550·34

ON T-PHASE AT VISAKHAPATNAM

A short period phase having period less than one second travelling through the ocean with the speed of sound in sea water is often observed on seismograms of island or coastal observatories for earthquakes in which the path of propagation is mostly oceanic. The phase was first noted by Linehan (1940) and the mechanism of propagation was established in the works of Tolstoy and Ewing (1950) and Ewing, Press and Worzel (1952).

There is little doubt the energy propagates in the deep ocean as sound waves probably in the so called SOFAR channel. Compressional, shear and possibly surface waves may, however, be involved in the propagation across the land segment of the paths. Recent work with Pacific T-phases by Wadati and Inouye (1953) and Byerly and Herrick (1954) and Atlantic T-phase by Bath (1954) supports these conclusions. Shurbet (1955) reported observations of T-phases recorded at Barmuda from South American shocks in which the energy was transmitted over as much as 51° as P before entering the ocean at the scarp north of Puerto Rico.

Observational Data—The region of Andaman Island is seismically active for small and shallow shocks. Accordingly one would expect that these earthquakes should give rise to T-phase to be recorded by the coastal observatories on the east coast of India. Since the coastal observatories are equipped with microseismographs having peak magnification for waves in the range of 4-5 sec period, it was therefore quite natural that the T-phase generated by earthquakes in this region might go undetected in the microseismograms of the coastal observatories. Only recently a two component short period Wood-Anderson seismograph was set up in the campus of the Andhra University at Waltair. The present observation is from the records of the above instrument. An earthquake shock of moderate intensity originated near the Andaman Islands region, on 6 December 1961. The particulars of the shock as given by U.S.C.G.S. are as follows—

Epc—Lat. 13·7 N, Long. 93·6 E, Origin time 05^h 48^m $39^s.3$ GMT, Focal depth h (about)=53 km, Andaman Islands Mag: $5\frac{3}{4}$—6 (Pal).

The T-phase as recorded by the Wood-Anderson seismograph at Visakhapatnam is reproduced in Fig. 1. The characteristic feature of the phase is that the motion increased and decreased somewhat in the fashion of beats. At first the short period phase is observed riding on the longer period surface waves. The amplitude gradually increases to maximum value and then decreases gradually, the maximum duration of the phase was for 4 to 5 minutes. At Madras where there is no short period instrument in operation, the T-phase appeared to

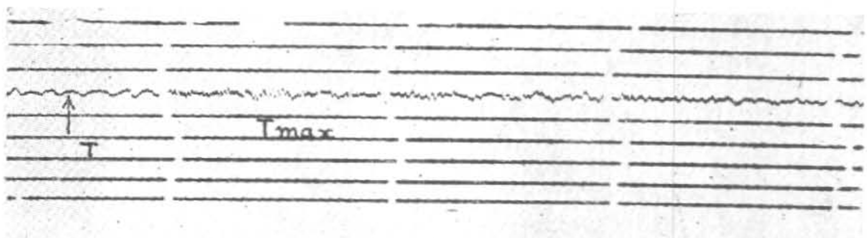

Fig. 1

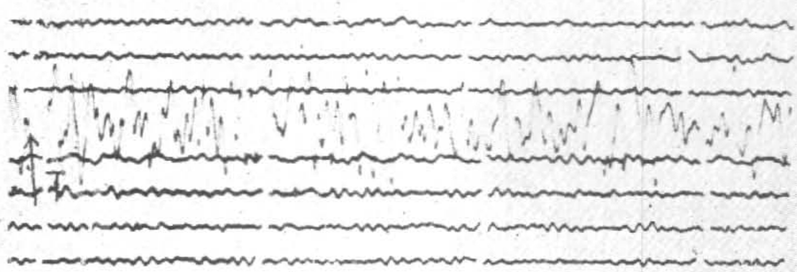

Fig. 2

Fig. 1. Section of Visakhapatnam Wood-Anderson seismogram (N-S) of 6-7 December 1961
T_0 = 2·0 sec; Time scale 30 mm/min

Fig. 2. Section of Madras Sprengnether microseismogram (E-W) of 6-7 December 1961
T_0 = T_g = 7·7 sec; Time scale 30 mm/min

Fig. 3

have been recorded riding on the surface waves of appreciable amplitude. The portion of the Madras microseismograph is reproduced in Fig. 2. The particulars of the well recorded phases at above two stations are given below —

Station	Time (GMT)			$\triangle$ (km) (P—O)
	P	S	T	
Visakhapatnam	05 51 07	05 52 56	06 00 37	1140
Madras	05 51 40	05 53 58	05 04 52	1410

The epicentre and the position of the seismological observatories are shown in Fig. 3.

Assuming that the path of propagation is entirely oceanic, the mean velocity of the T-waves comes out to be 1·52 km/sec. This observed velocity is slightly higher than the mean velocity of 1·49 km/sec observed by others. This higher value may be due to our assumption that the entire path is oceanic. In reality a small portion of the path across the continental shelf near the coast has continental structure. Shurbet and Ewing (1956) have shown that the higher observed velocity of the phase results from transformation of a T-phase, a phase travelling through the continent with a velocity of about 3·5 km/sec which is the velocity of the propagation waves of *Lg* or *Sg* (in the case of near earthquakes) in the continental crust.

Conclusion— 1. The study of the T-phase from the records of the several coastal observatories may lead to a very correct determination of the epicentre because the travel time is linear with distance $\triangle$.

2. The accurate determination of the observed velocity may be used in determining the lengths of oceanic and continental segments of the combined propagation paths.

3. On account of the high frequency of the occurrence of small earthquakes under the sea and the efficiency of the propagation in the SOFAR channel it is quite likely that the T-waves would contribute significantly to the accoustic 'noise level' in the SOFAR channel.

4. The land segment of the path in which the velcoity of propagation is higher is apparently very small.

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