PAPER SIX

" LONG ISLAND INSPECTION, NOVEMBER , 1993, PNG."

by

LUTHER SIPISON - Volcanolgical Surveyor. Department of Mining and Petroleum (Geological Survey), PNG

Long Island Inspection, November 1993, Papua New Guinea.

Luther P. Sipison, Volcanological Surveyor, Rabaul Volcano Observatory.

Abstract

The monitoring of volcanoes in Papua New Guinea is carried out by Rabaul Volcano Observatory. This paper presents a history of volcanic activity and a description of the surveillance of Long Island in November 1993.

Introduction

The Rabaul Volcano observatory (RVO), is responsible for the surveillance and monitoring of all volcanoes in PNG. It is the function of the Observatory to advise the National Government on volcanic activity throughout the country and to issue warnings whenever possible of impending dangerous eruptions. The Observatory is involved in assessing the degree of risk presented by each volcano and to identify the areas most likely to be at risk from volcanic eruptions.

The Observatory gathers information on day-to-day levels of activity at selected volcanoes and assess this with a view to issuing warnings of impending dangerous eruptions. It also advises on measures that should be taken to prevent and mitigate volcanic disasters. This paper presents events that took place during a respond to reports of seismic and volcanic unrest at Long Island in November 1993.

Locality

Long Island is located at the northern end of the Vitiaz Strait, about 50 km from the New Guinea mainland. William Dampier first sailed past the Island in 1700 AD and named it. (Fig. 1).

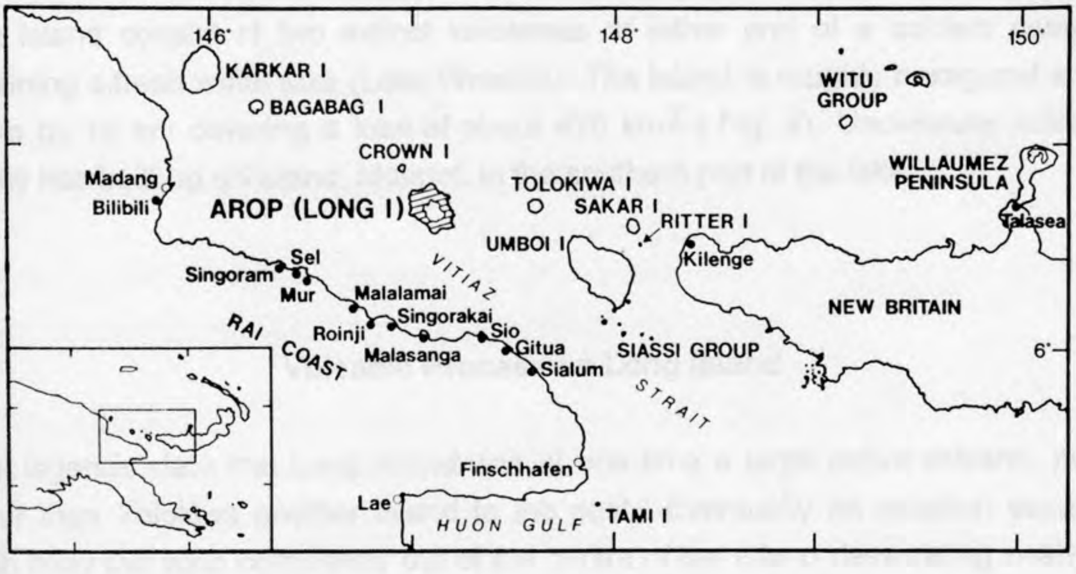


Fig. 1 Location diagram showing Long Island and adjacent islands on the north coast of Papua New guinea.

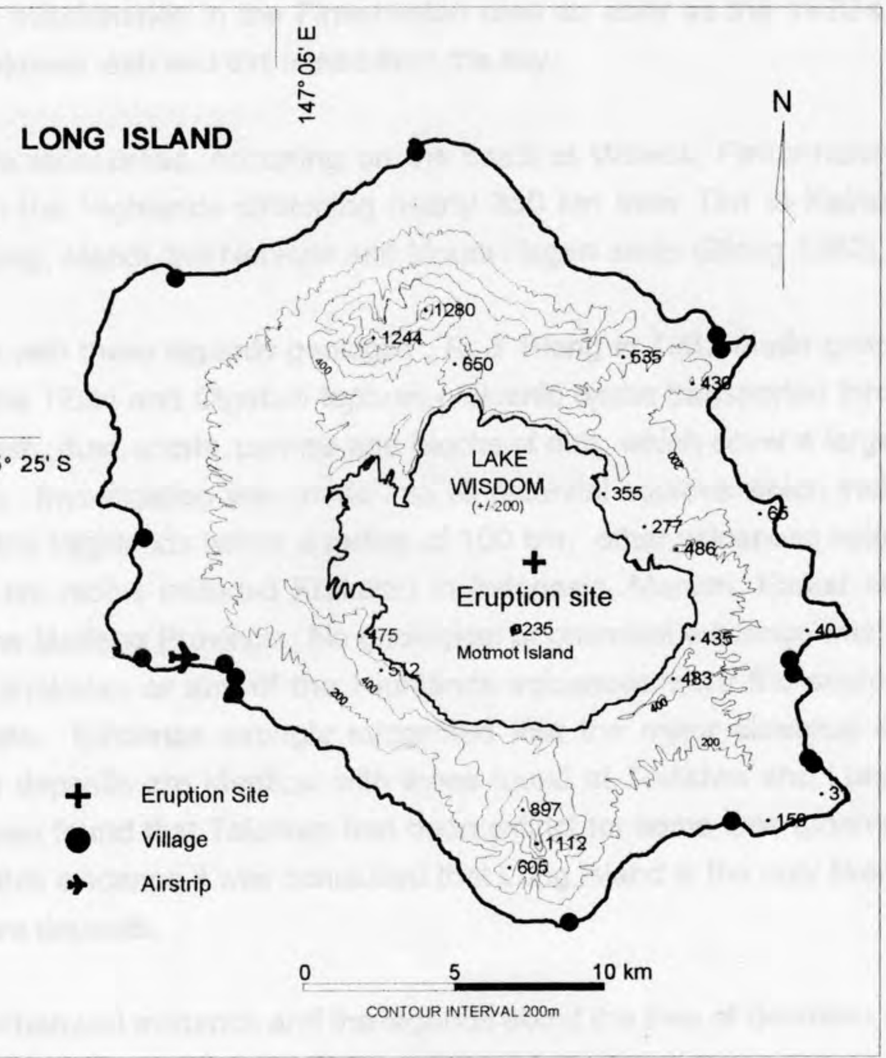


Fig 2. Long Island showing Lake Wisdom, eruption site, Motmot Island and village locations.

Long Island consist of two extinct volcanoes at either end of a caldera complex containing a fresh water lake (Lake Wisdom). The island is roughly hexagonal about 27 km by 18 km covering a total of about 425 km^2 (Fig. 2). Underwater volcanic activity has built up an island, Motmot, in the southern part of the lake.

Volcanic Process on Long Island

Local legends state that Long Island was at one time a large active volcano, much higher than Tolokiwa another Island to the east. Eventually an eruption occurred which blew the cone completely out of the centre of the island devastating nearly all life there. Ball and Johnson (1976) concluded that the eruption most likely occurred sometime during the first half of the eighteenth century, but an earlier date is possible. A time of darkness legend involving several days of complete darkness was known to missionaries in the Finschhafen area as early as the 1920's. During the time of darkness ash and dirt rained from the sky.

This legend is widespread, occurring on the coast at Wewak, Finschhafen and in Manus and in the Highlands stretching nearly 350 km from Tari to Kainantu and including Wabag, Mendi, the Nebilyer and Mount Hagen areas (Blong 1982).

In conjunction with these legends geologist , R. J .Blong in 1982 made geochemical analysis of the Tibito and Olgaboli tephras (volcanic ejecta transported through the air including ash, dust, scoria, pumice and blocks of dirt), which cover a large area of the Highlands. Investigation was made into all potential sources which included all volcanoes in the Highlands within a radius of 100 km, other volcanoes selected out side the 100 km radius included Krakatau in Indonesia, Manam, Karkar and Long Island all in the Madang Province. No geological or chemical evidence was found to suggest that Krakatau or any of the Highlands volcanoes were the source of the tephra deposits. Evidence strongly suggested that the major chemical elements found in both deposits are identical with those found at Tolokiwa and Long Island. Moreover, it was found that Tolokiwa had been extinct for some time (Johnson et al; 1972). From this evidence it was concluded that Long Island is the only likely source for both Tephra deposits.

From the geochemical evidence and the legends about the time of darkness it can be suggested that:

(a) There was a cataclysmic volcanic eruption on long Island 300 years ago which produced the Tibito and Olgaboli Tephras, the magnitude of that eruption can be ranked as one of the greatest eruptions in the last one thousand years.

(b) This gigantic upheaval initiated a wide spread legend varying from place to place and spreading across a number of cultural groups.

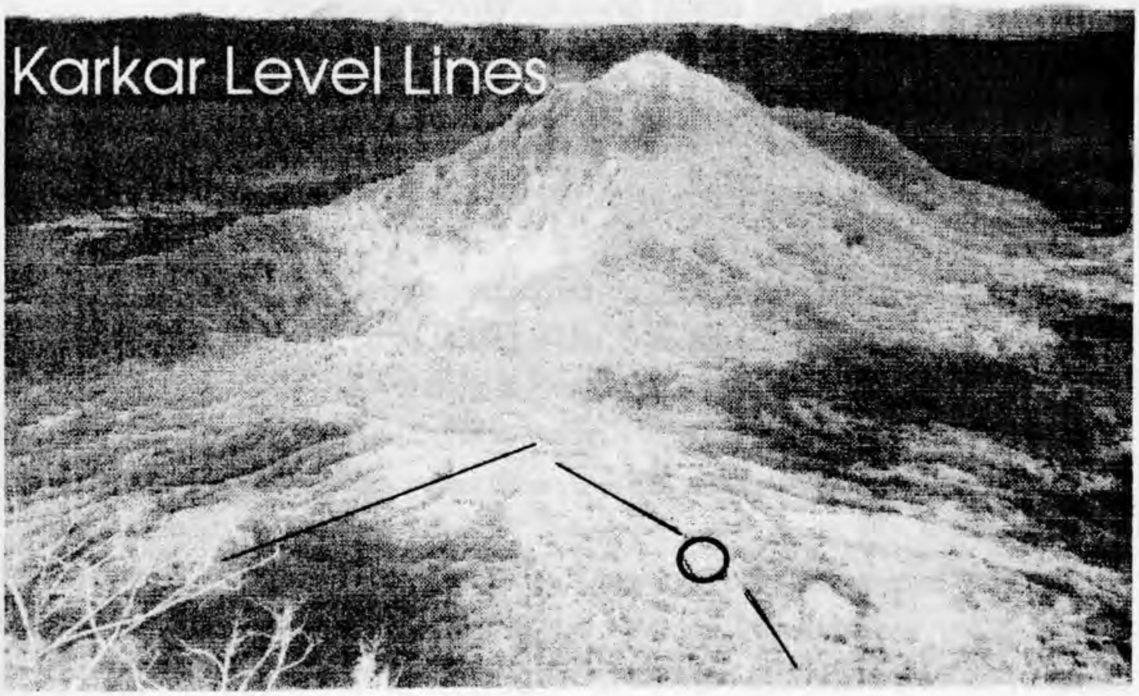
(c) While the eruption was unrecorded by Europeans the accuracy of the legends retain memories recorded in numerous oral histories, these legends have demonstrated an accurate history by comparison with other known volcanic eruptions (Blong 1982).

History of Monitoring of Long Island.

The first well documented records of volcanic activity in Lake Wisdom are aerial photographs taken in 1943, which showed a low-lying, shoe shaped crater island about 3 km from the southern shore of the Lake.

In 1953, an island was created from the same site in Lake Wisdom it consisted of two craters which joined to form a ridge about 400 m long, 100 m wide and 30 m high (Best, 1956).

Further activity took place in 1969 and a second small Island could be seen just above water level, which was separated from the main island by a channel 1 m deep (Fig. 3c). On all subsequent visits the second island could not be seen although a shoal was still present below lake level. The only activity observed between 1969 an 1972 was the opening of a vent about 1.5 m in diameter on the crater wall, which was probably caused by gas or steam explosions. Motmot was again intermittently active between May 1973 and February 1974, producing lava flows (Cook et al. 1981). The remoteness, irregular communications and absence of direct view of Motmot by the local people have led to the poor knowledge of recent eruptive phases on Motmot.



Motmot
Nov. 1969

Fig. 3a. Karkar Caldera showing level lines. Helicopter circled.
3b Motmot Island oblique photograph from southwest, November 1993.
3c Motmot Island oblique photograph from the southeast, November 1969.

Volcanic Activity on Long Island 1993

A new eruption began at Long Island in early November 1993. The first evidence of the eruption were records of a seismic swarm recorded on Karkar Island sent to the Observatory on 8 November.

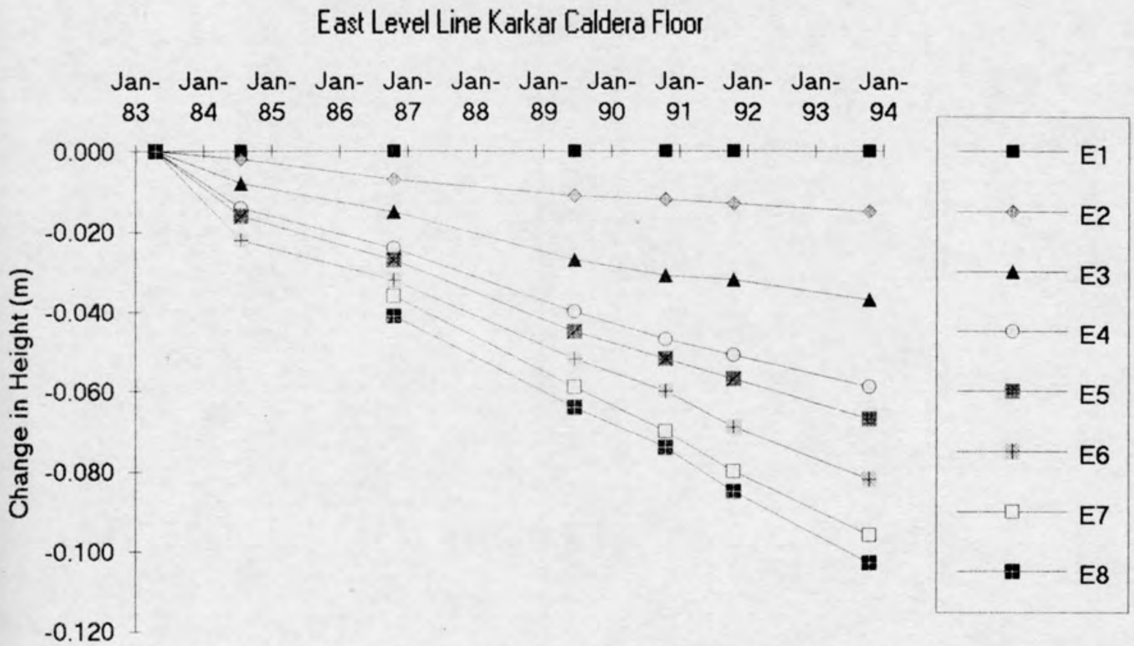
A team of volcanologists were dispatched on 9 November to check the reported activity. The team overflew Long Island while enroute for Karkar Island and found that almost the entire body of water in the caldera had changed colour, from blue-green to orange-brown (Fig 3b). Surface water associated with active volcanoes can exhibit physical and chemical changes when there is renewed volcanic activity.

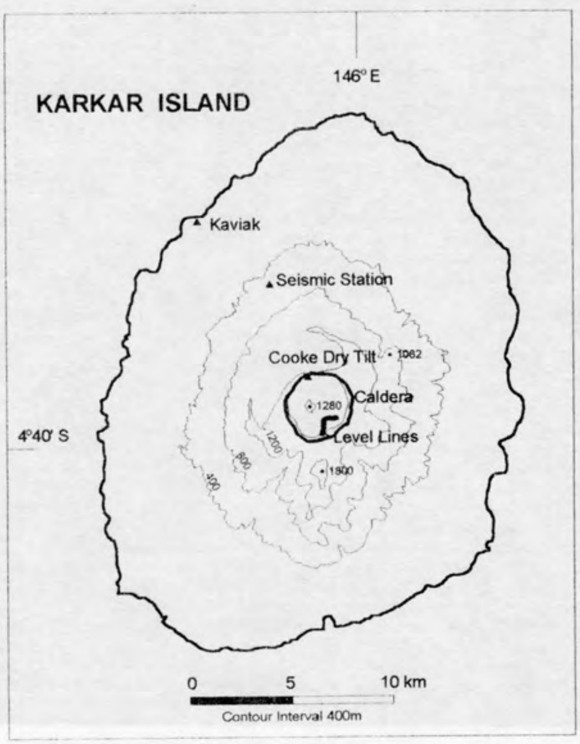
On 10 November, the team carried out volcanological, seismic and deformation monitoring on Karkar volcano to confirm the tremor's recorded previously on the island. However, results from the investigations showed that there was no renewed volcanic activity on Karkar.

Seismic records taken on the caldera floor did not show any earthquakes that would normally be associated with renewed volcanic activity.

A geodetic level line (Fig. 3a) on the caldera floor was surveyed and the results showed a deflationary trend consistent with previous surveys (Fig. 4). Temperature measurement also indicated no abnormality in the state of the volcano. These results confirmed that the seismic swarm recorded at Karkar was not related to volcanic activity on the island.

On 11 November the team decided to carry out further ground based investigations on Long Island. A portable seismograph was deployed on Motmot; while setting up the seismograph, frequent earthquakes were felt, and muffled thudding noises were heard. The noises were more noticeable on the north side of Motmot which suggested the source of activity to be offshore to the north. Seismic records consisted of continuous harmonic and irregular tremor with variable amplitude corresponding with the sound effects out (Fig. 5). Temperature measurement was carried out around Motmot but the results were much lower than normal than, this suggested that the source of the activity was not on Motmot.





4. Levelling data from the East level line on the Karkar caldera floor, insert is a locality map of the level lines.

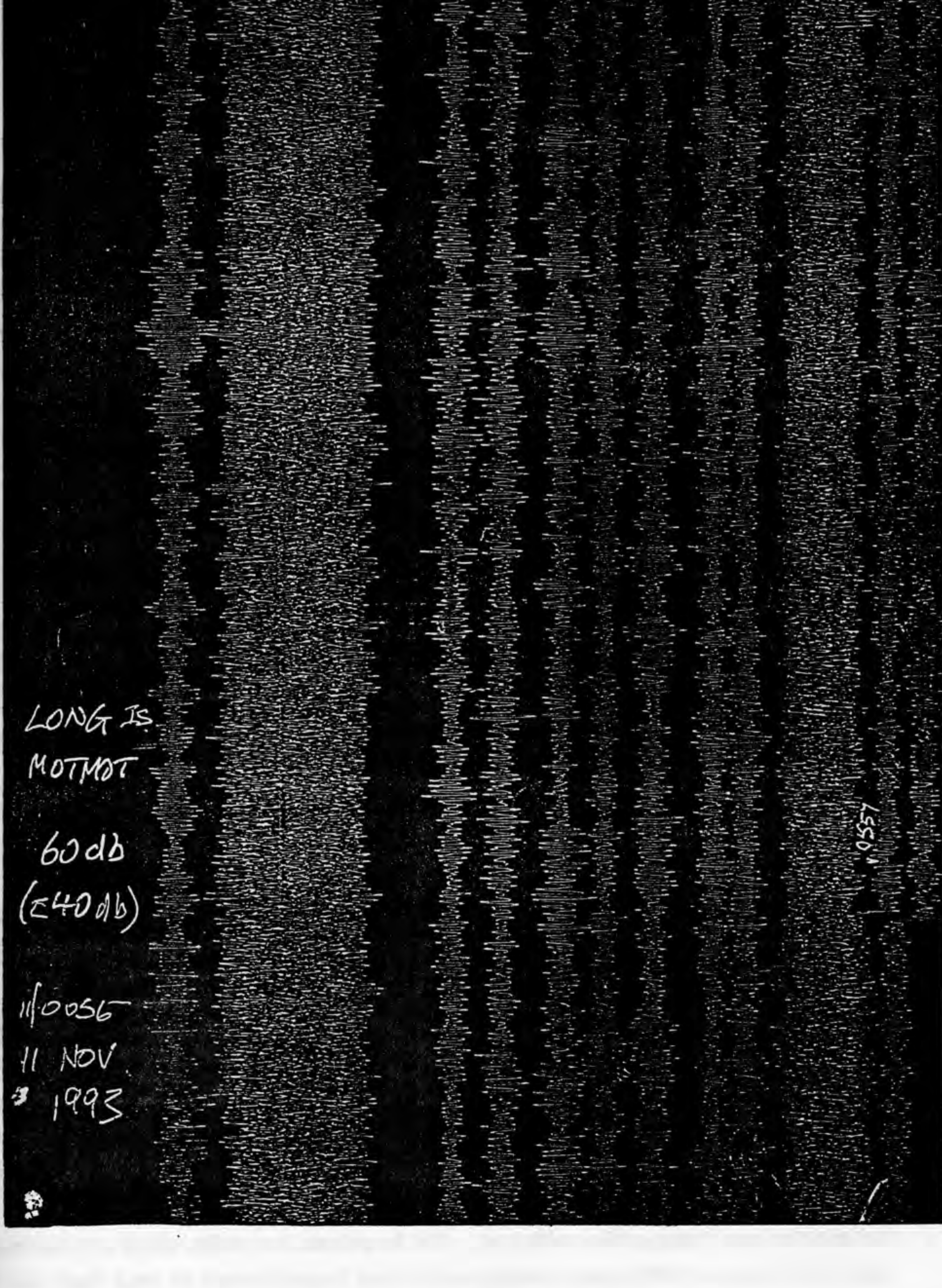


Fig. 5. Seismic record taken on Motmot on the 11th November 1993.

Mapping

While on Motmot a compass and tape survey was carried out to establish three survey points for the control of aerial photography of Motmot. Co-ordinates of one of the stations was determined with a Trimble single frequency GPS (sd of ±30 m approx.) for plotting purposes.

A 35 mm slightly oblique photograph was taken from 600 m above Motmot. This photo mosaic was used to produce a map of Motmot (Fig. 6). This method is subject to fairly large distortions, but for the purpose of comparative work on volcanoes the distortions are acceptable.

Eruptive Source

Following the photography flight over Motmot, an aerial inspection was carried out over the caldera lake. A sub-circular patch of grey-brown water was seen near the centre of the lake. On a closer inspection, it was noticed that the central part of the patch of discoloured water was being frequently disturbed by underwater explosions, there were several sites of non explosive up welling fluids and fine solid particles.

The frequent underwater explosions were producing visible shock waves seen as flashes of white light. The larger explosions broke the lake surface and ejected sprays of water and ash a few tens of metres above the lake surface. The source of the eruption was identified and the eruptive vents were located in water deeper than 300 m, probably 350 m.

The team returned to Karkar on the evening of 11 November, report of the eruption was released to the office of the Director General Disaster and Emergency Services in Port Moresby and to the Madang Provincial Government. The local residents of Long Island were notified of the eruption and informed to keep away from the caldera and Lake Wisdom.

A temporary observation post equipped with a portable seismograph was established a few days later at the northeast rim of the caldera about 200 m above the lake. Activity similar to that observed on the 11 November continued until the 16th and declined. From the 17th the explosions were not strong enough to break through the surface of the lake. Audible explosive activity was not detected after the 21st. At the

Fig. 6 Photomosaic of Motmot Island

end of November the earthquake activity was so weak it could not confidently be distinguished from normal background activity.

Conclusion

Volcano monitoring and surveillance, provides the primary data for short term forecasting of volcanic eruptions. This data will then provide the principle data for the scientific understanding of the volcano. Most eruptions are preceded or accompanied by measurable or even visible changes in their physical nature. No two volcanic eruptions are identical. Every volcano has its own unique chemical, seismic and geological behaviour.

The inspection of Long Island add to the documented eruptive history of the volcano and helps in the future study and understanding of volcanic activity on Long Island. It also fulfils the primary role of RVO in surveillance, research and advise on volcanic and seismic phenomena in PNG.

Acknowledgement

I would like to thank N. M. Lauer, Senior Volcanological Surveyor for his assistance in the preparation of this paper.

References.

Ball, E. E. and R. W . Johnson, 1976. *Volcanic history of Long Island, Papua New Guinea.* In R. W. Johnson (ed.), Volcanism in Australasia, 133-147, 7 figs. Elsevior, Amsterdam.

Blong, R. J., C.F.Pain and C.O.Mckee, 1982. *Long Island, Papua New Guinea - Aspects of Land Forms and Tephrostratigraphy.* Record Australian Museum 34 (7) : 419-426.

Blong, R. J., 1982. *The time of darkness; Local legends and reality in Papua New Guinea.* Australian National University Press, Canberra.

Specht, J., E. E. Ball, R. J. Blong, B. J. Egloff, I. M. Hughes, C. O. Mckee and C. F. Pain, 1982. *Long Island, Papua New Guinea - An Introduction.* Record Australian Museum 34 (6) : 407- 417.

Information Booklet, 1987. Geological Survey of Papua New Guinea,