## Testing the Ontong Java Nui hypothesis

SANO, TEJADA, NEAL, ET AL. (2020) IODP FULL PROPOSAL 967

# Pacific oceanic plateaus and the Ontong Java Nui hypothesis





# Pacific oceanic plateaus and the Ontong Java Nui hypothesis



-6000 -4000 -2000

0

2000 4000 6000

8000

the three oceanic plateaus (Ontong Java Plateau, Manihiki Plateau and Hikurangi Plateau) formed one plateau 120 my ago.



### Southern margin of the OJP

Malaita, Solomon Is. 121-125 Ma



## Evidence for Ontong Java Nui?

Ages overlap among plateaus

Similar evolution from tholeiitic to alkalic volcanism





### 200-1200 km long OJP flows



Identical composition and volatile contents
 Sites 1186A, 1185B

CO2 contents = shallow eruption depths

170°E

Greater

Ontong

Java

NB

140°W

20°N-

10°N-

Michael et al., Goldschmidt 2022



Primitive Mantle Normalized

Implications



Implications

#### Models for OJP-MP-HP origin

Not a single model can account for all observations



A. Surfacing Plume Head

B. Bolide Impact



## Potential problems?

- Ontong Java crust >> Manihiki and Hikurangi crustal thickness
- Paleolatitudes differ
- Majority of Manihiki
   tholeiitic flows are
   compositionally distinct from
   OJP and HP



# Ontong Java Nui configuration?



#### 10 0 Ma Nauru Basin Ontong 0" Java Manihiki -10' -10 Farallon Pacific Plate Plate -20' -20' Ontong Hiturang Java -30" -30° Phoenix Rapuhia Plate Scarp 125 Ma -40° -40° Hikurang 150° 160° 170° -170° -160° -180°

-180

-170'

-160°

#### Margins:

150

160

170

- subducting margin
- tectonically inactive margin
- stretched margin with little volcanic activity
- stretched margin with massive volcanic activity
- rifted margin
- sheared margin

#### Hochmuth et al., 2015



#### Ontong Java Nui source?

LLSVP root for the Ontong Java Nui?
("JASON" = Pacific Large Low-Shear Velocity Province)



#### Torsvik et al., G-cubed 2019

## IODP Full 967 proposal

Focus on:

True extent of the OJP or OJN

Origin and mechanism of formation

Magmatic/source evolution

Environmental impacts



### Primary objectives

Question 1: Did Ontong Java Nui once exist?





## Primary objectives

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Pacific plate

NB

PB

OJP

(e.g., Larson, 1991, Geology)

EMB

Separate plateaus

Α

0°

- 20°S

- 40°S



### Primary objectives



10°N

### Secondary objectives

Examine new models of origin based on new geophysical observations and geochemical data

♦ e.g., LLSVP source for the Ontong Java Nui?



## Secondary objectives

- Investigate geodynamic evolution
  - Effect of chemical root on the OJP?



Richardson et al., 2000

#### Suetsugu et al., 2019; Isse et al., 2021

### Secondary objectives



#### Paleoenvironmental impacts??

New ages:

◆OJP = 118 – 103 Ma

(Davidson & Koppers, 2022)

#### Summary (What do we need to test the OJN hypothesis?)

- Obtain 100 m of basement rocks from all 5 sites in the eastern OJP and adjacent basins
  - Obtain freshest as possible, stratigraphcally controlled samples
  - Improved dating technology for high-precision age controls
  - Volcanological study and paleodepth estimation
  - Geochemical fingerprinting
  - Paleomagnetic study for paleolocation
- Borehole heat flow measurements
- Obtain a complete sedimentary section at Magellan
  - Capture the paleoenvironmental record before, during and after the OJN event
  - Biostratigraphy to monitor impact on marine life

#### Thanks for your attention!





#### Japan OJP Working Group