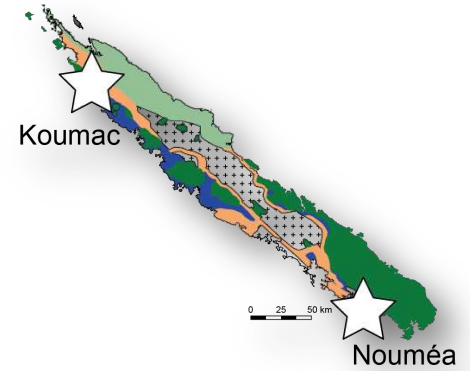
Calci-Turbidite

Micrite

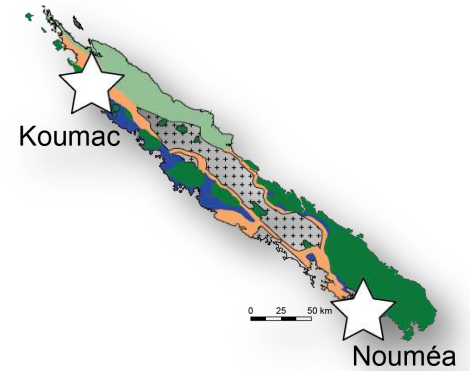


Ilot Brun, Noumea

Noumea
New Caledonia



Koumac New Caledonia



Pierre
Maurizot

Brice
Sevin

Dominic
Strogen

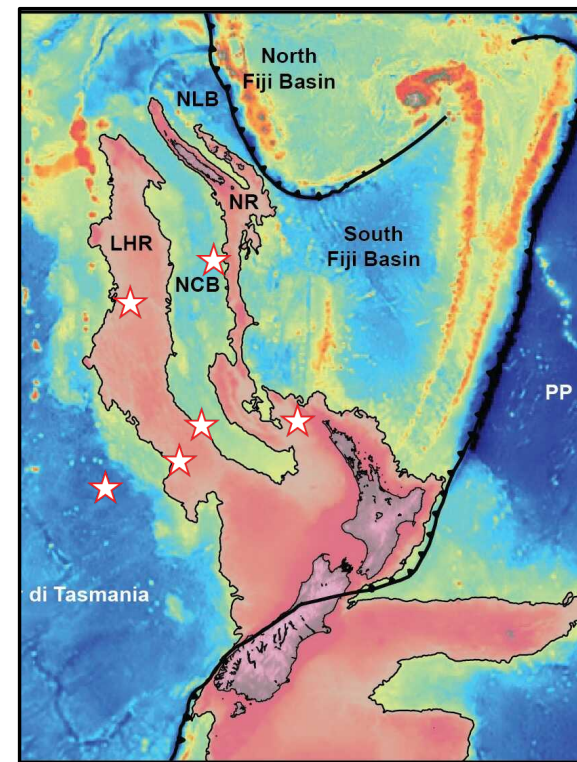
Valerian
Bachtadse

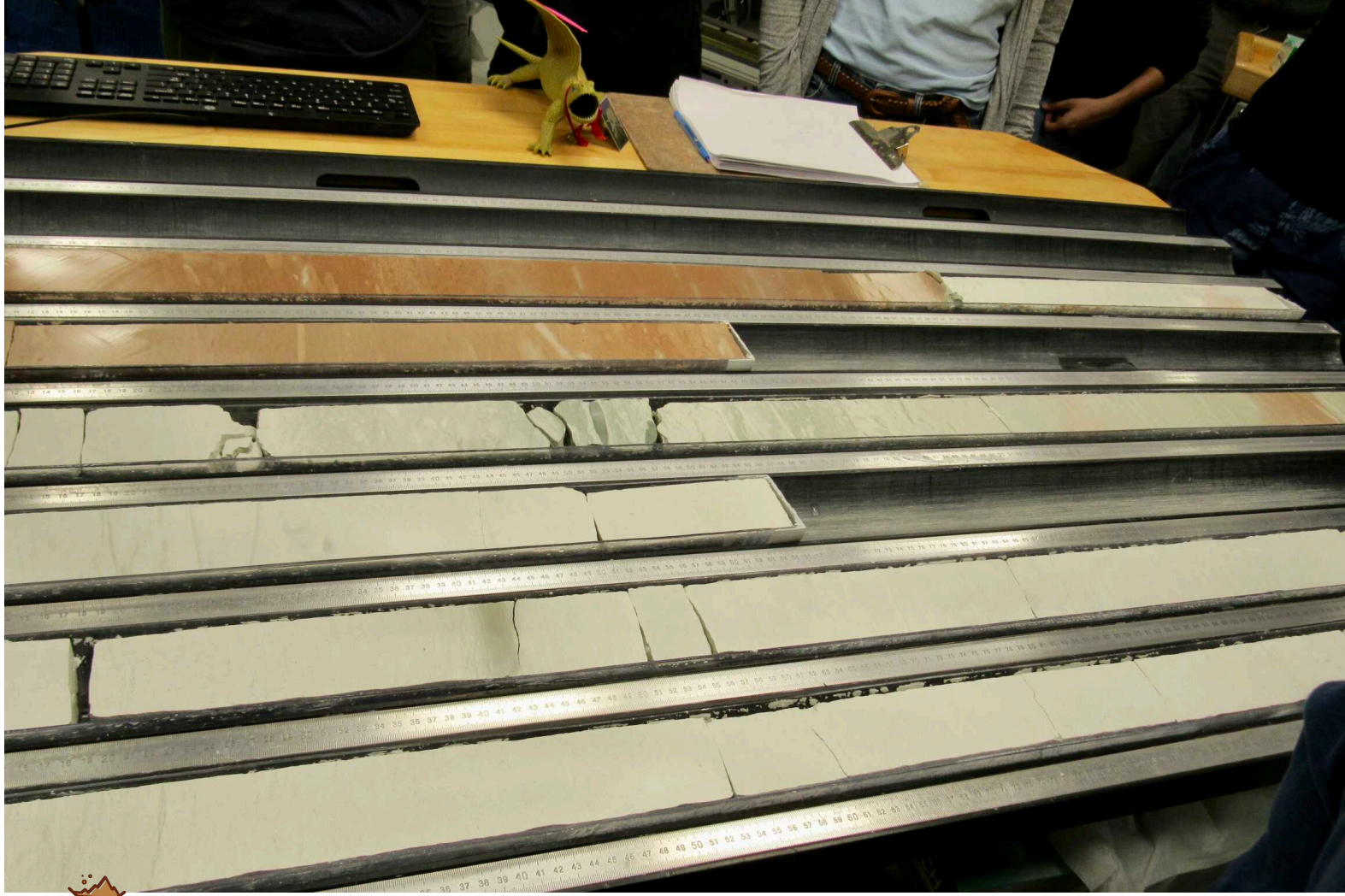
Chris
Hollis

Julien
Collot

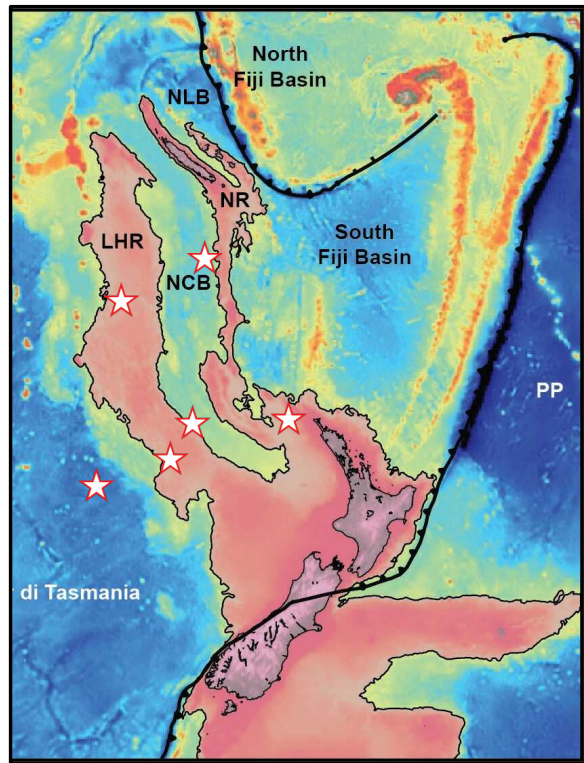


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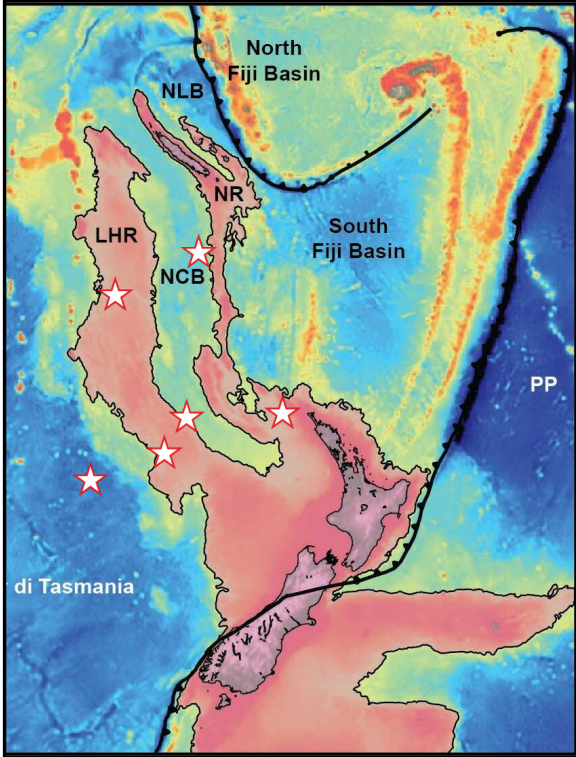
IODP Exp. 371



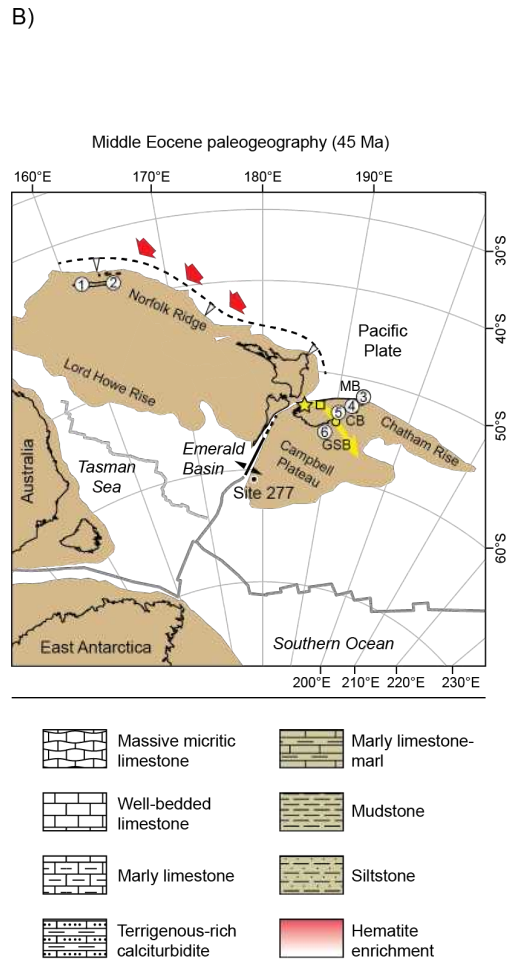
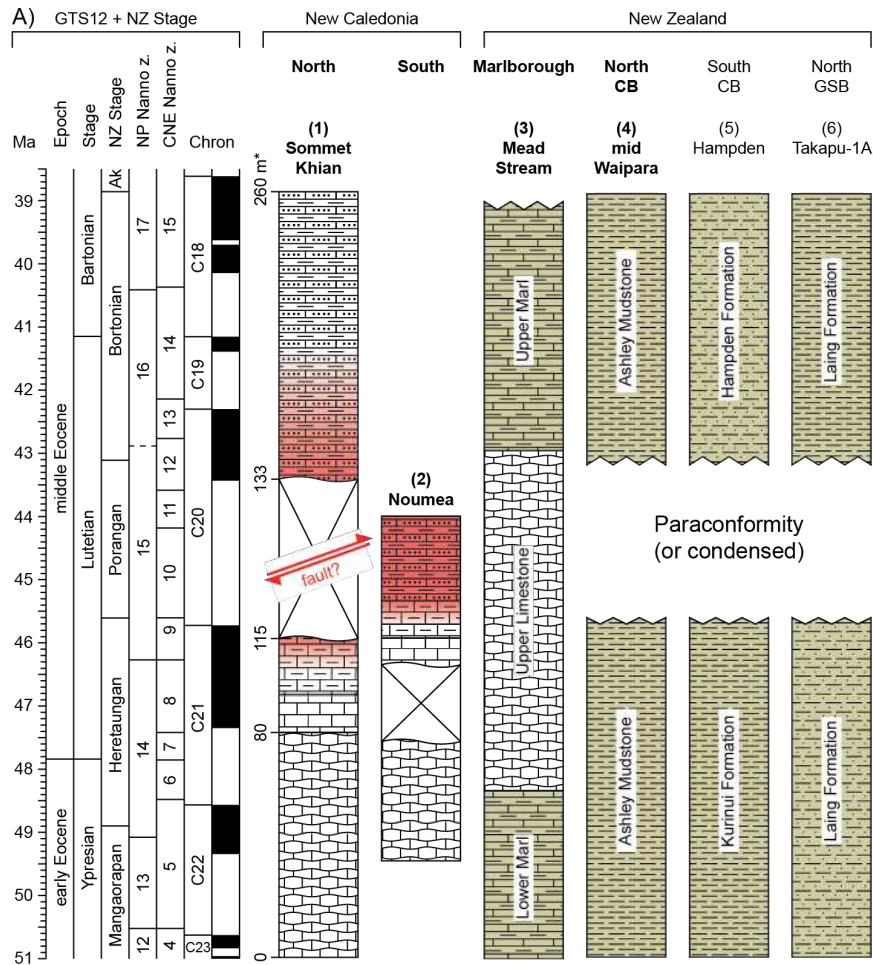
Balene (??)



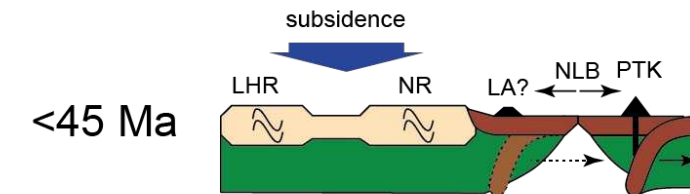
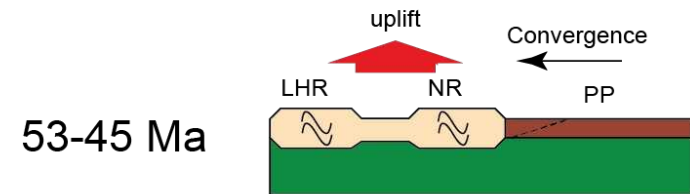
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Cosa portiamo a casa?



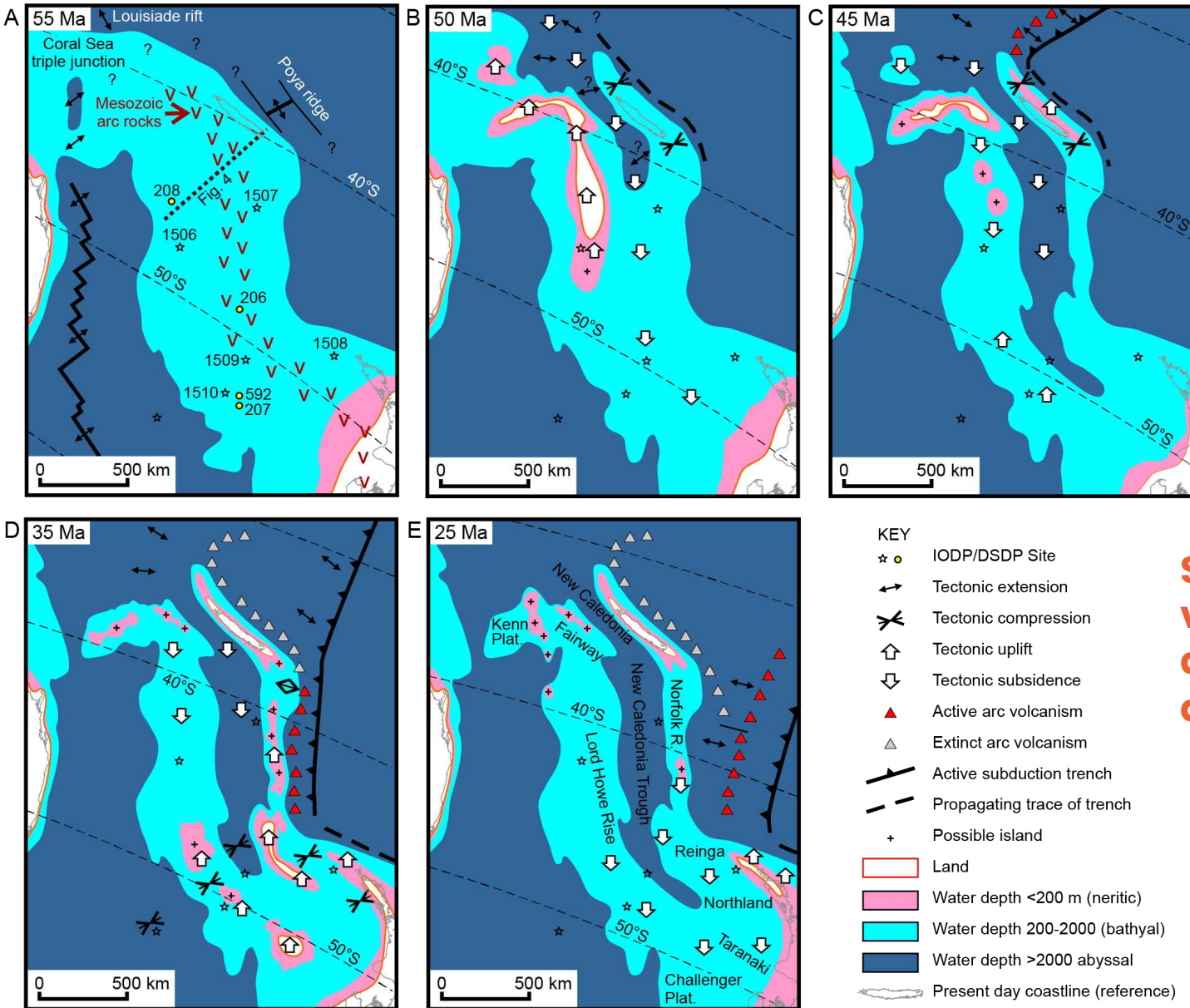
Modello 2(?) meno complesso

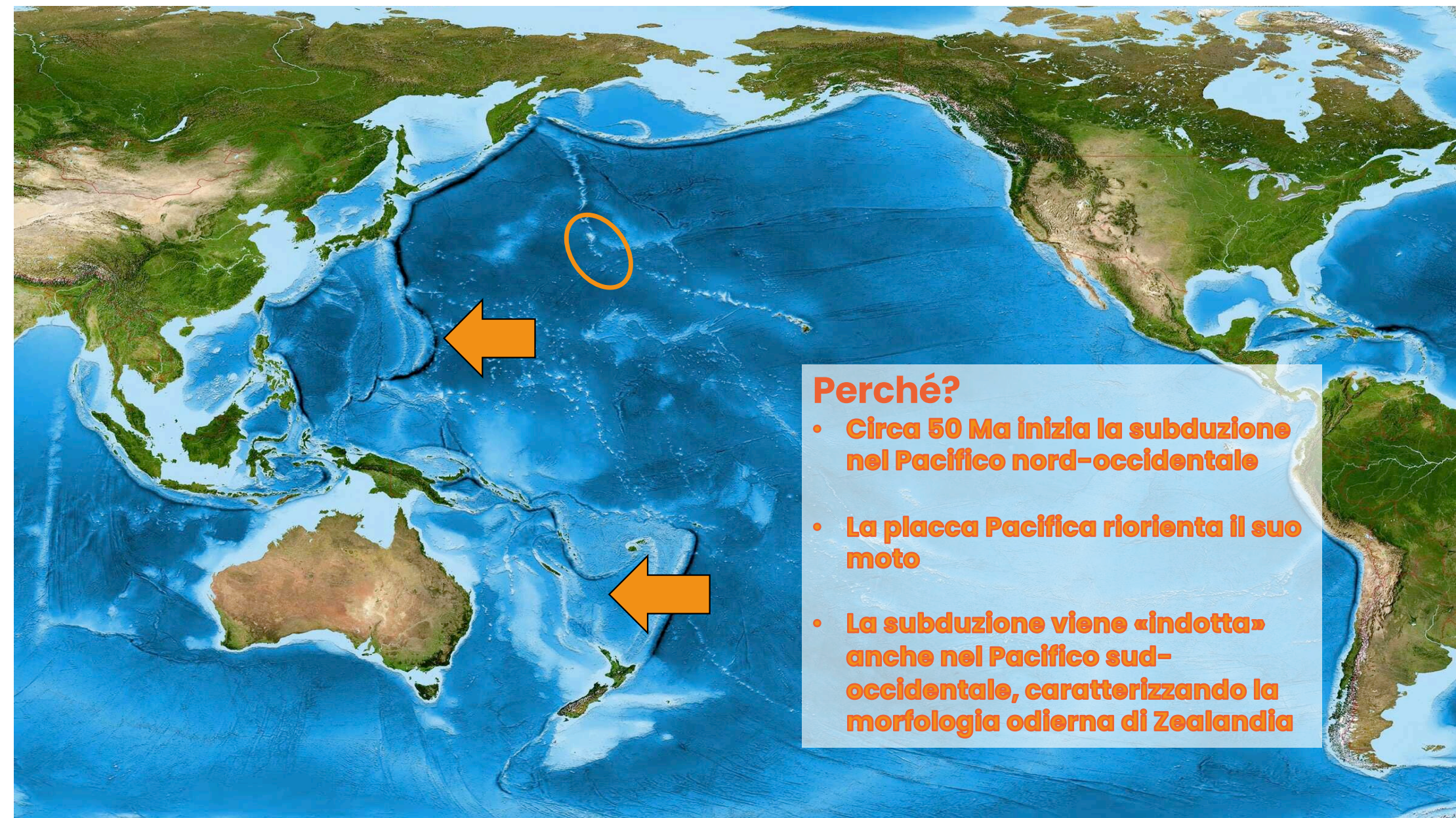


**Più in dettaglio,
unendo i dati dai
sedimenti profondi**

**Storia dettagliata dei movimenti
verticali di Zealandia
dall'Eocene inferiore (55 Ma)
all'Oligocene superiore (25 Ma)**

Sutherland et al., 2020





Perché?

- Circa 50 Ma inizia la subduzione nel Pacifico nord-occidentale
- La placca Pacifica riorienta il suo moto
- La subduzione viene «indotta» anche nel Pacifico sud-occidentale, caratterizzando la morfologia odierna di Zealandia



29 Novembre 2024

Grazie!

