northern and southern Sumatra. These rocks appear to be related to the peculiar tectonic setting of Sumatra where subduction is oblique, and plate movement appears to be taken up in part at least by movement along the Semangko Fault — a major strike-slip fault which extends along the length of Sumatra. Chemical evidence strongly suggests a crustal origin and it seems that these rocks may represent the last stages of island arc evolution, whereby an island arc is converted into a chemically zoned stratified crust.

MAGNETICS OF THE RABAUL CALDERA

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The Rabaul caldera in East New Britain is a collapse caldera of about 10 km. diameter within which some active volcanism remains. Total magnetic field measurements show large anomalies associated with volcanic centres on the East side of the caldera, but only a small one on Vulcan which is on the West side. This correlates with the contrast between the basalts and andesites erupted on the East side, and the dacite pumice and ash of Vulcan. The absence of a large anomaly field on Vulcan may also be due to its structure, being an ash cone lacking in solid lave flows. A programme of repeat measurements on two potentially active craters on the East side has been mounted in order to detect possible anomaly field changes due to thermal changes.

TIME VARIATIONS IN RECENT VOLCANISM AND SEISMICITY ALONG CONVERGENT PLATE BOUNDARIES OF THE SOUTH BISMARCK SEA, PAPUA NEW GUINEA.

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A striking spatial and temporal clustering of volcanic eruptions has occurred in the Bismarck Volcanic Arc, Papua New Guinea, since late 1972. In the complete arc, six volcanoes have been active during this period, Long Island, Langila, Ulawan, Karkar, Manam, and Ritter Island. Ulawan is located in the eastern (New Britain) half of the arc. The other five are located consecutively in the western half of the arc; no definite historical eruptions are known from any other volcano in the sector containing them. This western half is distinguishable from the eastern half on petrological and geophysical grounds by Johnson (this Symposium). The only western volcanoes with historical eruptions but not active in this present phase, are in the Schouten Islands at the far western end of the arc; this sector is also petrologically distinguishable.

Of the western group of five, two volcanoes have erupted after long periods of apparent repose, 84½ years (Ritter Island) and 78½ years (Karkar), while the other three have erupted fairly frequently during the last 20 years. The character of the eruptions is notable in that four of the five volcanoes produced lava flows, while the fifth (Ritter Island) had submarine eruptions of ambiguous nature. Lava flows in this sector had historically been rare occurrences, except at Manam.

An earlier clustering of volcanic eruptions, fewer in number and more loosely associated in time, occurred in this sector during the 1950s, when four volcanoes, Long Island, Bam, Langila, and Manam erupted between 1953-60. A possible fifth centre, submarine and a little to the northnortheast of Markar, may have erupted during 1951. This clustering occurred during a decade which also contained the notable eruptions at Tuluman in the north Bismarck Sea, and Lamington in eastern Papua, both outside the Bismarck Volcanic Arc. Another Papua New Guinea volcano, Bangana in the north Solomon Islands arc, was active during both the 1950s and 1970s clusters.

Such clusterings suggest an underlying common cause, which is best sought in the processes occurring at the plate boundaries comprising the Bismarck Arc. Volcanism and seismic activity are the two obvious dynamic features of a plate boundary, and it is natural to seek correlations between the two. A list was prepared of all earthquakes of magnitude M 6¼ or greater, from 1947 to the present, which were apparently associated with the plate boundaries at the southern edge of the Bismarck Sea between longitudes 143¼° and 149¾°E covering the western active sector. Maximum earthquake focal depths in this region are about 230 km; occasional very deep earthquakes at the extreme eastern margin of the region were deliberately excluded. The list of M6 events for the earlier part of the period appeared to be incomplete, and consequently all M6 events were excluded.

A strain-release diagram for all these events shows a marked increase in activity in 1951-53, immediately preceding the clustered eruptions of the 1950s, and a less notable increase from 1970-72, prior to the 1970s cluster. The late G.A. Taylor had recognized a "regional stress pulse", determined by earthquake activity, as an important factor in predicting volcanic activity during the 1950s. However, the strain-release diagram also shows peaks of seismic activity in 1947-48, 1959, and 1963, none of which seems to be associated with a **general** increase in volcanic activity; the latter two peaks are caused only by single large earthquakes. A check was also made for association between volcanic activity and more specific strain-release plots for restricted depth ranges, and different parts of the complex plate boundaries in the region. There might be correlations between local seismic activity and particular eruptions, but the evidence for a general increase in seismic activity associated with regional upsurge in volcanic activity is not very convincing.

The nature of the seismic activity, and the occurrence of any other eruptive activity which might constitute a cluster, at the time of the previous eruptions of the long dormant volcanoes, Karkar and Ritter Island, is now known reliably. Certainly these two eruptions, seven years apart, were not as closely grouped in time as at present. Of the other three currently active volcanoes, Manam has an eruptive history demonstrating a rough cyclicity, and from limited information available only from the 1950s onwards, Long Island and Langila might also show cyclic behaviour.

The correlation in time of eruptions at three cyclic volcanoes might occasionally be expected without the need for assuming a common cause, but the correlation with them of eruptions at two long-dormant volcanoes seems too great a coincidence. On the present occasion, the absence of a marked correlation with general seismic activity, which can be taken as the symptom of actual convergent movement at the plate boundaries, indicates that the striking **general** increase in volcanic activity is not simply the result of a surge in plate convergence. The role of a creep contribution in such convergence is unknown.

DISTRIBUTION OF UNDERTHRUST LITHOSPERIC SLABS AND FOCAL MECHANISMS – PAPUA NEW GUINEA AND SOLOMON ISLANDS REGION

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Studies of the spatial distribution of shallow earthquakes define the present day plate boundaries. In the Papua New Guinea and Solomon Islands region (PNGS) these are well determined and indicate a mozaic of several small plates each moving relatively to the other (see fig. 1). Some of the boundaries are zones of plate convergence where lithospheric material is being thrust (or sinks) deep into the mantle. These regions are indicated by earthquakes occurring at depths greater than 100 km.

In the PNGS region there appears to be three main zones where the lithosphere is being underthrust.

1. **The Mainland of New Guinea.** Here the situation is similar to a continent/continent collision zone where earth-

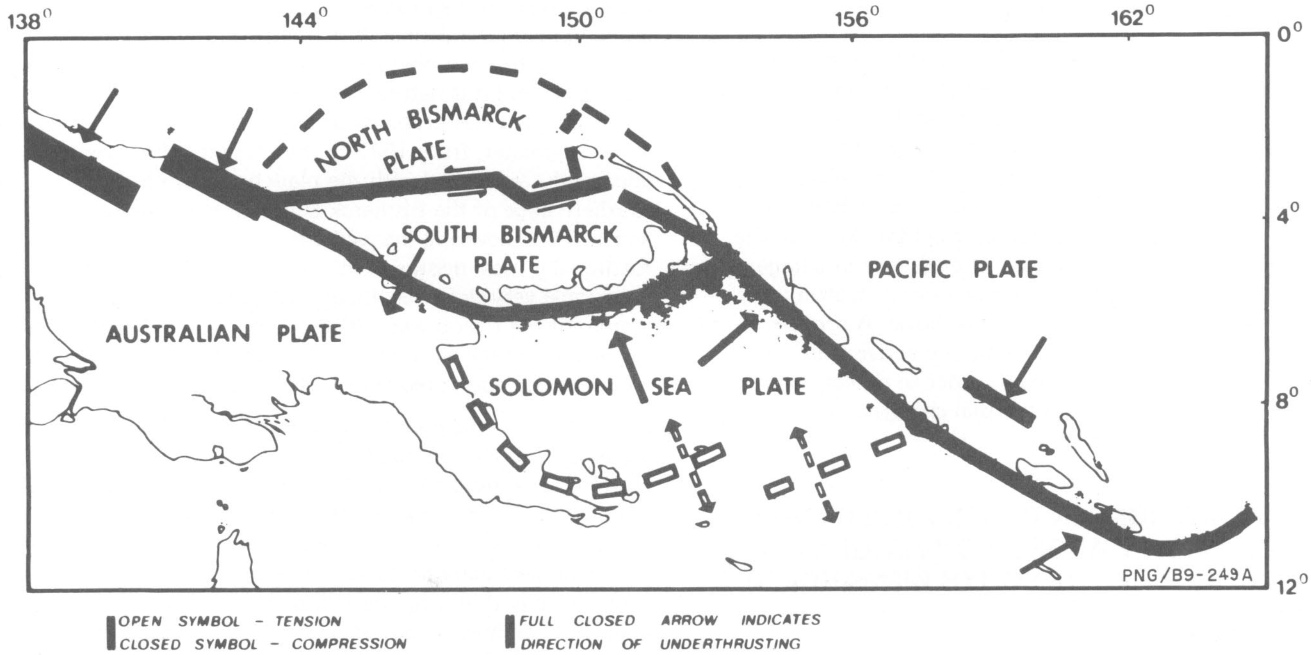

Figure 1. Locations of plate boundaries in the Papua New Guinea/ Solomon Island region.

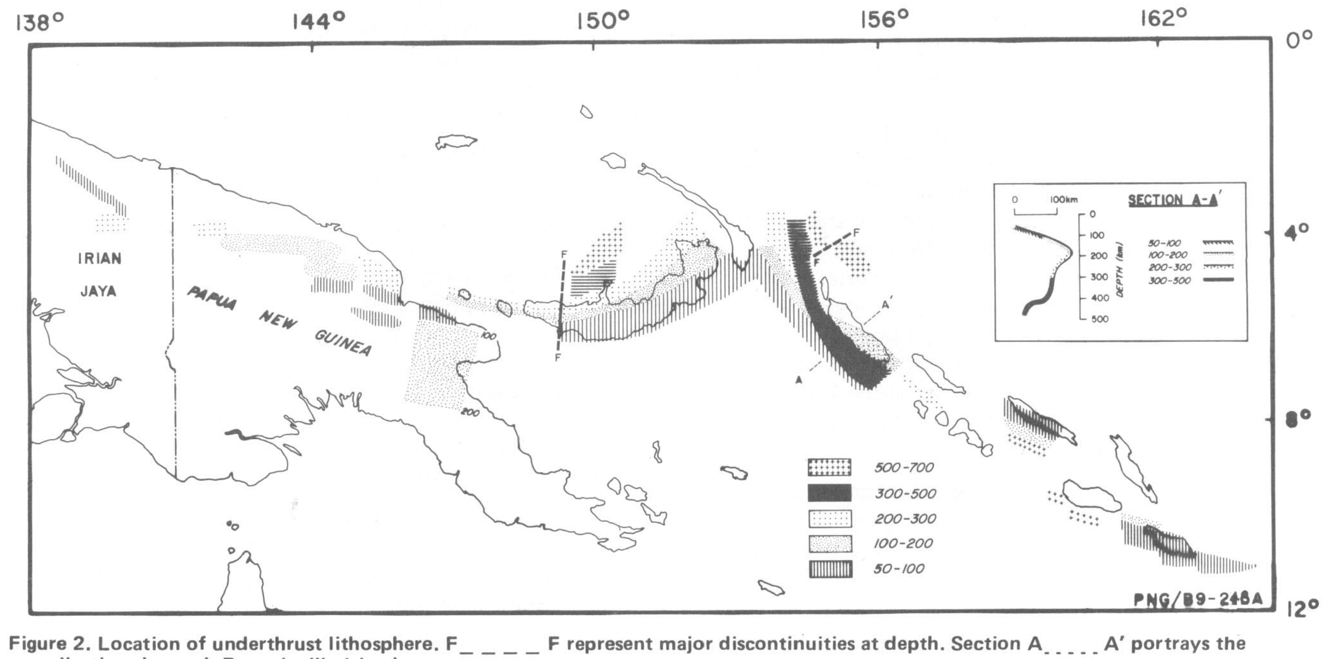

Figure 2. Location of underthrust lithosphere. F_ _ _ _ F represent major discontinuities at depth. Section A_ _ _ _ A' portrays the complications beneath Bougainville Island.