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Earth's Longest Lava Flows Erupted from its Largest Igneous Province: Ontong Java Plateau

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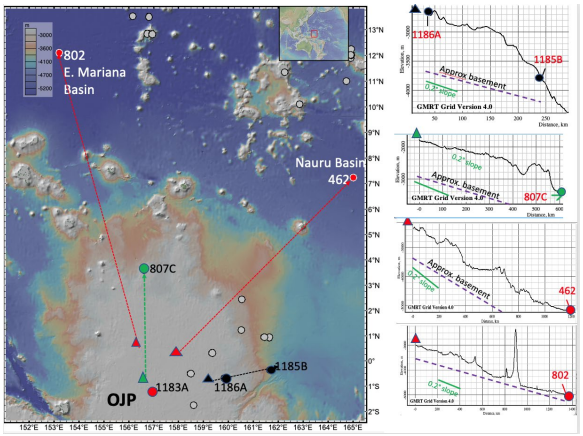

Fresh basalt glasses from the submarine Cretaceous Ontong Java Plateau (OJP) recovered by the Ocean Drilling Programs provide three lines of evidence for very long lava flows. 1. The absence of vesicles in OJP glasses suggests they were saturated or undersaturated with CO_2+H_2O when emplaced, in contrast to MORB that almost always contain vesicles and are often oversaturated. OJP's lavas remained liquid for longer periods so that they degassed to equilibrium levels of dissolved CO_2+H_2O *and* lost all bubbles. 2. H_2O+CO_2 contents dissolved in glass allows calculation of paleoeruption depths which can be compared to emplacement depths. 3. Precise major element compositions of glasses, uncomplicated by crystals or alteration, allows correlation of lavas over 100s of km.

Glasses from ODP Holes 1185B and 1186A, which are 200 km apart, are compositionally identical within precise limits and must have erupted simultaneously from the same well-mixed magma chamber. Identical CO_2+H_2O contents show they erupted at the same depth, but 1185B is directly downslope from 1186A and has a corrected basement depth that is >700m deeper. The glasses' major element equivalence requires that <2°C cooling took place during the additional 200 km of flow.

Eruption depths in Hole 807C are 3040m for Kwaimbaita-type lavas but 1110m for Singgalo-type lavas that directly overlie them suggesting that the Singgalo lavas erupted 550 km away (near Site 1183) and flowed to the emplacement site. Eruption depths for eight lava groups from six sites on OJP permits reconstruction of flow distances that are ≈0-550 km.

Eruption depths for glasses from East Mariana and Nauru Basins adjacent to OJP are shallower than those of 1185B and 1186A on OJP even though their reconstructed basement depths are >2200 m deeper, suggesting that the basins' lavas flowed approximately 1200 km from the plateau: longer than any lava flow known on Earth.

Long distance flow with minimal cooling was facilitated on OJP by favorable slopes, lack of barriers, insulation of rapidly forming glass [1], and possibly by flow within lava tubes. Lava effusion rate was probably >100m^3/sec and flow rapid: >1m/sec.

[1] Gregg & Fornari (1998), *JGR* 103, 27517-27531