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Detailed Seismicity Observations in the Forearc Region of a Convergent Plate Boundary: Malekula Island, Vanuatu

S.T. WRAY, R.K. CARDWELL, B.L. ISACKS, E. COUDERT (all at: Dept. of Geological Sciences, Cornell University, Ithaca, NY 14853)

J.-L. CHATELAIN (ORSTOM, Noumea, New Caledonia)

Malekula Island in the central Vanuatu (formerly New Hebrides) island arc lies trenchward of the volcanic arc and directly above the interplate thrust zone. Cornell and ORSTOM have jointly operated a seismograph network in this region since mid-1978 and also conducted an ocean bottom seismograph experiment there in 1978. Shallow earthquake locations do not show a well-defined interplate thrust boundary as they do immediately to the north beneath Santo Island. Instead, earthquake hypocenters are distributed (in cross section) over a broad region straddling the inferred interplate boundary. In detail the hypocenters appear to be grouped in clusters located primarily within the overriding and descending plates. Focal mechanism solutions differ between these clusters and suggest thrust faulting in the overriding plate and normal faulting in the descending plate. The normal faulting in the descending plate may be due to extensional stresses produced in the plate as it bends sharply into the mantle. The spatial distribution of these clusters of earthquakes and their focal mechanism solutions can be used to infer the position of the interplate thrust boundary. There is an indication of enhanced activity in the thrust zone and in the upper plate near the southern end of the rupture zone of the 1965 episode of plate boundary slippage beneath Santo and northern Malekula. The difficulty in clearly defining the thrust zone in the southern Malekula region may be due to the long interval of time (at least 28 years) since the last large, interplate thrust event.

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2. WRAY209409
3. S.T. Wray
Dept. of Geol. Sci.
Cornell Univ.
Ithaca, NY 14853
(607) 256-3686
4. S (Seismology)
5. None
6. O (Oral)
7. None
8. Tom Trencansky
Dept. of Geol. Sci.
Cornell Univ.
Ithaca, NY 14853

Student rate applicable
9. C (Contributed)

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