COMMONWEALTH OF AUSTRALIA

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RECORDS

RECORDS 1960, No. 45

A NOTE ON THE WINDWARD ISLANDS EARTHQUAKE, 8th JANUARY 1959.

by

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ABSTRACT

The arrival times of longitudinal core waves recorded at Australian stations from a Windward Islands Earthquake (Δ = 145 - 154°) have been examined. The results appear to confirm a reported extension of one branch of the travel time curve of waves through the outer core, to a reversal point beyond 147°.

TABLE 1.

G.M.T. ARRIVALS OF CORE PHASES.

	DF branch (PKIKP)	Extended BC branch	AB branch (PKP)	
CHARTERS TOWERS	01 53 32	01 53 40	01 53 53	153°.7
ADELAIDE	01 53 33	53 40	53 54	153°.2
PORT MORESBY	01 53 31	53 37	53 47	151°.9
MELBOURNE	01 53 27	-		148°.0
CANBERRA	01 53 22	53 23	-	146°.7
RIVERVIEW	01 53 19		53 25	145°.7

TABLE 2.

p REFLECTION DIFFERENCES.

	pPKIKP - PKIKP	$pPKP_1 - pPKP_1$	$pPKP_2 - PKP_2$	Remarks
CHARTERS TOWERS	28 sec.	-	-	Interpreted from bulletin.
ADELAIDE	(25) sec.	(26) sec.		Doubtful.
PORT MORESBY	27 sec.	27 sec.	27 sec.	Fairly Clear.
MELBOURNE	-	-	-	
CANBERRA	-	-	-	
RIVERVIEW	-	-	-	

(FACING PAGE 1)

INTRODUCTION

Interpretation of earthquake records at Port Moresby is based on the standard travel time curves of Jeffreys & Bullen (1948). The travel times given for PKP and PKIKP paths are illustrated in fig. 1. The theory that the particular form of the curve between 143° and 147° is determined by the velocity gradient distribution in the "transitional zone" between the outer and inner cores, is well known.

In 1952, evidence was presented which tended to confirm the particular form of the travel time curve given by Jeffreys & Bullen (Denson, 1952). However, it was suggested that the reversal point C (fig. 1.) apparently extended beyond 147° to 157°.

RESULTS

On January 8, 1959, an earthquake occurred in the Windward Is. U.S.C.G.S. preliminary data for the quake read:-

Epicentre	:	15½°N 61°W.
Origin time	:	01 33 48 G.M.T.
Depth	:	Approx. 100 Km.

The record of this quake made at Port Moresby (151°.9) clearly exhibited a phase between the AB and DF branches of the PKP travel time curve, which were also clearly observed. The phases corresponding to pPKP for all three onsets were also recorded and the depth thus calculated agreed with that given by U.S.C.G.S.

Copies of seismograms from Adelaide, Melbourne, Canberra and Riverview were examined in an effort to confirm the existence of the untabulated PKP onset mentioned above. Readings from the preliminary bulletin of the Charters Towers station were also examined. The results given in table 1, and plotted in fig. 2, support the readings made from the Port Moresby records. However, when plotted against the Jeffreys-Bullen travel time curve corrected for a depth of .01R (approx. = 100 Km), the observed curve is offset by about 6 seconds (fig. 3.). This could be due to

(1) An incorrectly assumed depth.

(2) An actual origin time later than that given by U.S.C.G.S.

(3) A combination of (1) and (2).

It is felt that because the p reflections observed (table 2) confirm the depth quoted by U.S.C.G.S., the major part of the error is more likely one of origin time, and therefore the actual origin time is approximately 6 seconds later than that given by U.S.C.G.S. i.e. 01 33 54.

The origin time calculated from the information given in Pasadena preliminary bulletin is 01 33 55.

It is noteworthy that (ref. table 1.) the three onsets at Port Moresby were recorded with equal clarity. As the onset 01 53 40 (Adelaide) was much clearer than the preceding one, and the Melbourne arrival at 01 53 27 was weak, the latter may correspond to the BC branch rather than the DF branch as marked (fig. 3.), any preceding onset not being observed.

SUMMARY

The above results, although meagre, tend to confirm Denson's findings concerning the portion of the travel time curves for longitudinal core waves at epicentral distances near 150°.

It appears that three core phases are observable beyond the 147° limit given by the Jeffreys and Bullen tables.

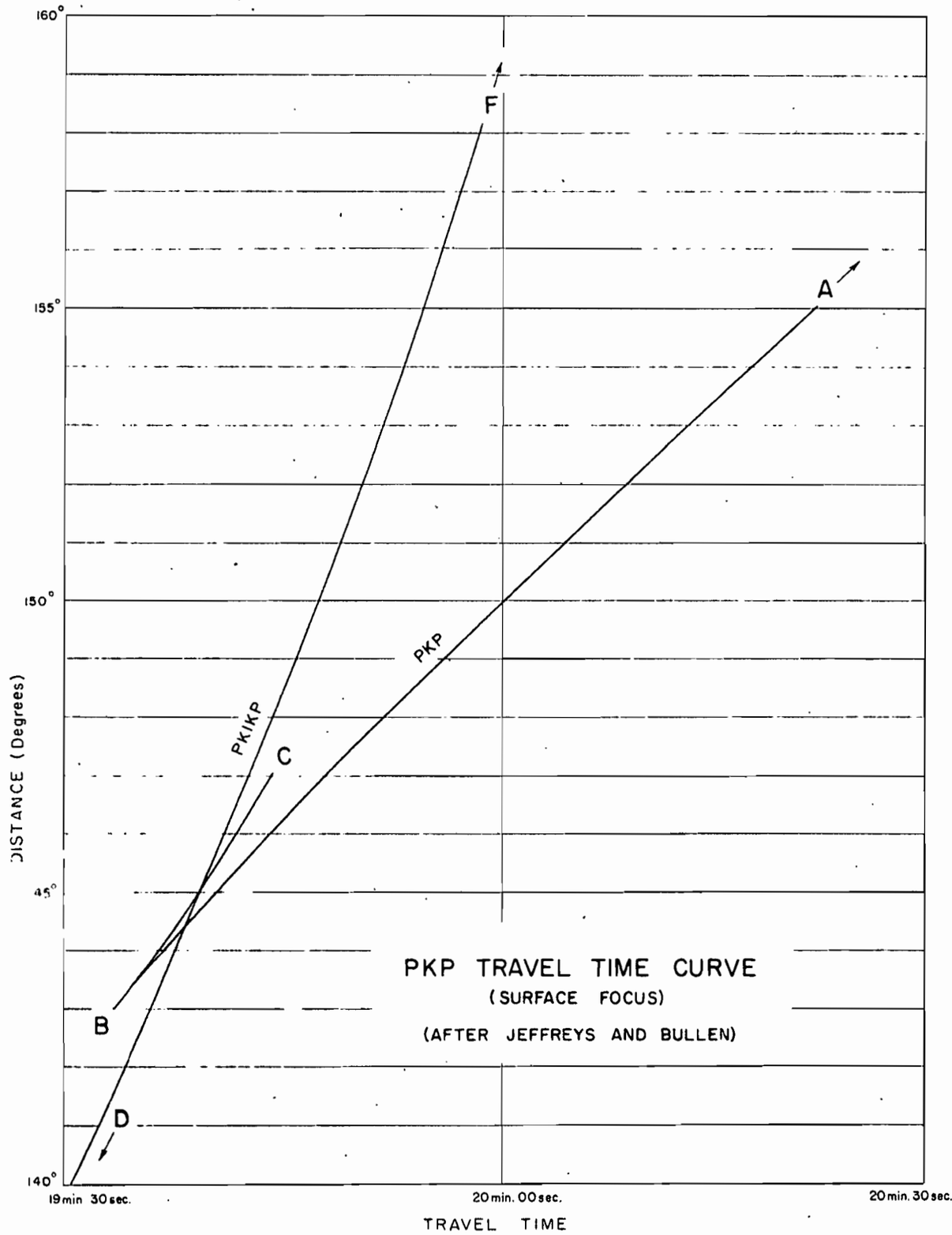
ACKNOWLEDGEMENTS

The Directors of the seismological stations at Adelaide, Canberra, Melbourne and Riverview are thanked for providing copies of records.

REFERENCES

JEFFREYS, H. and BULLEN, K.E., 1948 SEISMOLOGICAL TABLES.

DENSON, M.E., 1952 Longitudinal waves through the earth's core. Bull. Seismol. Soc. Amer. 42, 119-134.



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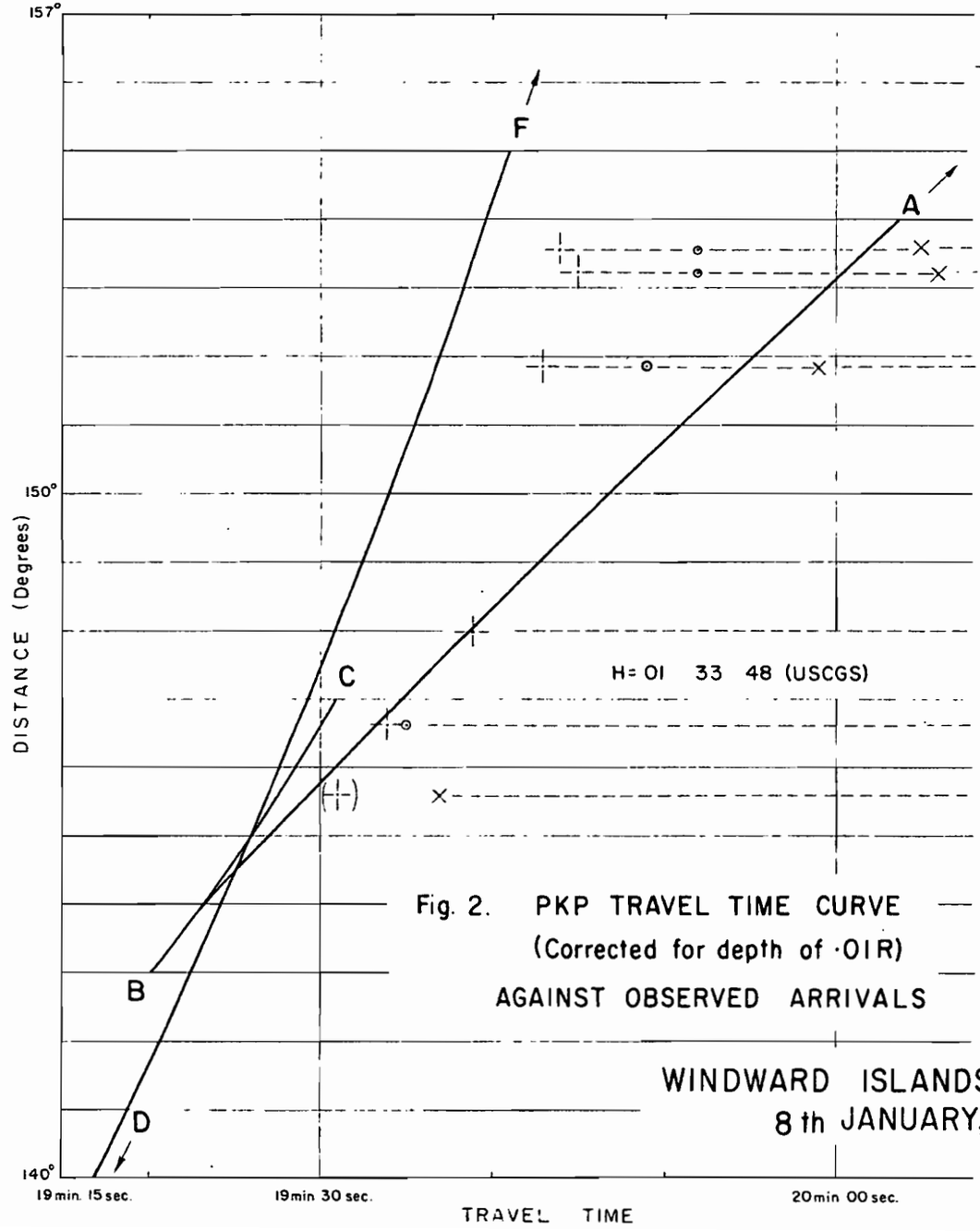

Fig. 2. PKP TRAVEL TIME CURVE
(Corrected for depth of ·01R)
AGAINST OBSERVED ARRIVALS

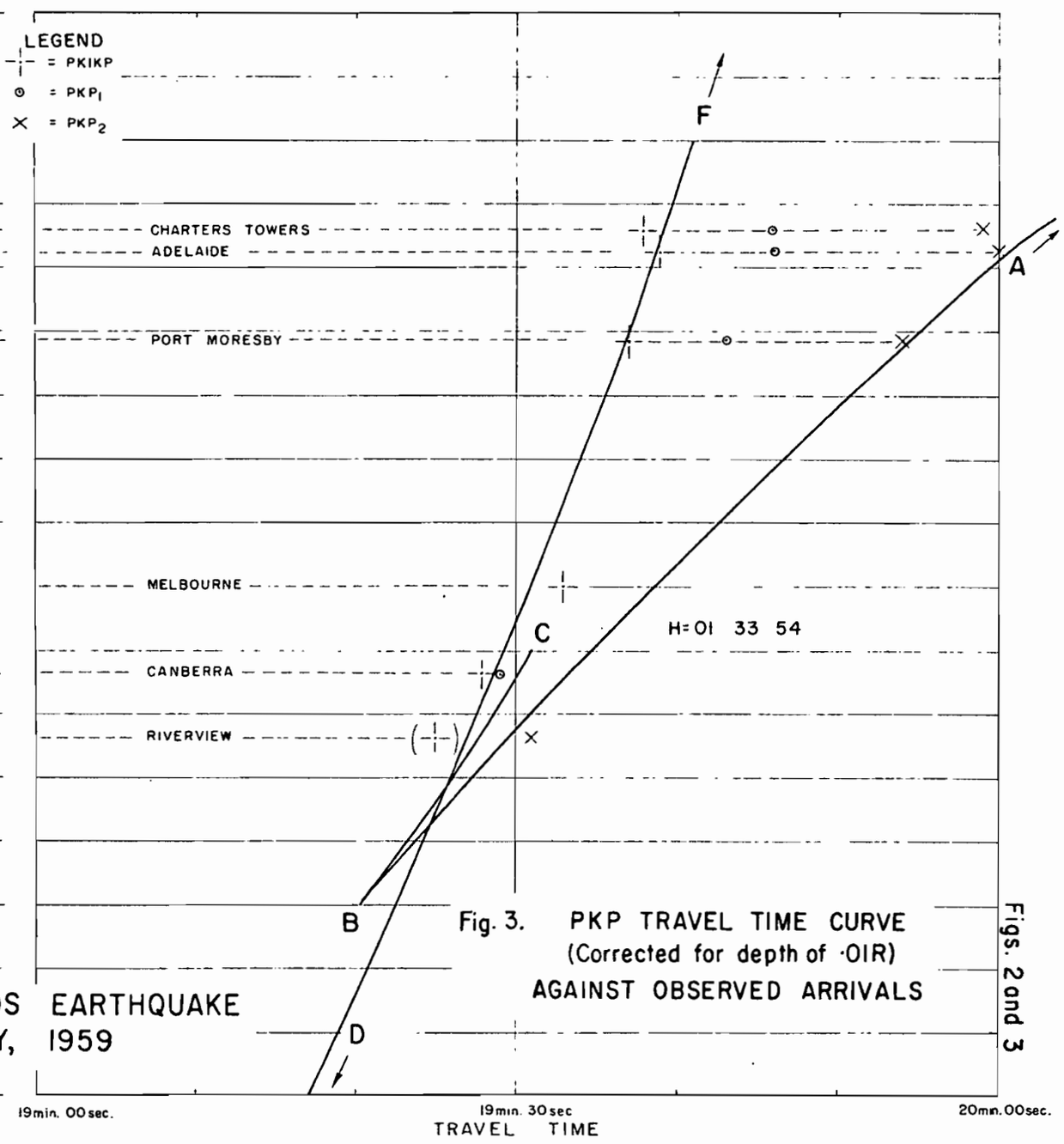

Fig. 3. PKP TRAVEL TIME CURVE
(Corrected for depth of ·01R)
AGAINST OBSERVED ARRIVALS

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Figs. 2 and 3

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