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M/V "NIMOS" SECTIONS: THERMAL PROFILES OF THE CORAL AND BISMARCK SEAS, JUNE 1983 TO JULY 1984

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ABSTRACT

This report describes the methods used to monitor the temperature profile in sections from the north-east coast of Australia across the Coral Sea to Papua New Guinea, across the Solomon Sea north of Papua New Guinea to the Bismark Sea, and from there back to the north-east coast of Australia. Plots of the station positions, steric heights and sea surface temperatures are presented, together with vertical temperature sections along the ship's track.

INTRODUCTION

Recent studies have shown (Nicholls 1983, Palmer and Mansfield 1984, Wright 1984) that year-to-year variations in the sea-surface temperature in the tropical west Pacific Ocean is one of the factors governing the onset of the El Nino-Southern Oscillation phenomenon.

The importance, therefore, of gathering regular temperature data in this little studied region is obvious. To this end, the CSIRO Division of Oceanography sought the cooperation of the Master and officers of M/V "Nimos", a container vessel that makes a round trip about once a month between Melbourne and Papua New Guinea ports (Figs 1a-12a). They agreed to drop expendable bathythermographs (XBTs) about every six hours along sections of their route north of 20°S latitude. The XBTs were provided by the Royal Australian Navy Hydrographic Office. CSIRO provided the equipment and is responsible for data processing.

The program has now been in operation since June 1983. This report describes the data processing and quality control procedures followed and presents a summary of the data obtained from 12 voyages during the first year.

METHODS

The XBTs are launched from the lee side of the vessel, using a Sippican LM-3A handheld launcher. From June 1983 to November 1983, the XBT casts were recorded on a Sippican Mk-2a XBT recorder; this instrument provided an analogue record, which was subsequently digitized. Since December 1983, a Sippican Mk-9 Digital XBT/XSV system has been used. It stores temperature at 0.6 m intervals on magnetic tape. Officers of the CSIRO Division of Applied Organic Chemistry collect the data records and replenish probe supplies whenever the vessel calls in at Melbourne.

DATA PROCESSING

(a) Sippican MK-2 System

The analogue traces were carefully inspected, using as a standard the "Guide to Common Shipboard Expendable Bathythermograph (SXBT) Recording Malfunctions" (Kroner & Blumenthal, 1978). Traces with obvious faults (fouling, insulation penetration, poor grounding or wire stretch) were rejected from the point where these faults occurred. The remainder of the trace and the traces without fault were digitized, using a Summagraphics Data Tablet Digitizer* which, after the initial tablet coordinates were transformed in the CSIRO Cyber76 computer, gave us a file of temperatures at 5-metre intervals. The station details were entered with the digitizer keyboard. This file was stored in Hobart on disc in a VAX 11/750 for later processing to produce plots of station position, surface temperature, steric height, and the temperature profile.

The chart drive motor of the Sippican MK-2 recorder sometimes ran slowly or erratically, producing incorrect depth-temperature relationships and traces that did not finish at the usual 500 metres. The resulting digitized temperatures were thus too cold, an error that was not immediately obvious because of the very strong El Nino-Southern Oscillation event which was affecting the seas north of Australia at the time. When the results of several voyages were available the error became apparent and all traces where the finish depth was less than 500 metres were rejected, except for those in shallow water or those where the short trace could be attributed to a fault such as a wire break or insulation breakdown.

(b) Sippican MK-9 System

The MK-9 system replaced the MK-2 system after the sixth voyage. The recorder processor in the MK-9 stores, processes, and prints a plot of water temperatures measured by the probe during its fall. When the station is complete, the data are transferred to magnetic tape, which is collected each time the ship visits Tasmania during the round voyage. The cassettes and plots of each probe are processed further in the Hobart laboratories.

The data stored on magnetic tape - the station details and temperature at approximately 0.6 metre intervals - are transferred to disc in a VAX 11/750 computer, which reformats the data as temperatures at 5-metre intervals for analogue processing. It also computes and plots the steric height and plots the station position, surface temperature and temperature against depth (Figs 1-9).

RESULTS

The results of each voyage of M/V "Nimos" are summarised in Figs 1-12. The sequence of plots is: station numbers allotted to each XBT drop (numbers not

always consecutive, due to data dropouts); surface steric height in metres relative to 400 db (further details below); surface temperature; a vertical section of temperature.

For the later voyages, there are sometimes two or three vertical temperature sections, instead of only one (e.g. Figs 4e,f). First and last station numbers are shown for each section plot; the corresponding map shows the location of each station unambiguously. Note that the ship did not always follow the same track from Port Moresby to New Britain and New Ireland, sometimes passing to the north of New Britain, sometimes to its south, and occasionally omitting this leg altogether. For this reason care must be taken when comparing vertical temperature sections between voyages in the Solomon and Bismarck Seas.

In the steric height maps, a single temperature-salinity relationship was used throughout the region. It is the average for the region of the T-S relationships given by Ridgway and Loch (1986); deviations of actual salinity from this curve are not expected to lead to important errors anywhere in the region.

The steric height maps distinguish between "Nimos" data and nearly simultaneous observations from M.V. "Hachiyo Maru", which were collected by the ORSTOM-Groupe SURTROPAC in Noumea, New Caledonia (Meyers and Donguy, 1984).

We have retained some XBT traces that may be erroneous; however, in view of the extremely anomalous conditions prevailing during these observations, and our present state of ignorance of the oceanography of this region, we did not feel justified in discarding them. These traces are indicated by asterisks in the steric height and station number maps, and in the vertical sections. The doubtful XBT traces have since been removed from the data set.

ACKNOWLEDGEMENTS

We are deeply grateful to the Master and officers of M/V "Nimos" who, despite the problems of sailing in waters renowned for their shoals and other hazards, so conscientiously dropped and recorded the XBTs.

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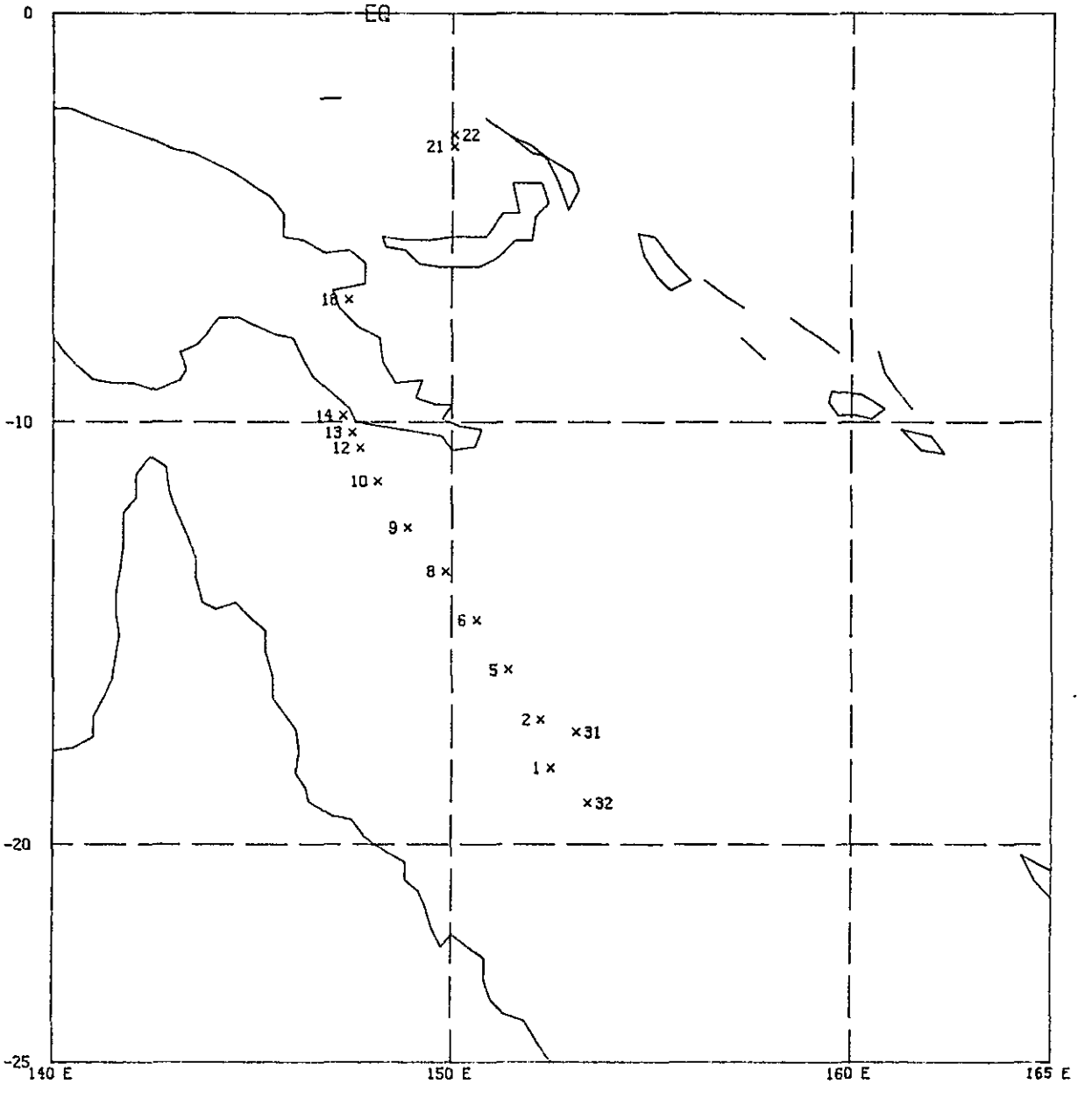


Fig. 1 Voyage 1 (a) Station positions, 13-28 June 1983

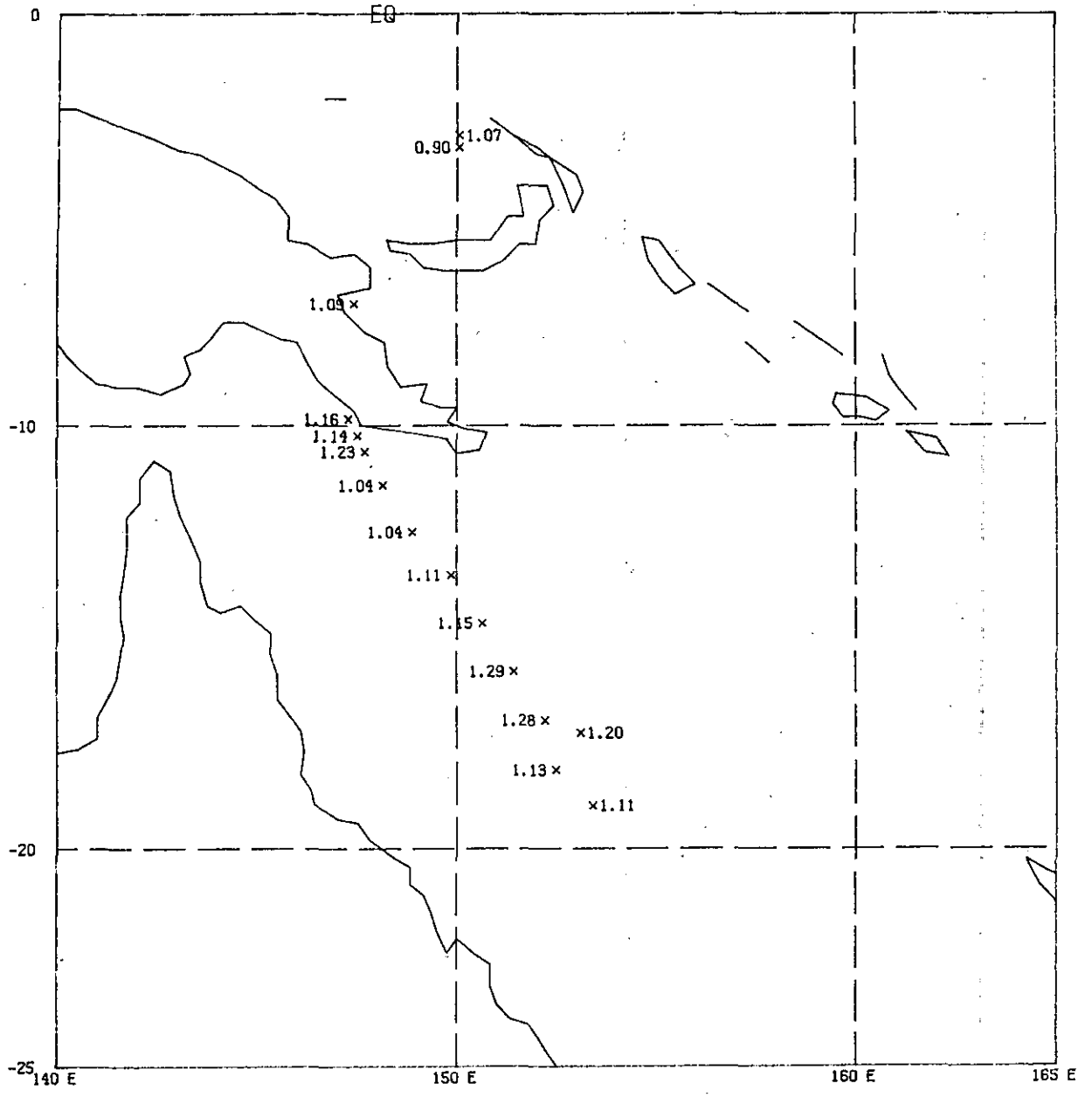


Fig. 1 Voyage 1(b) Steric height relative to 400 db 13-28 June 1983

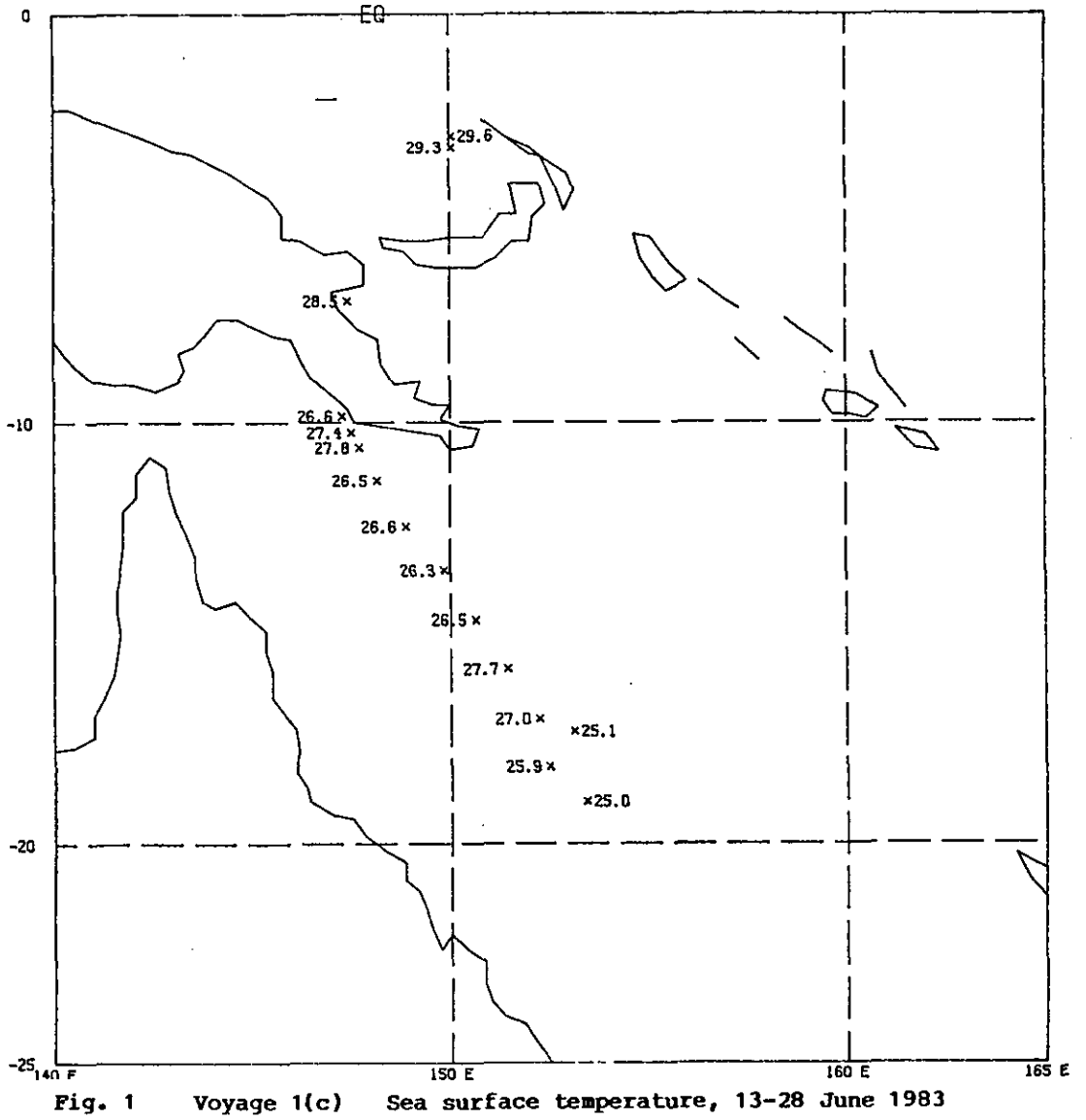


Fig. 1 Voyage 1(c) Sea surface temperature, 13-28 June 1983

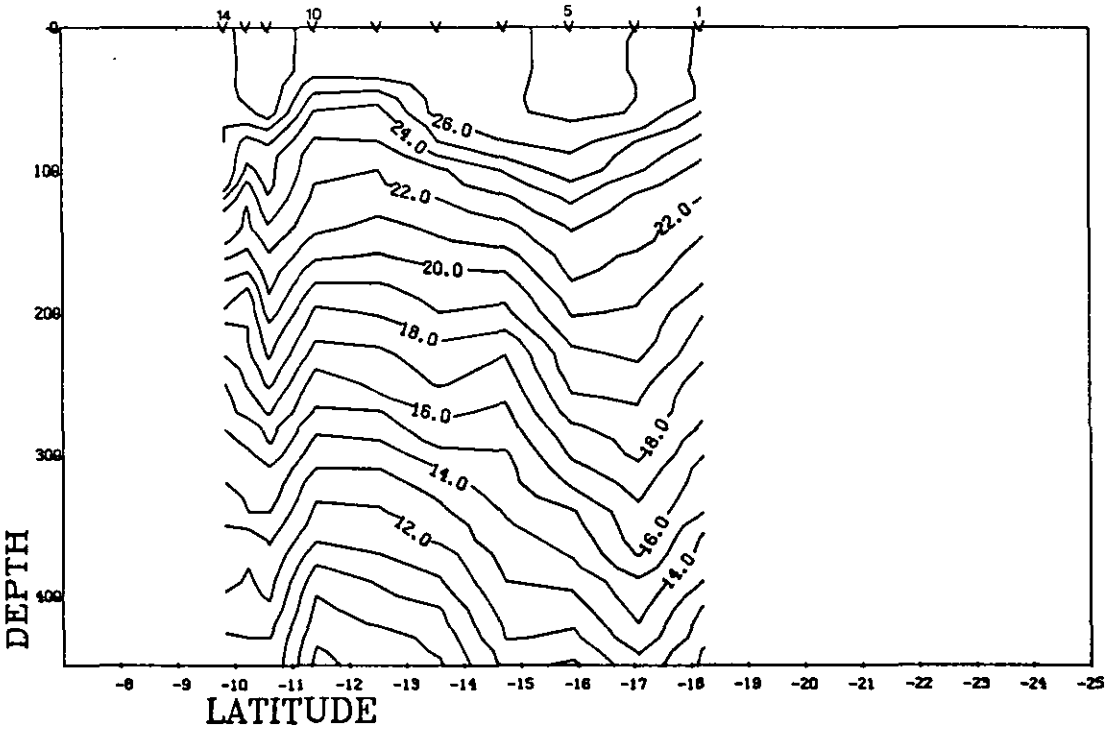


Fig. 1 Voyage 1(d) Vertical section, Stations 1-14, 13-14 June 1983

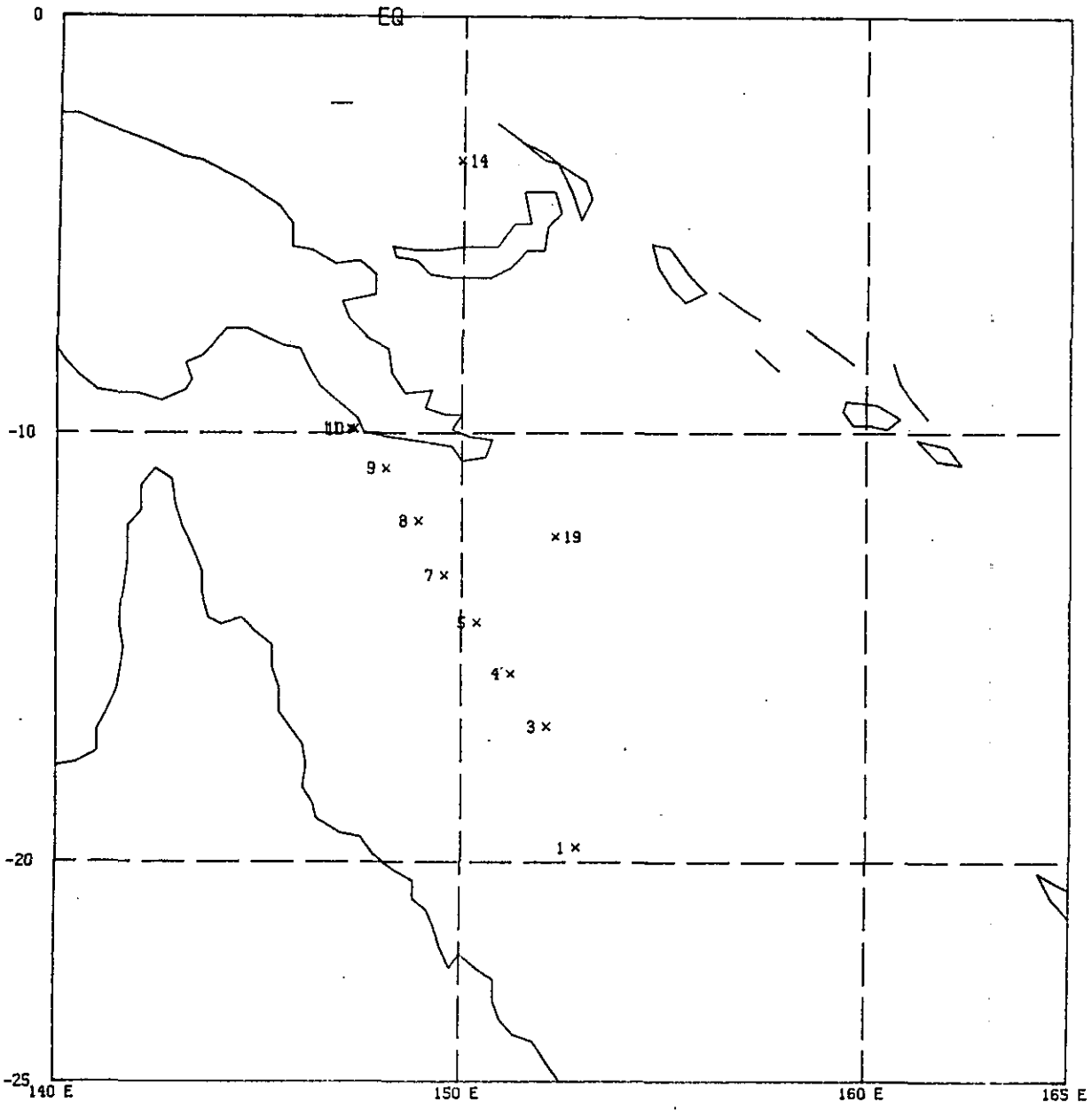
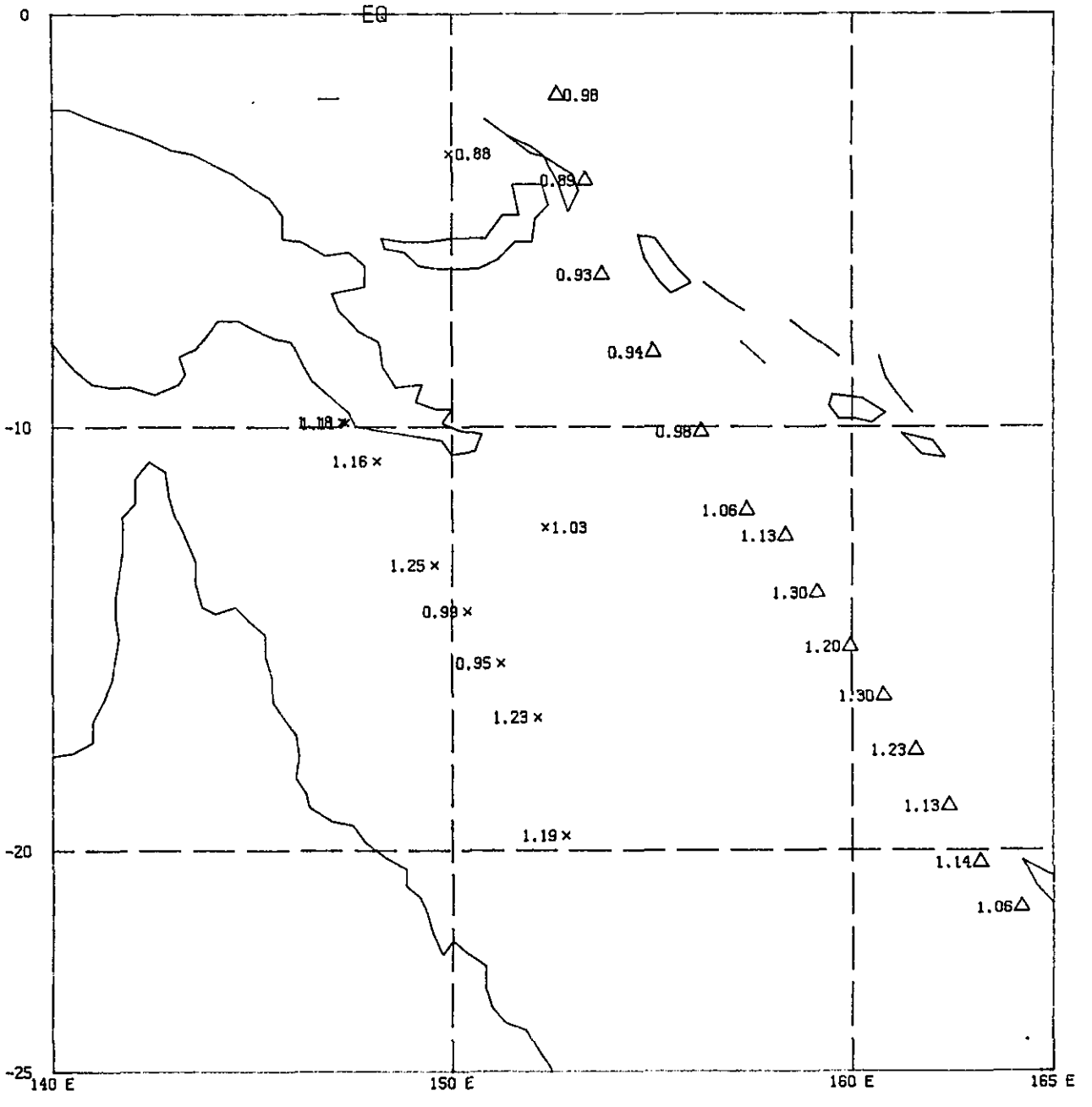


Fig. 2a As for Fig. 1, 19 July-2 August 1983



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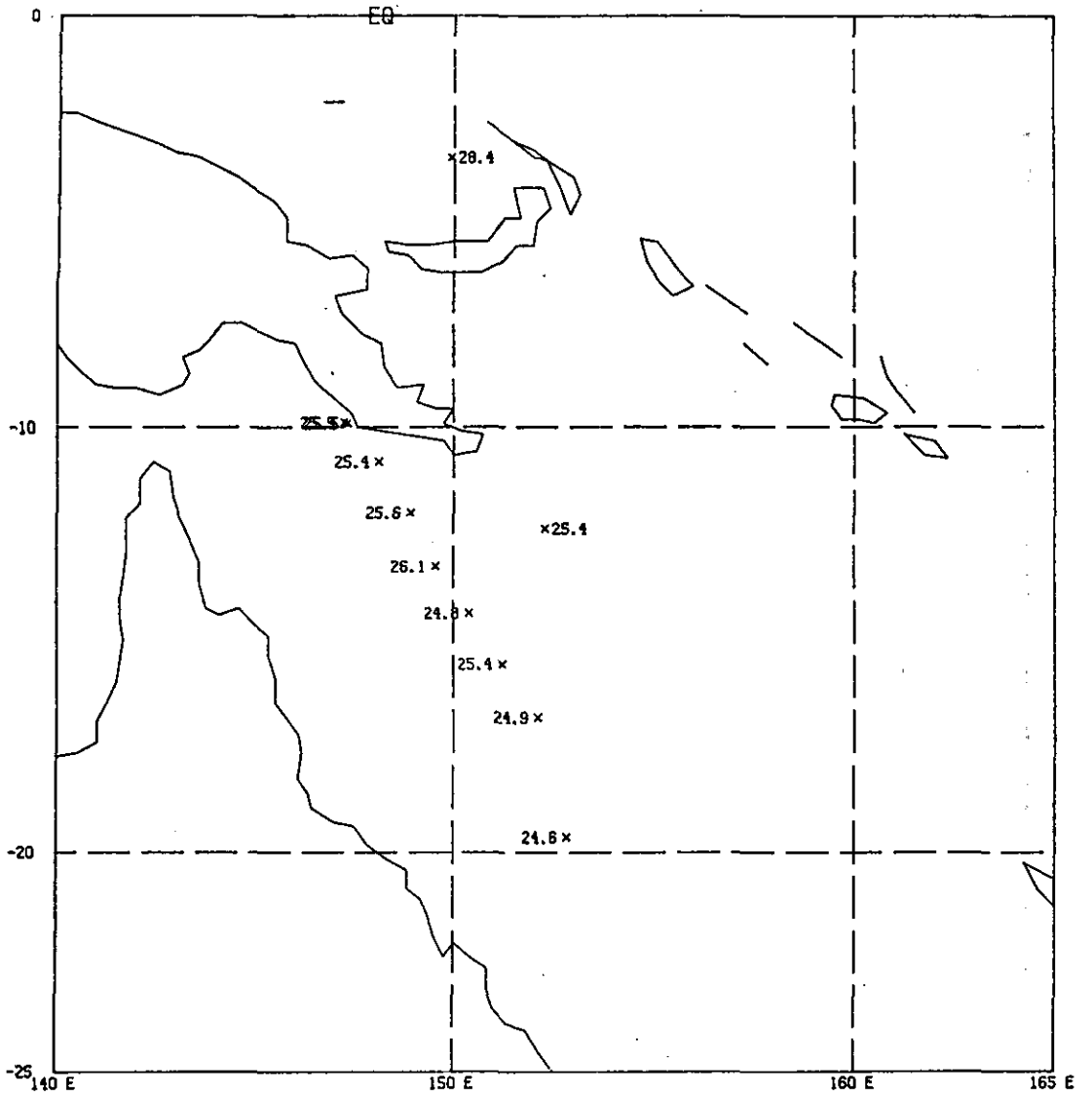

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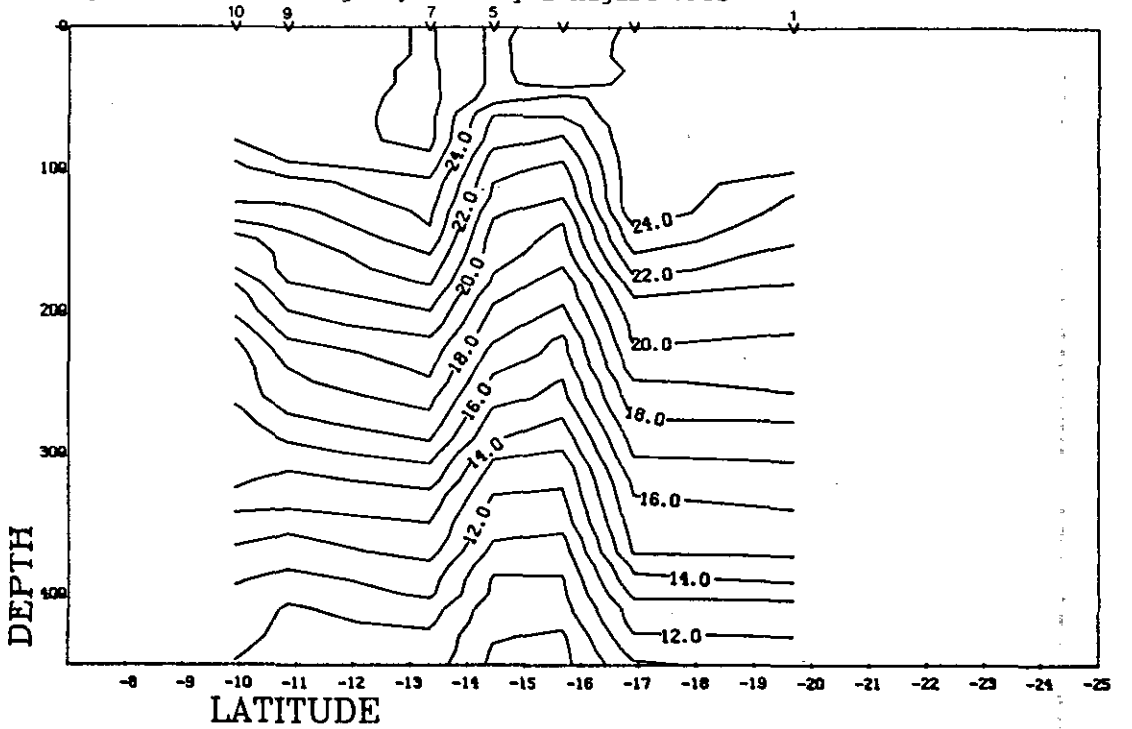
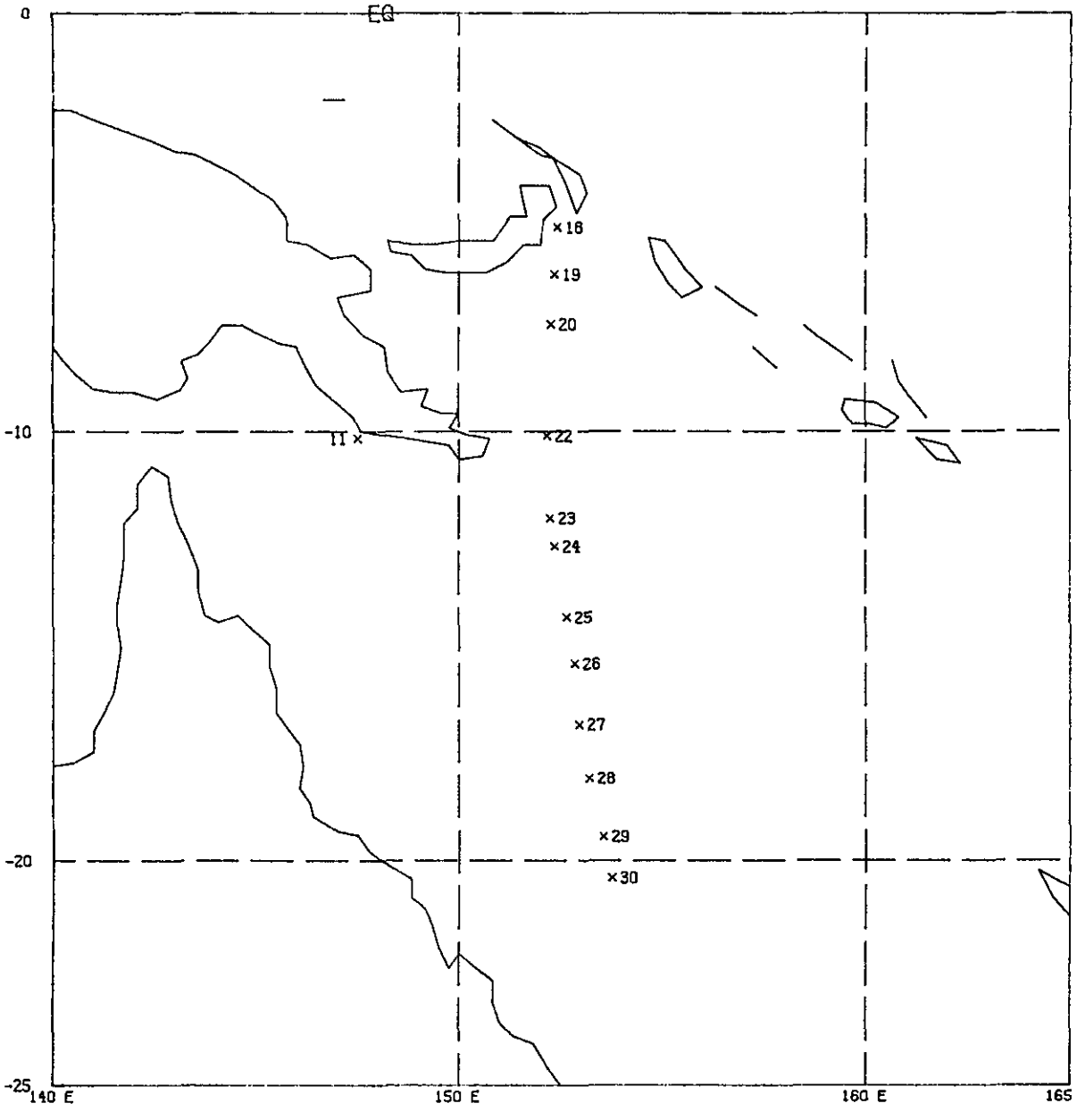


Fig. 2d: Vertical section, Stations 1-10, 19-21 July 1983



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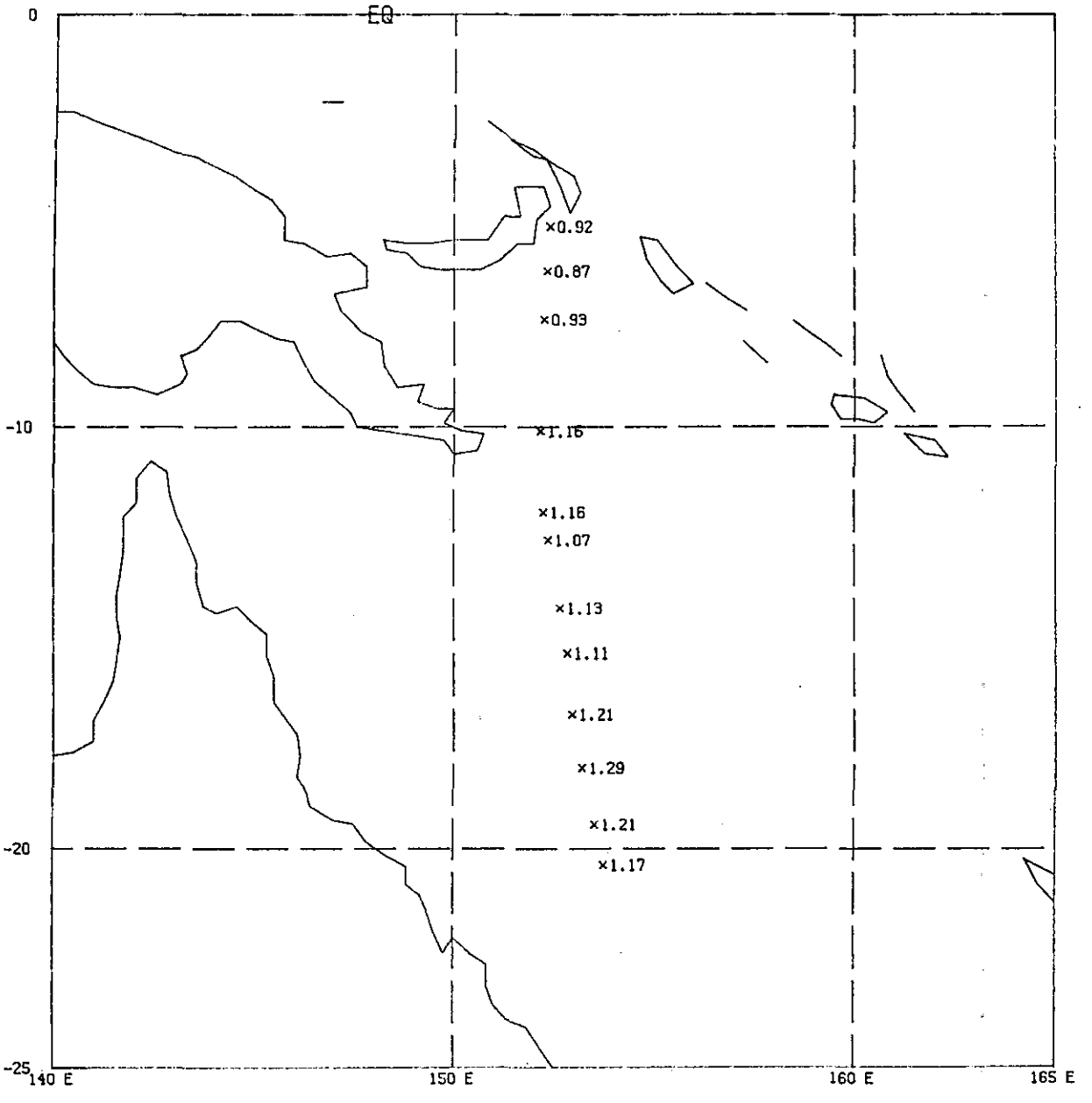

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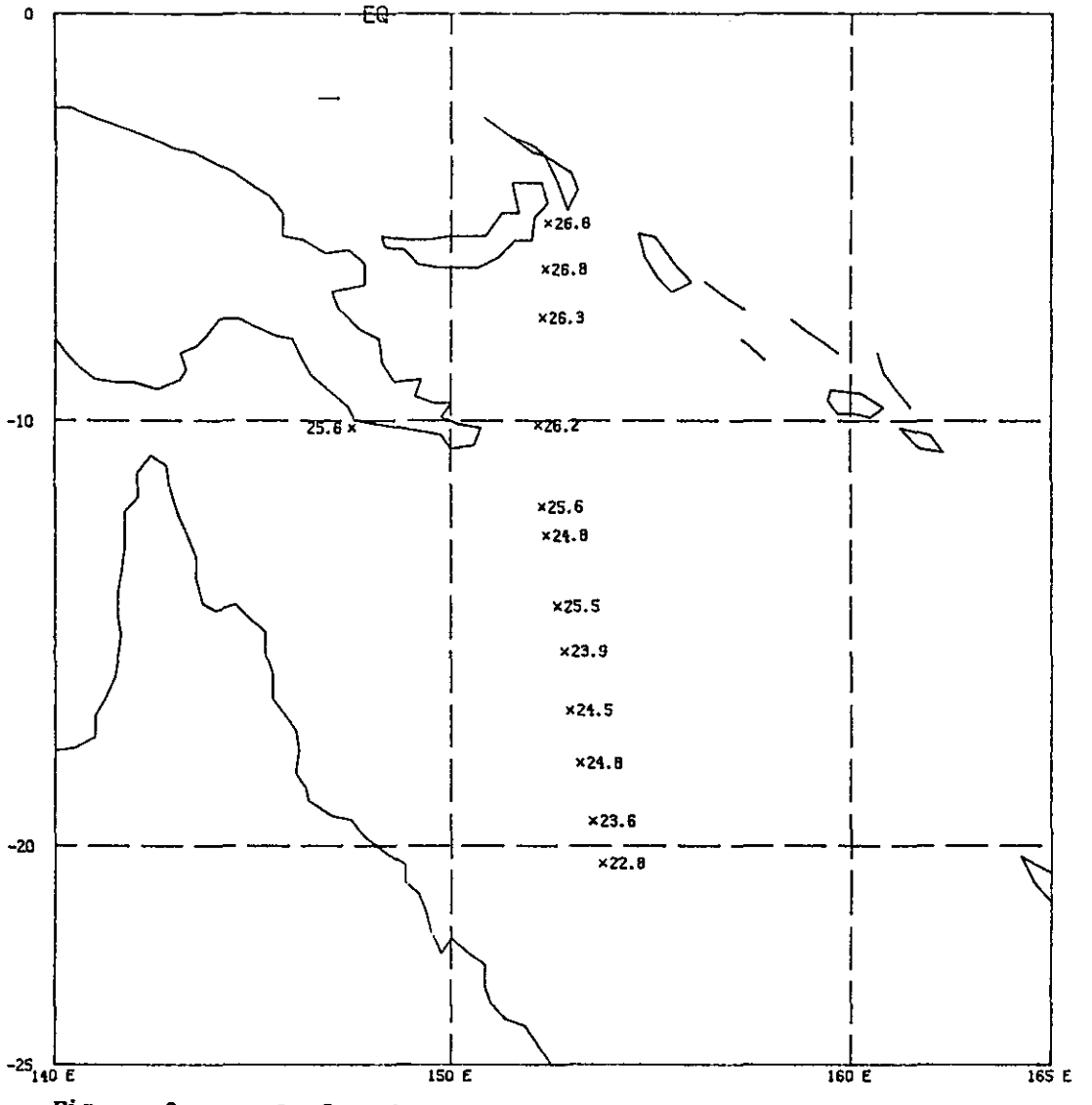

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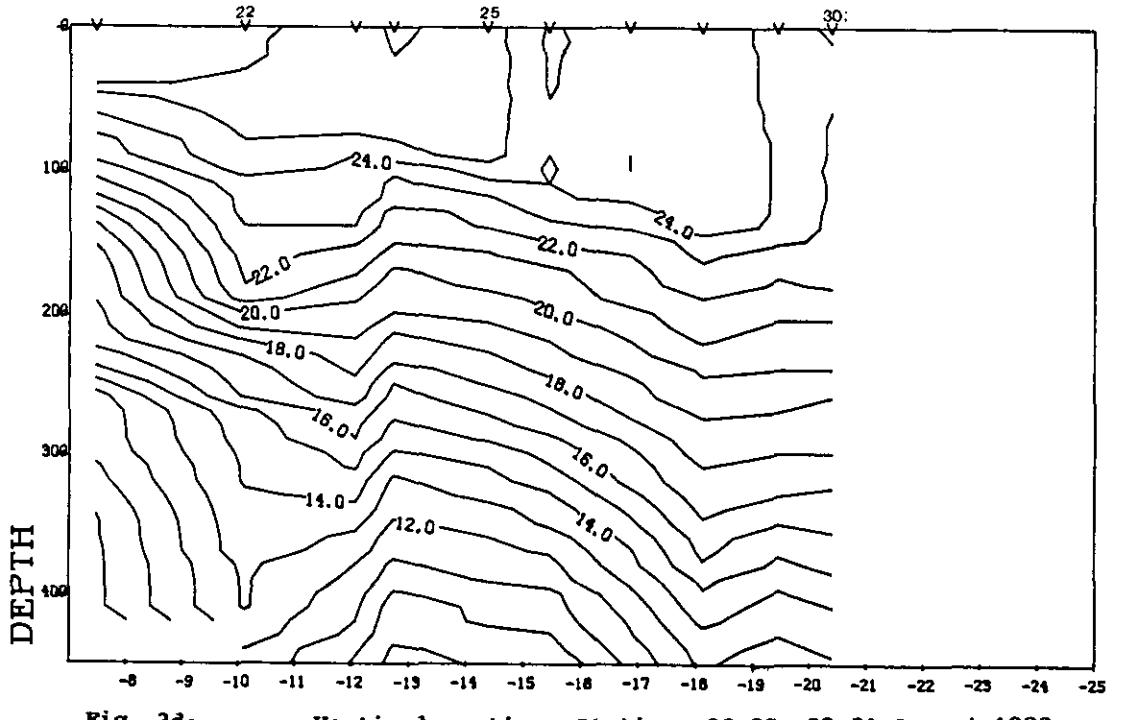
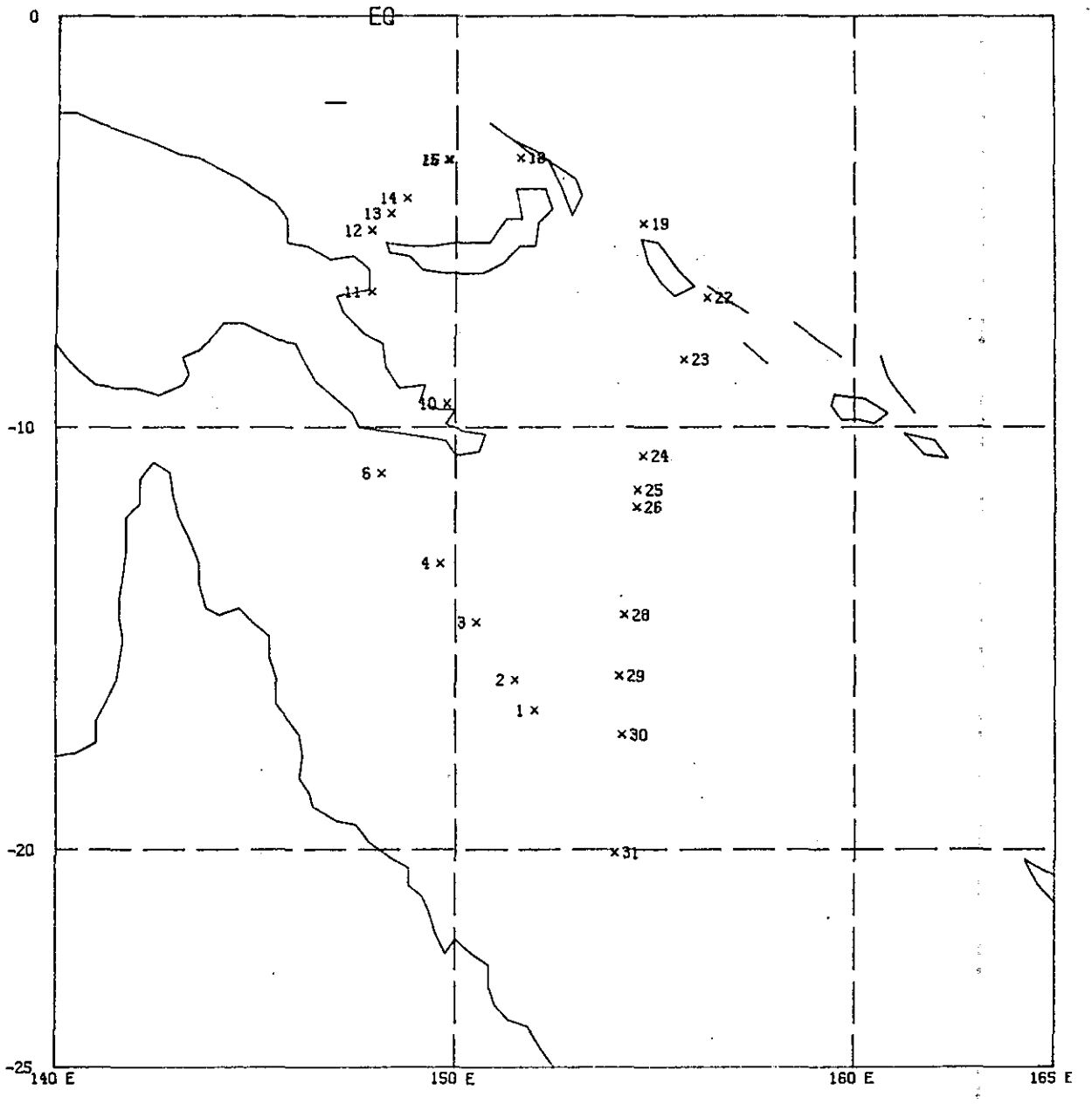


Fig. 3d: Vertical section, Stations 22-30, 29-31 August 1983



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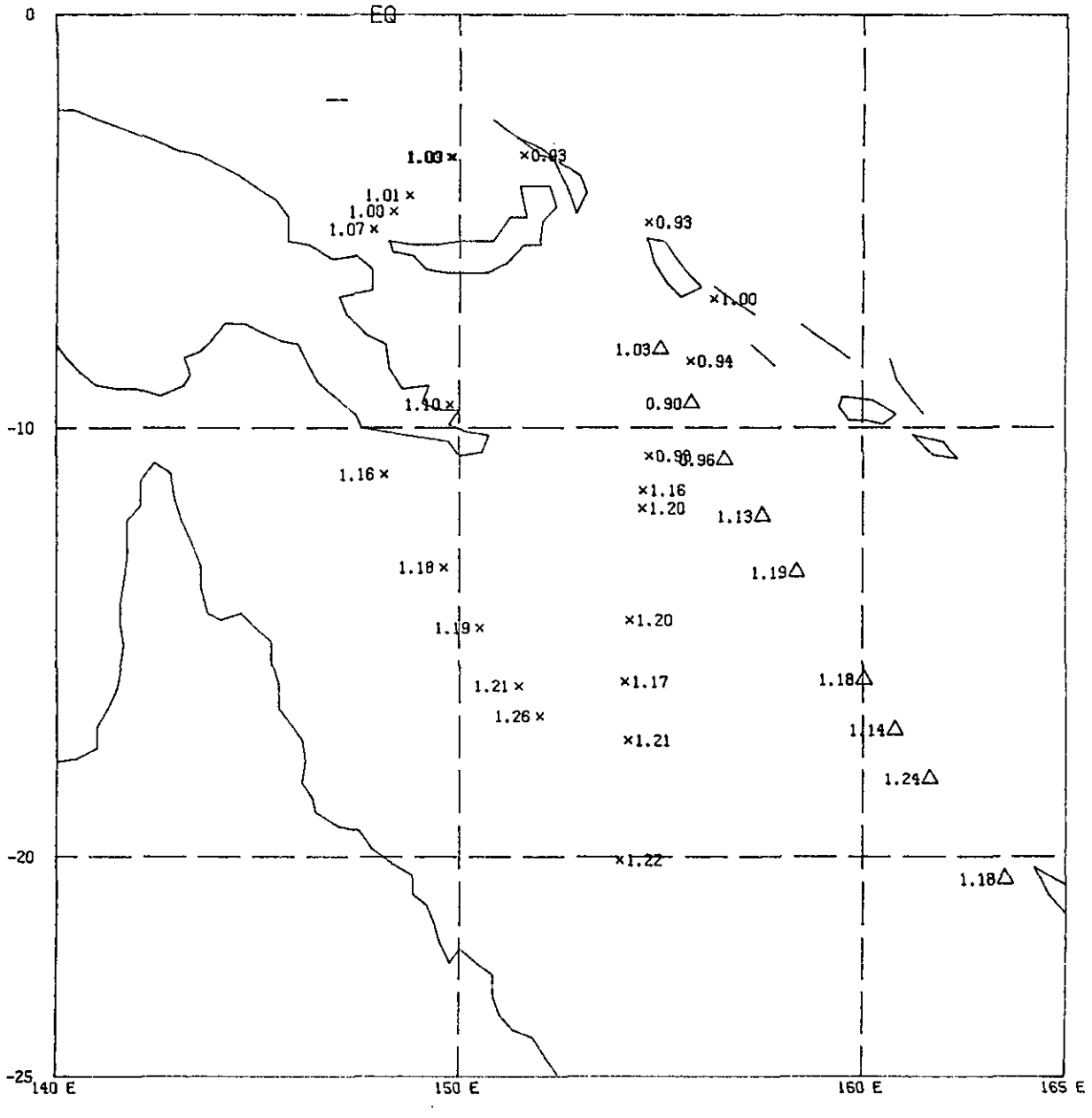

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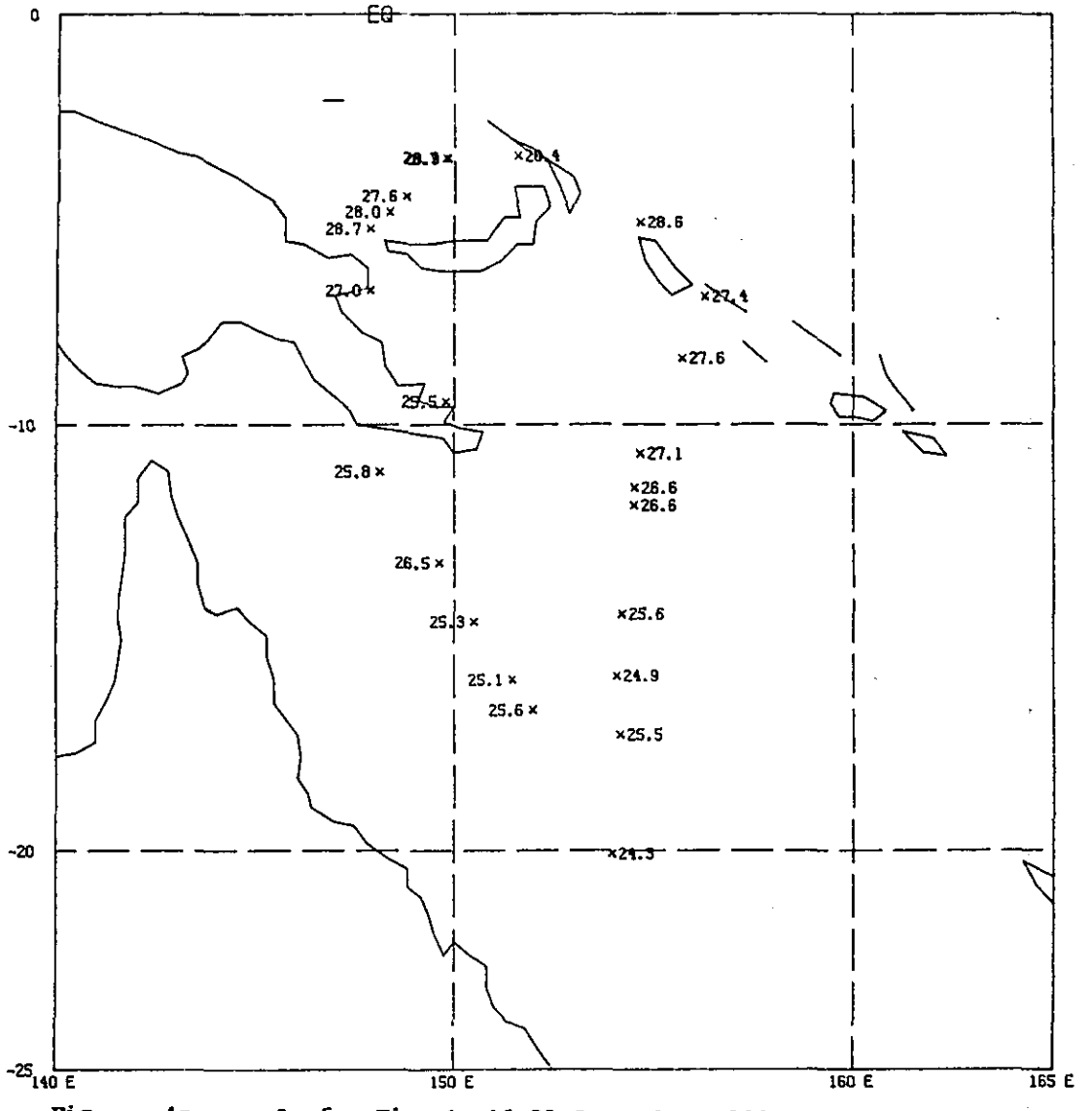

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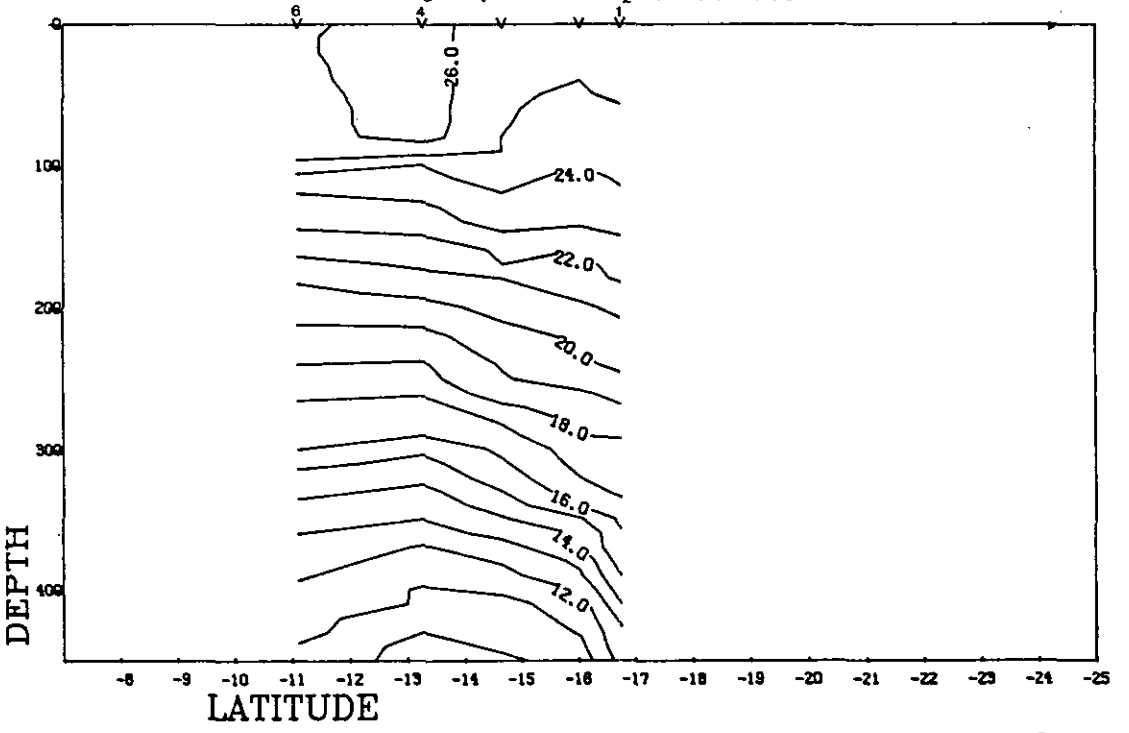


Fig. 4d: Vertical section, Stations 1-6, 16-17 September 1983

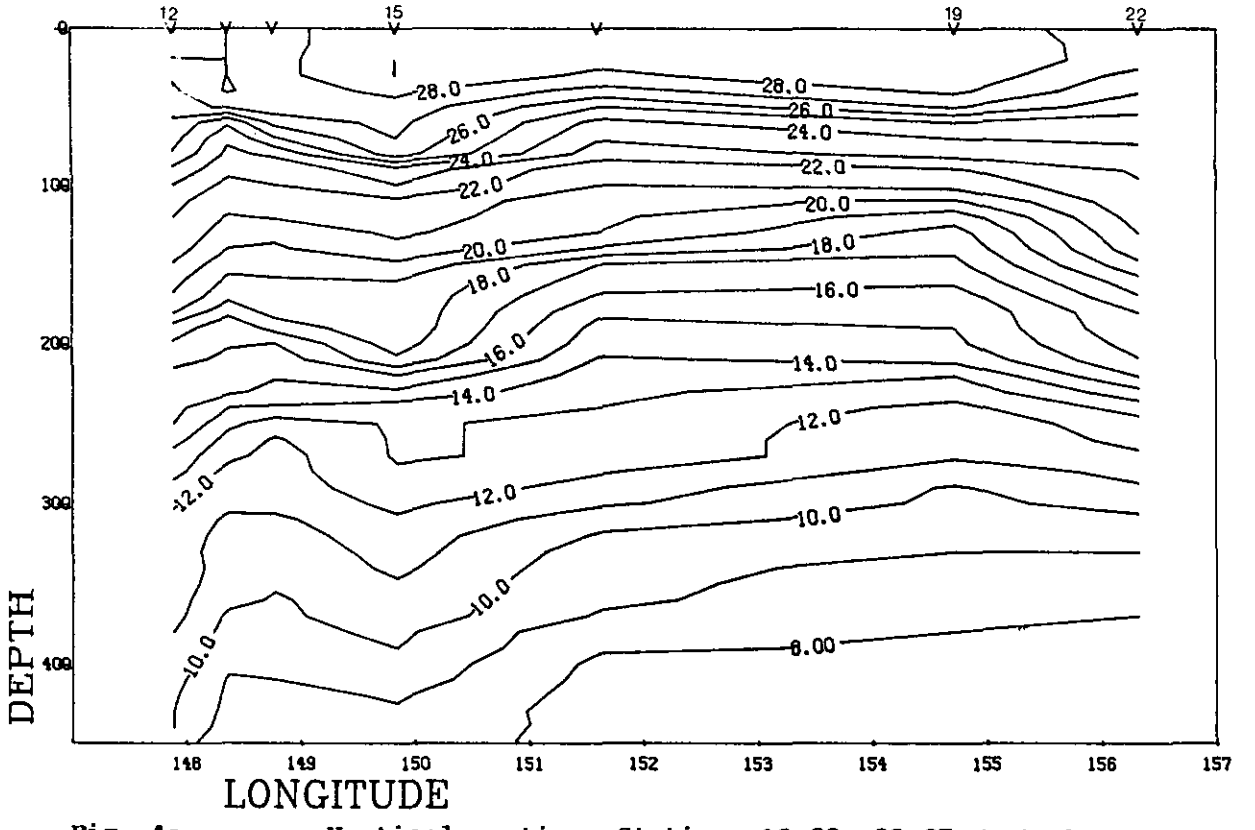
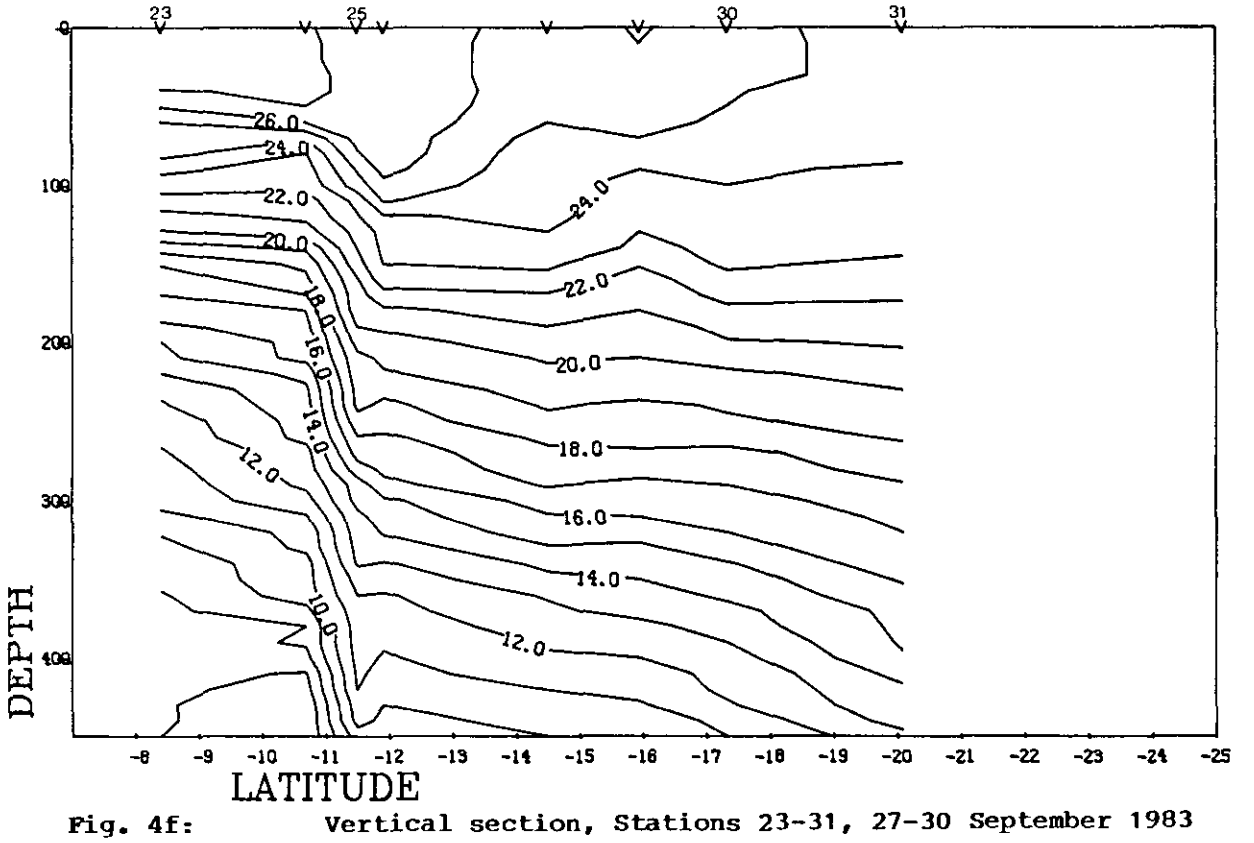


Fig. 4e: Vertical section, Stations 12-22, 23-27 September 1983



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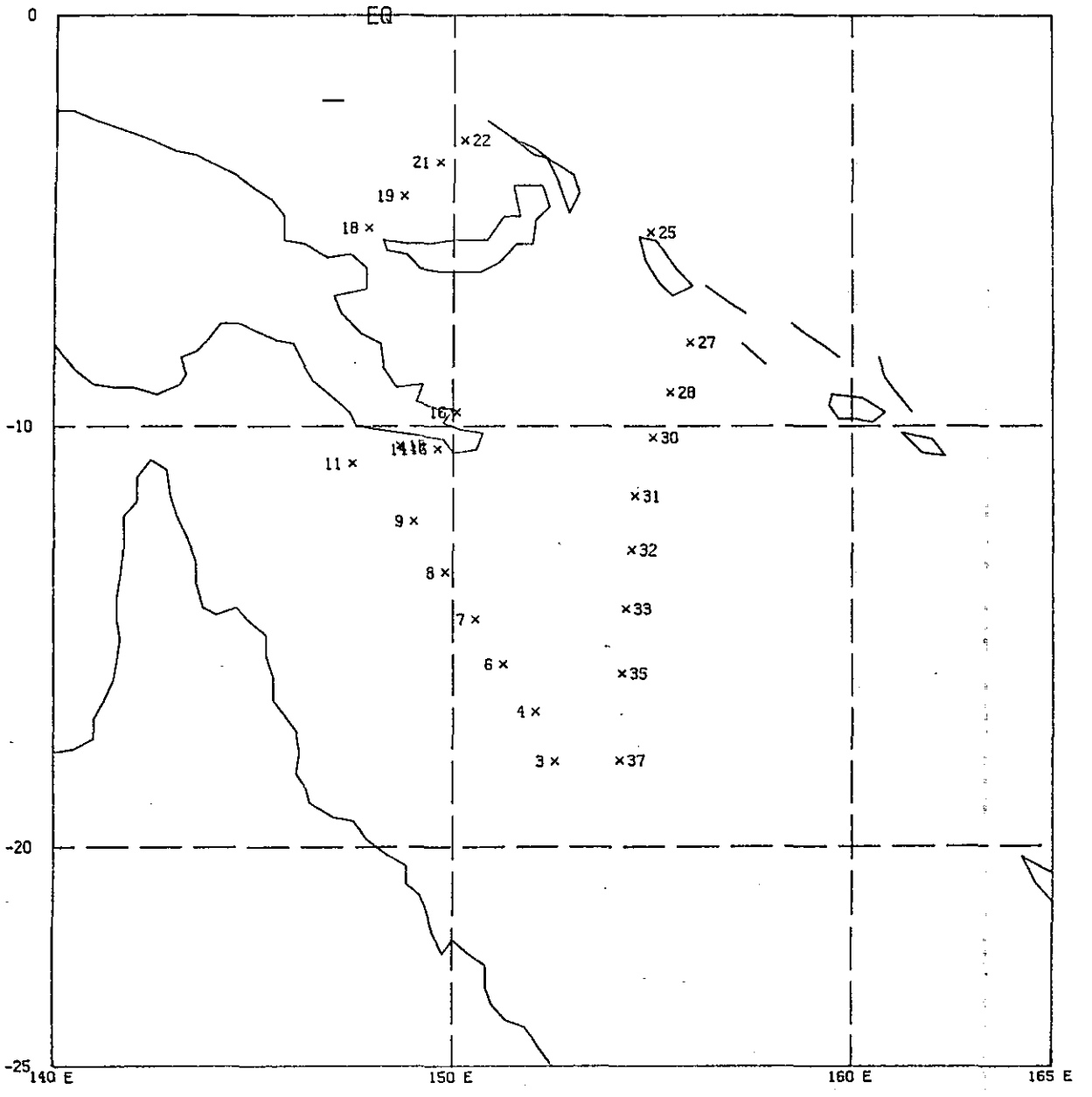

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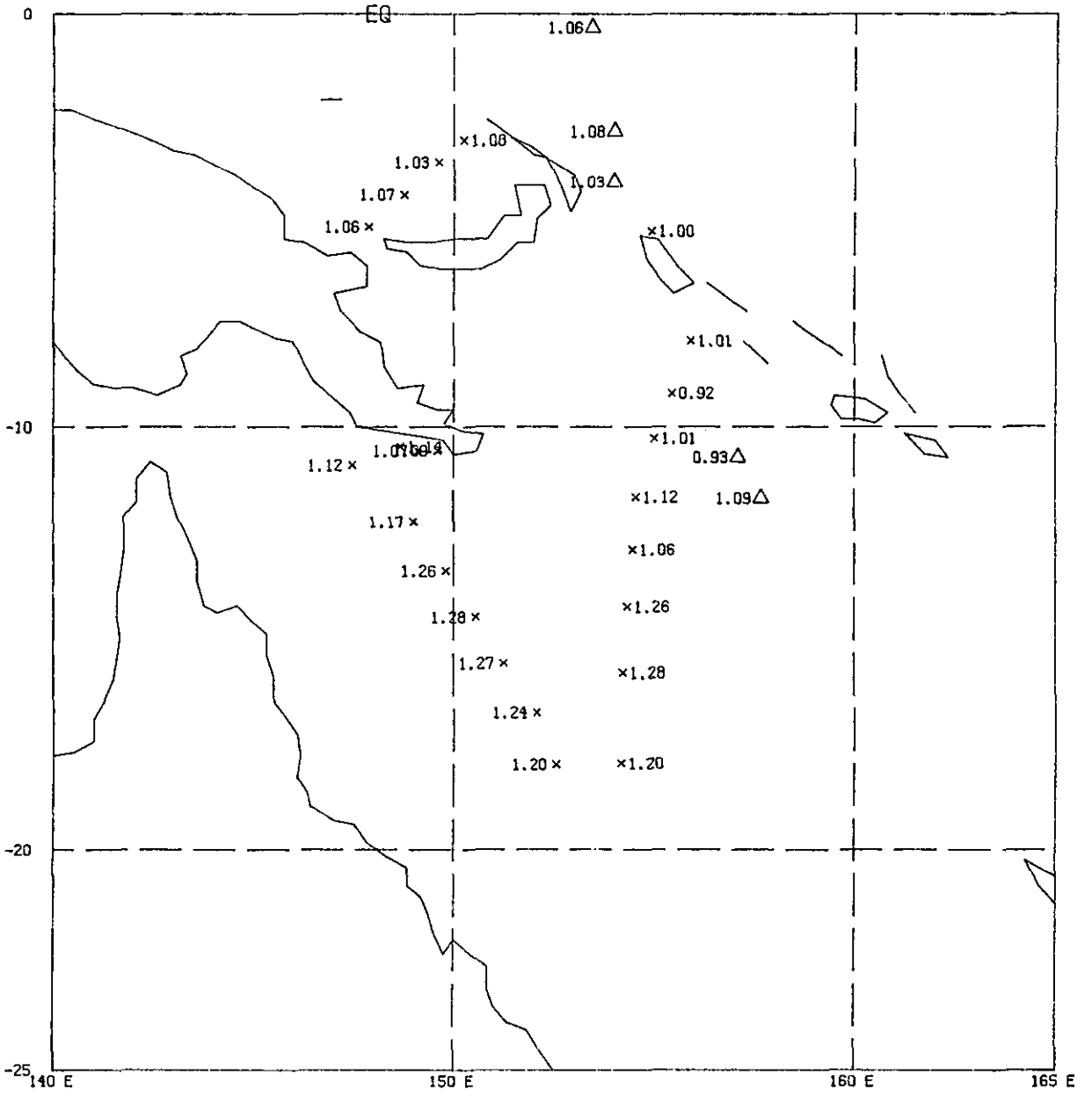

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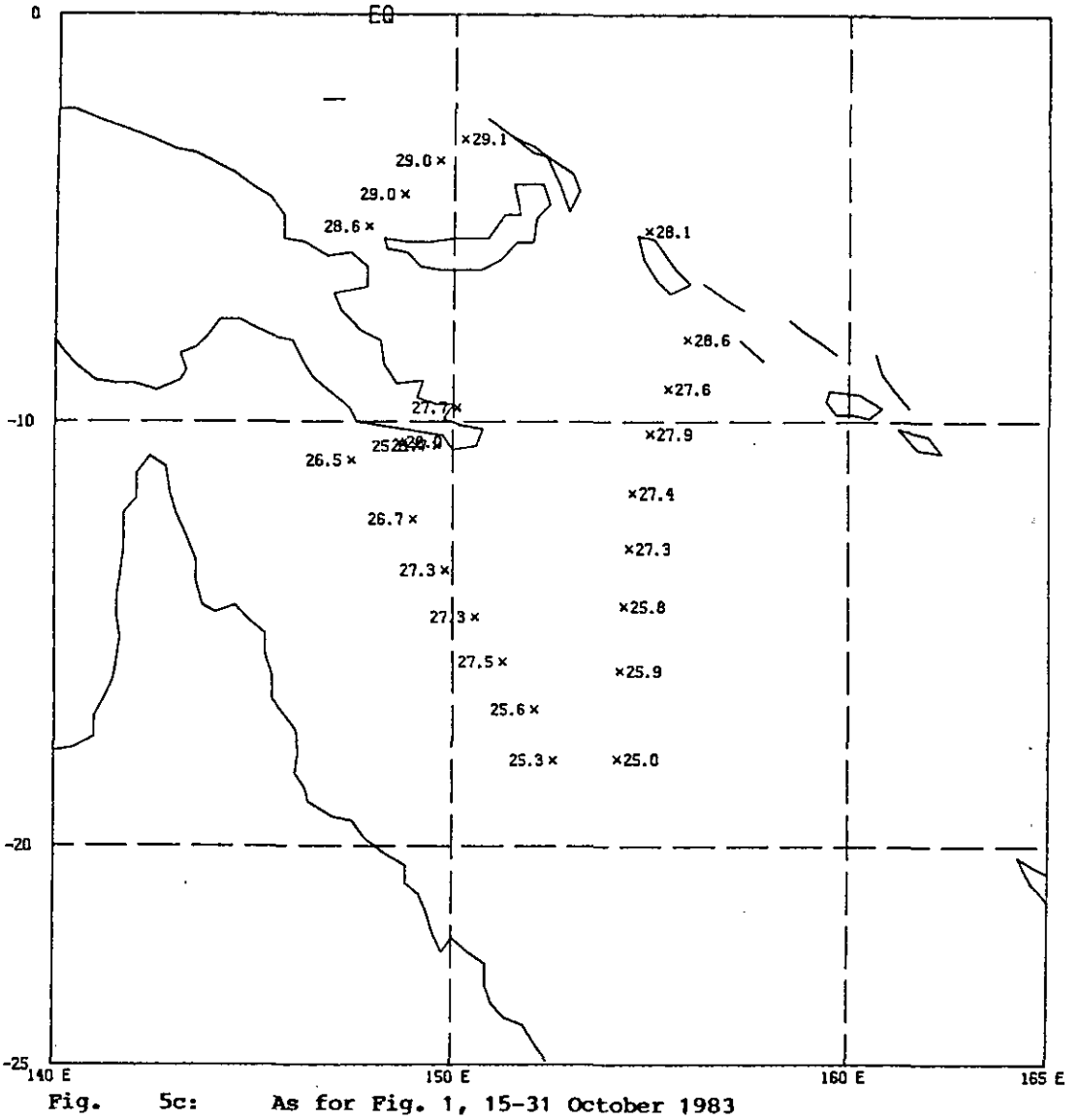

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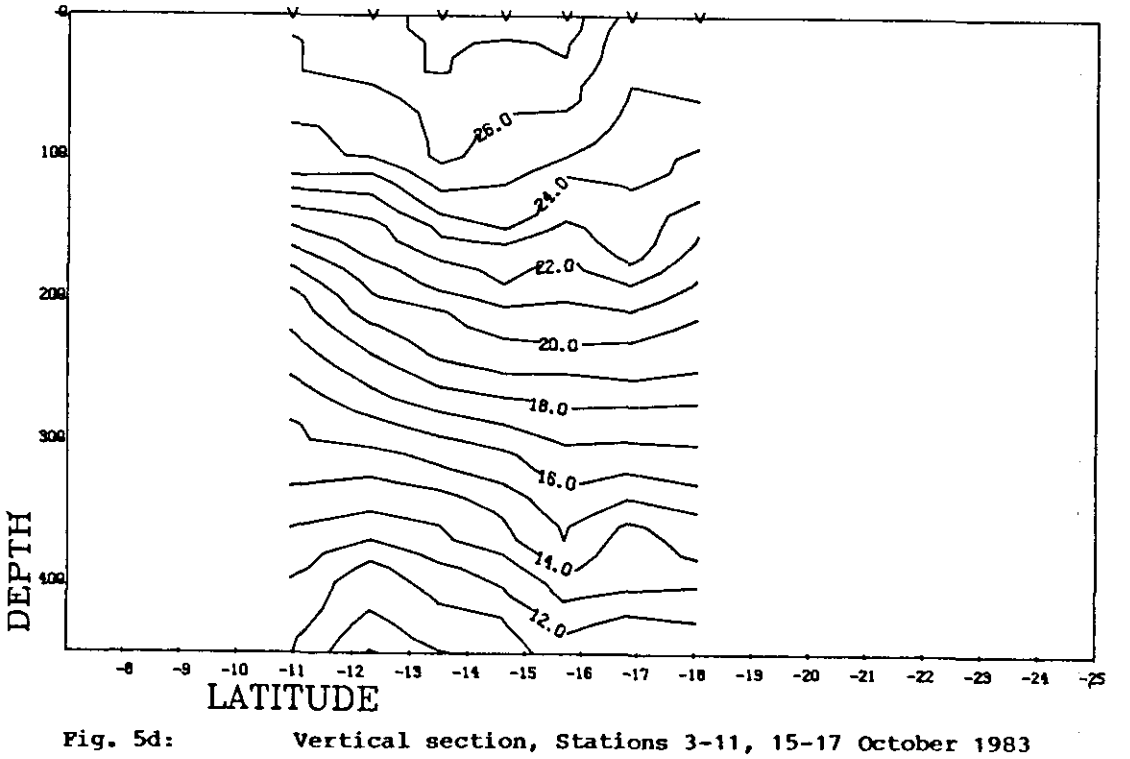

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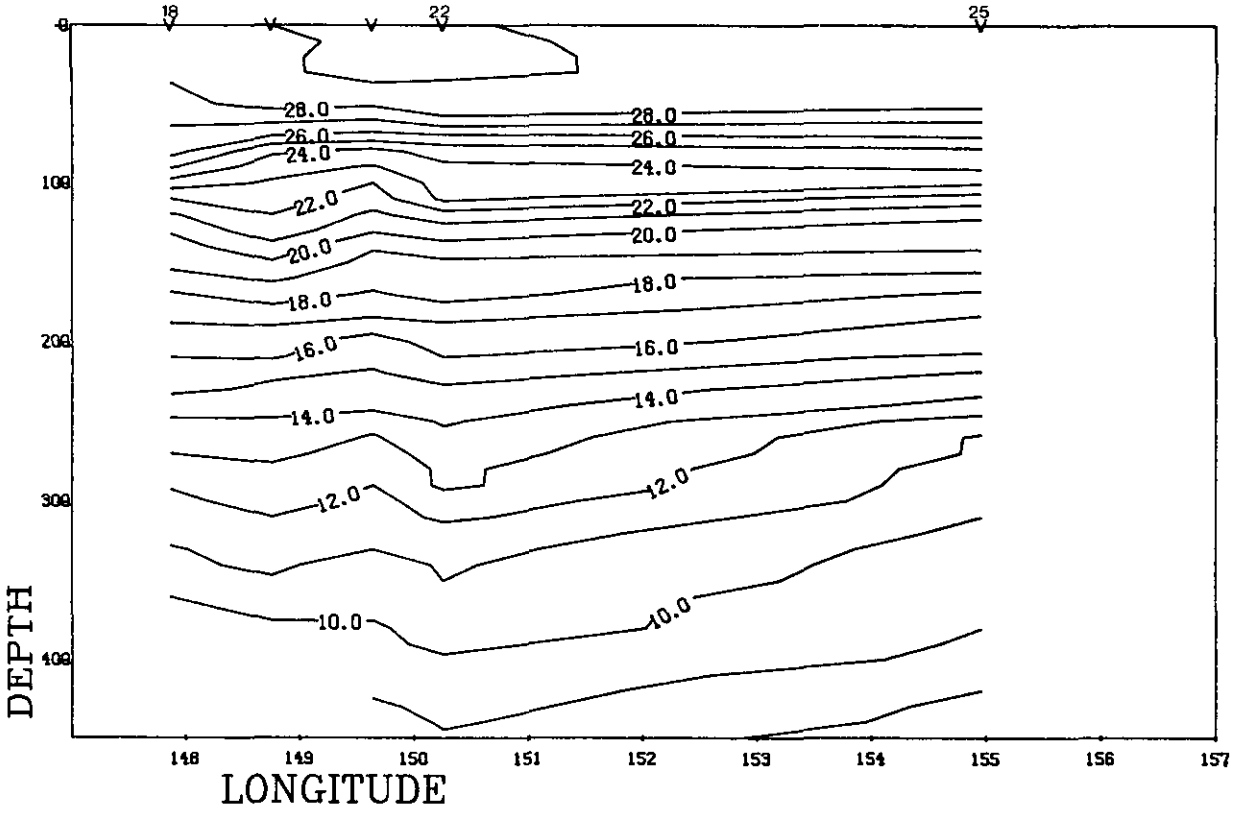

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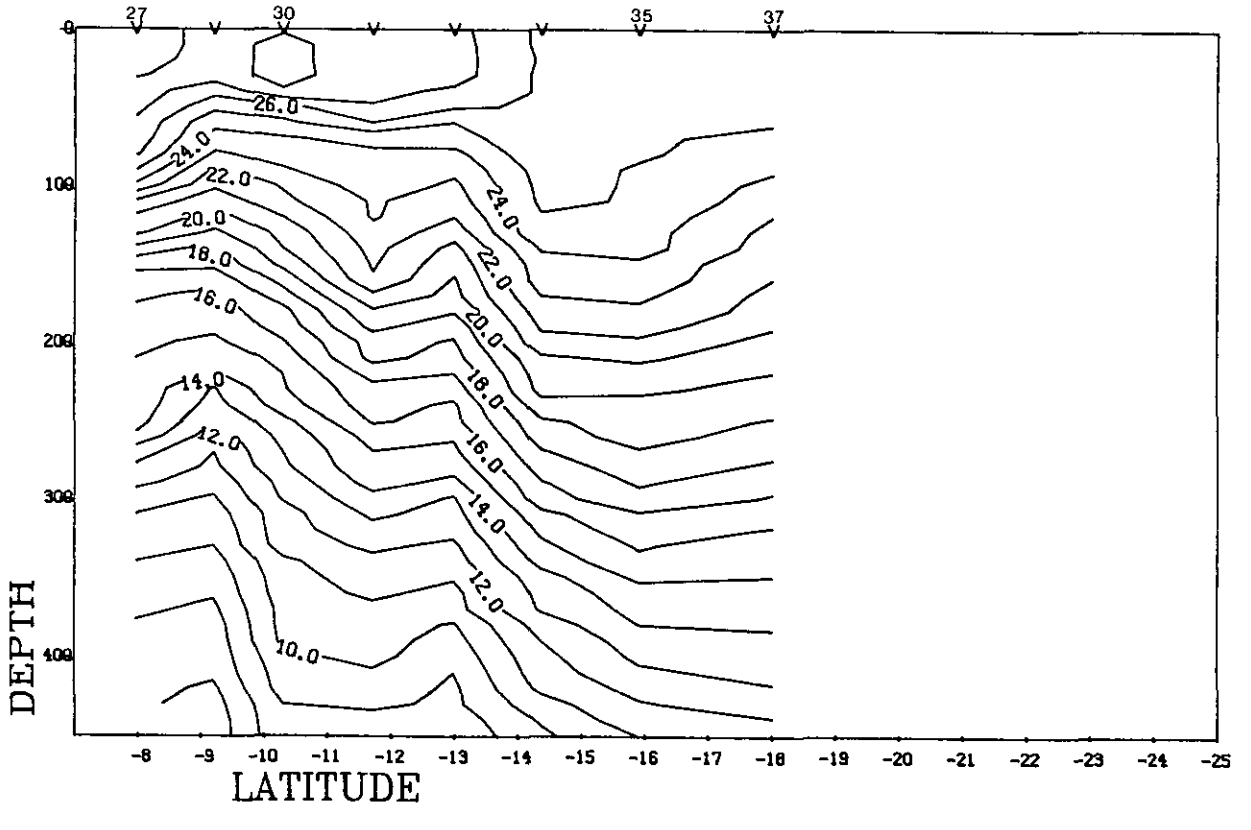

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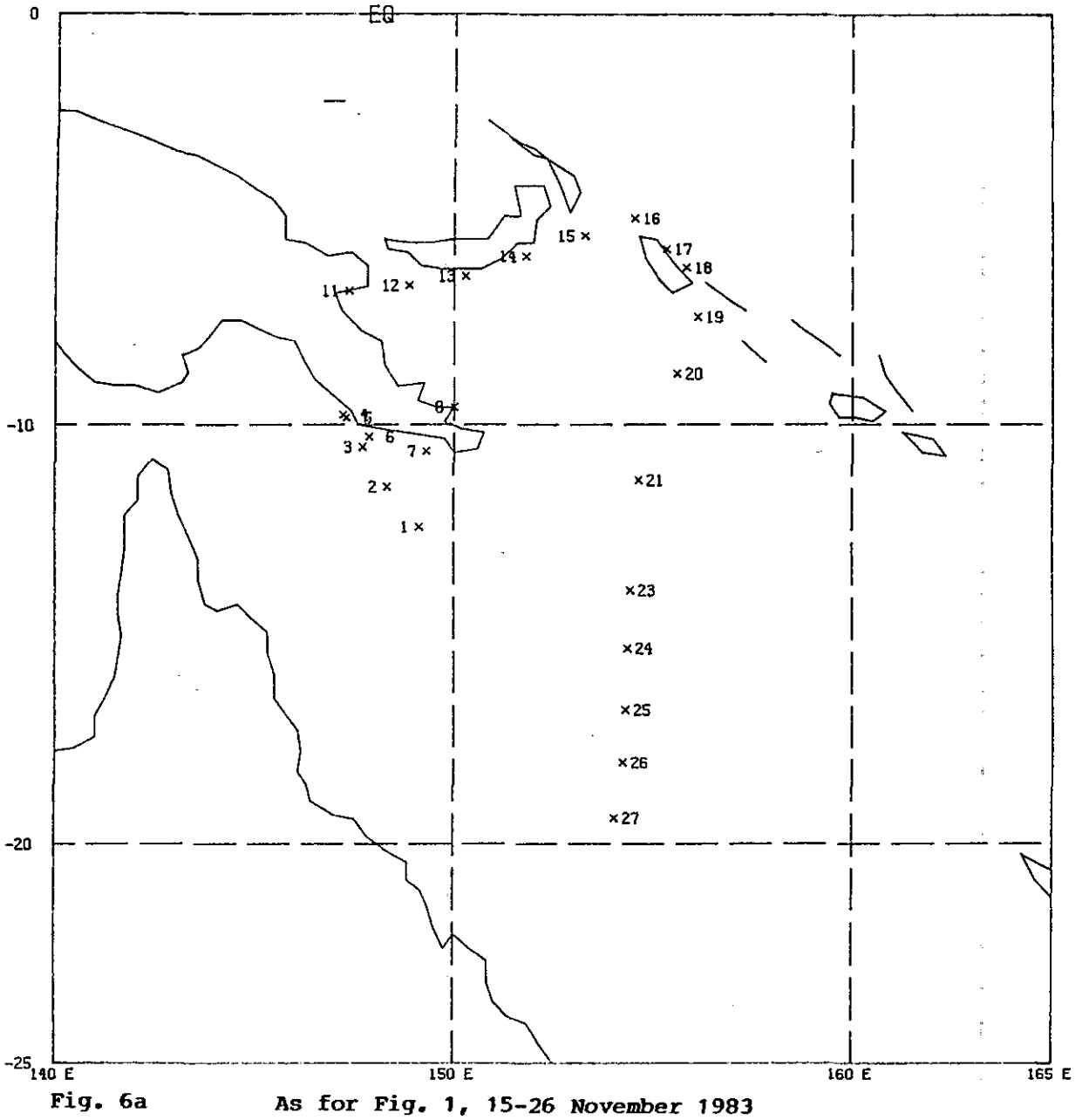

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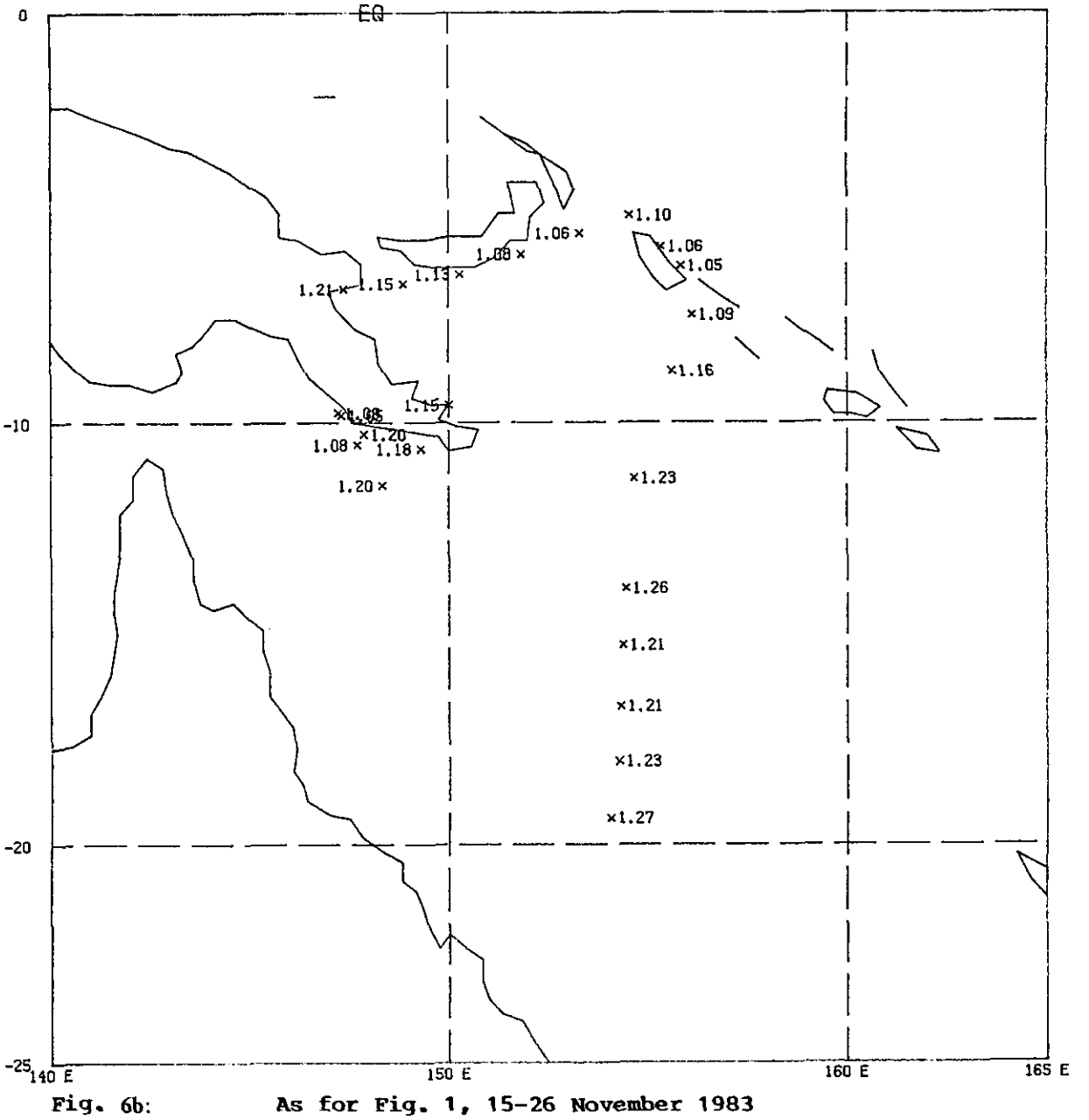

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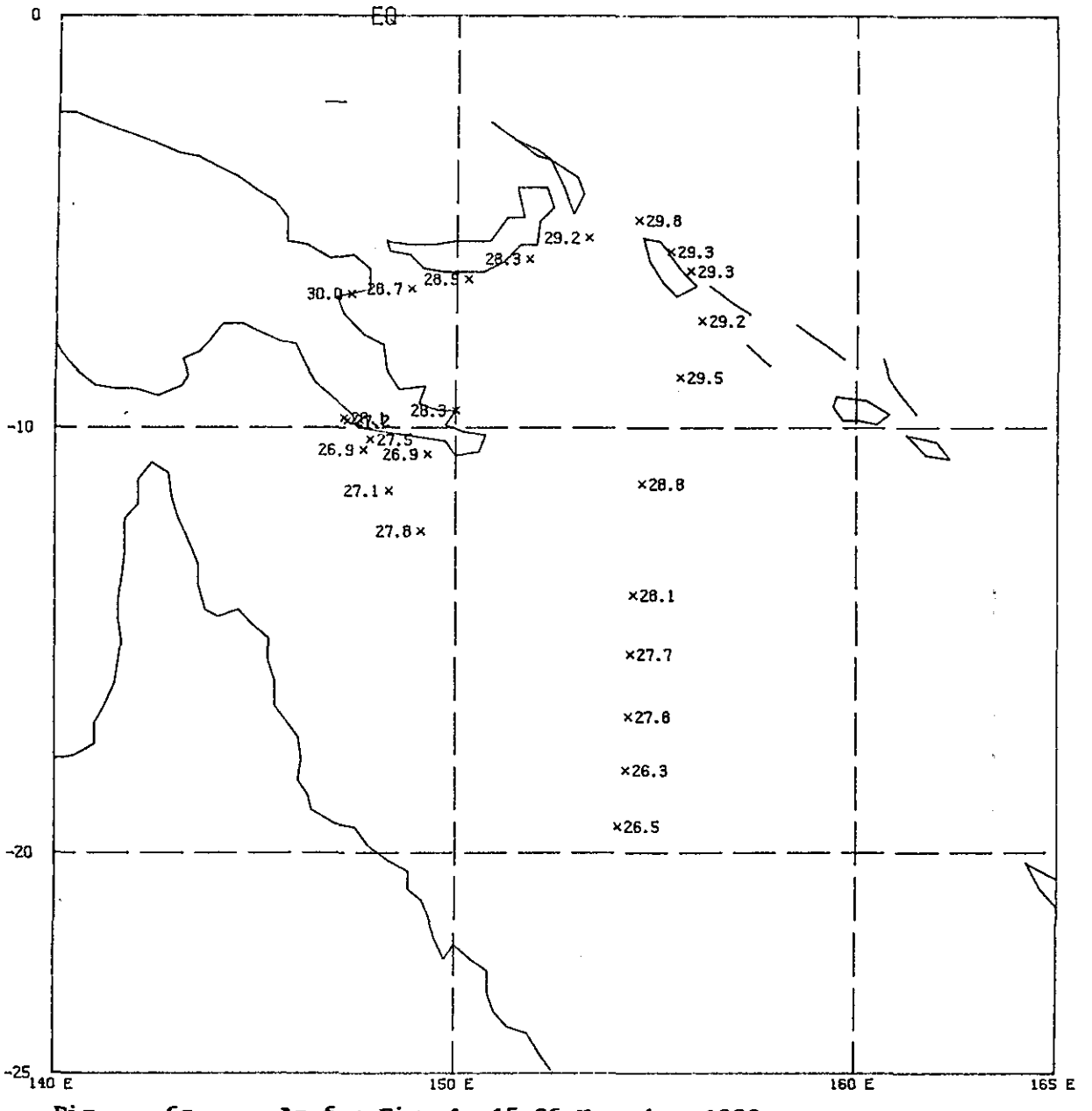

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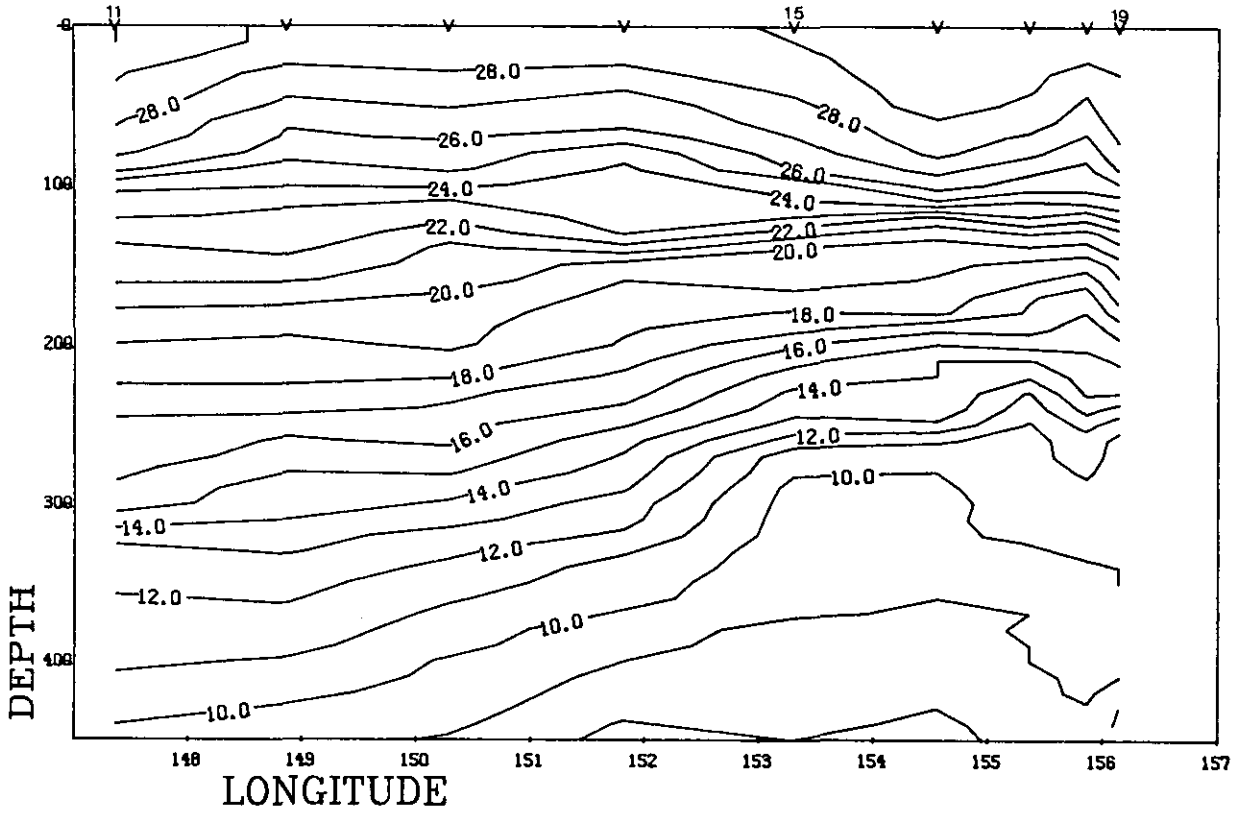

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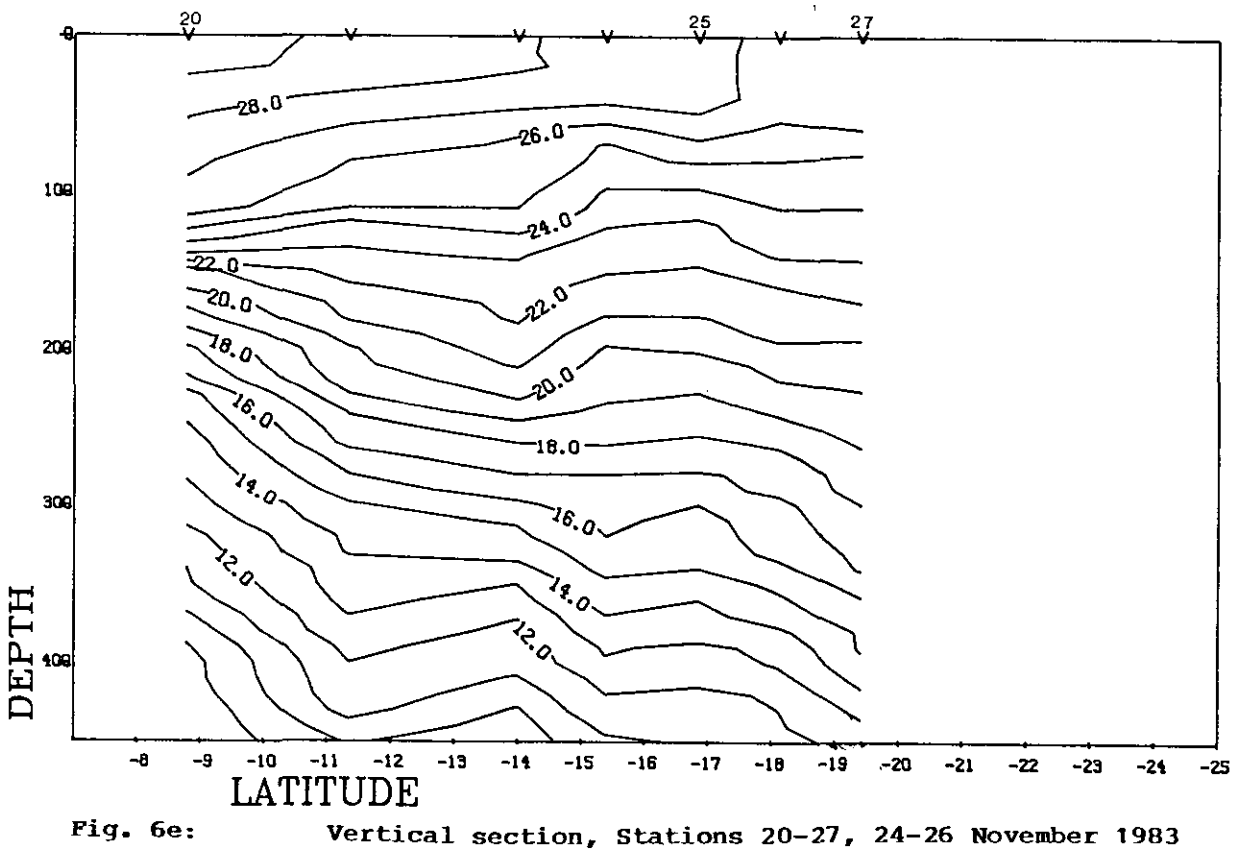

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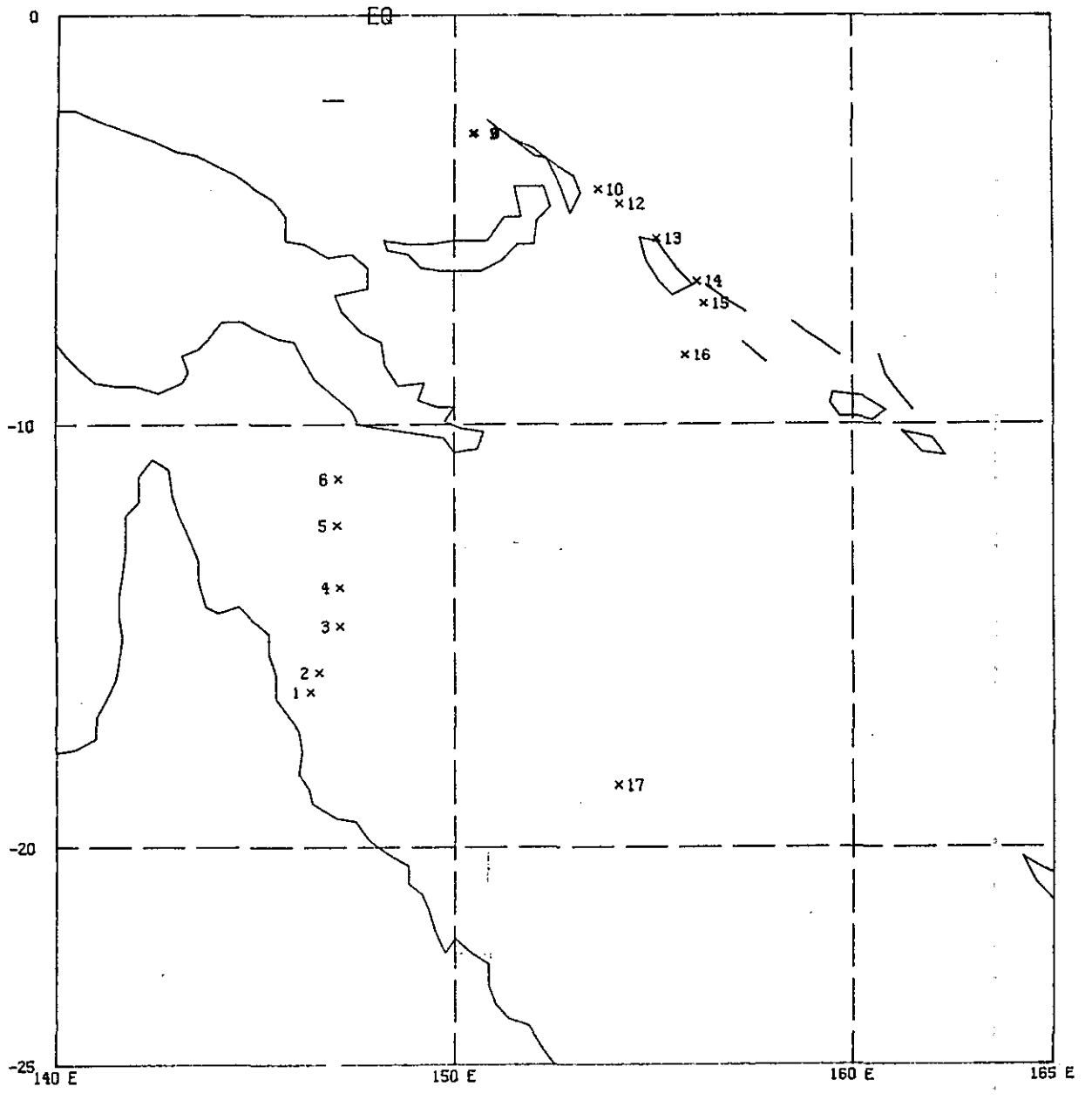

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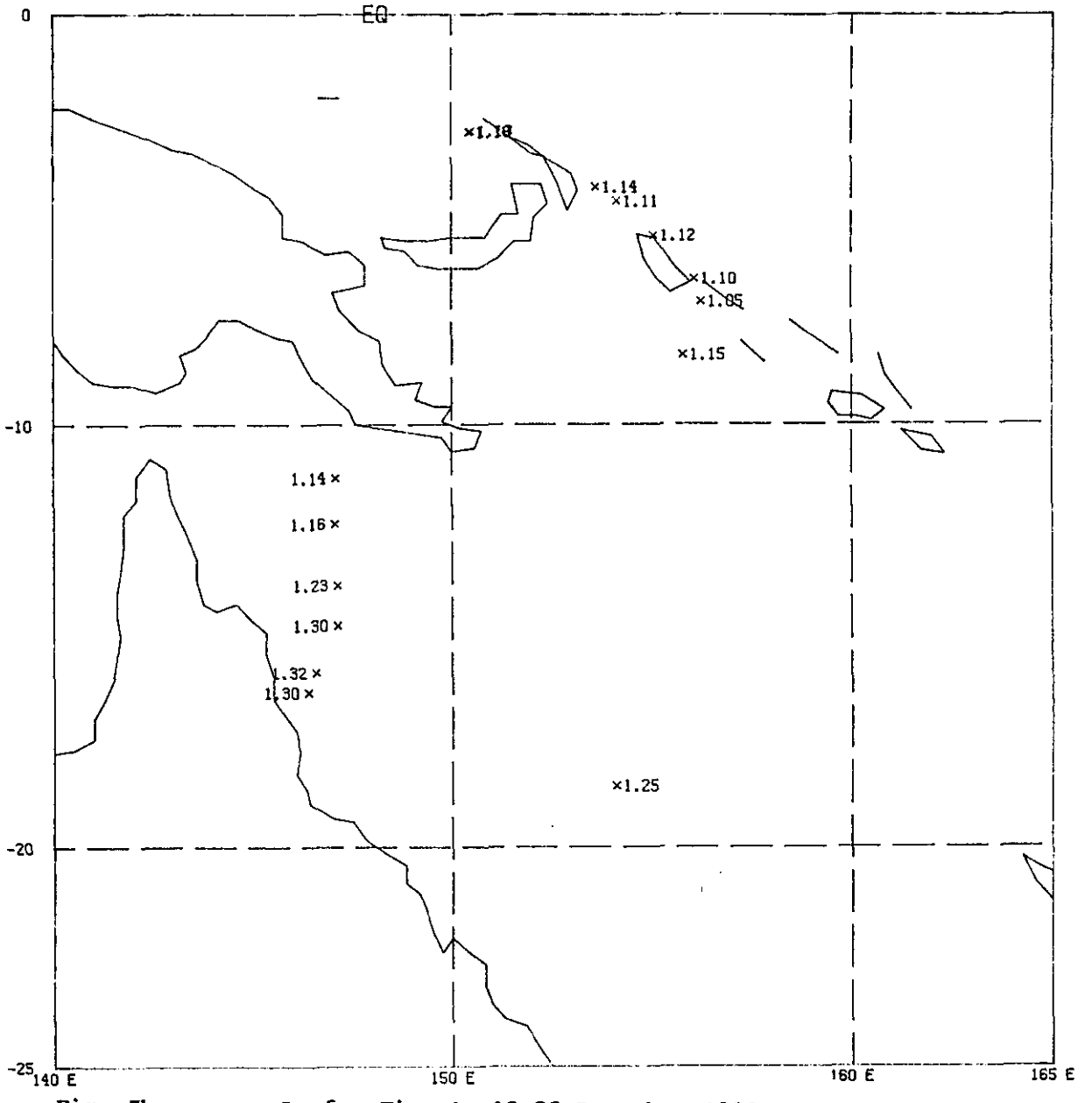

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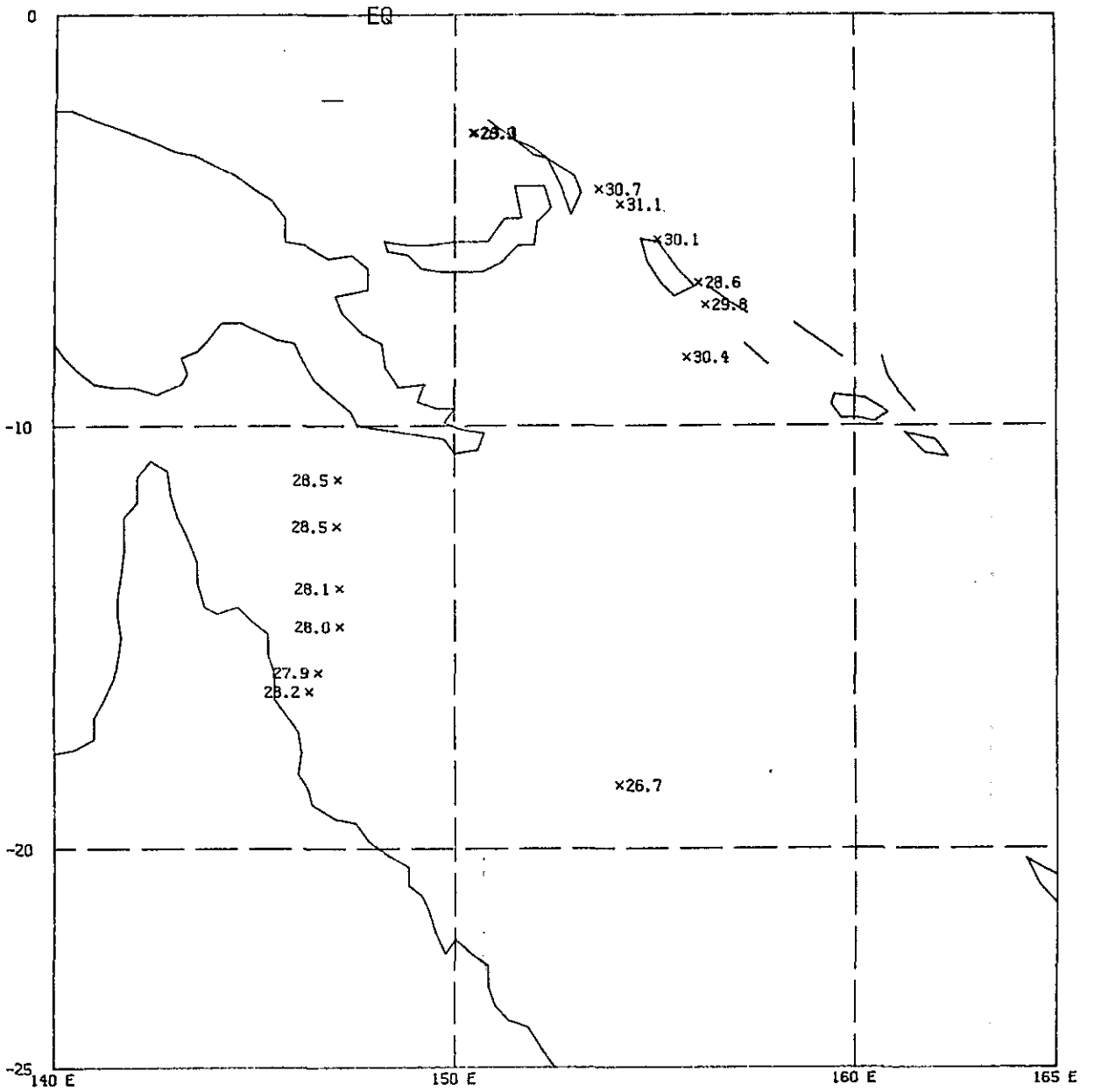

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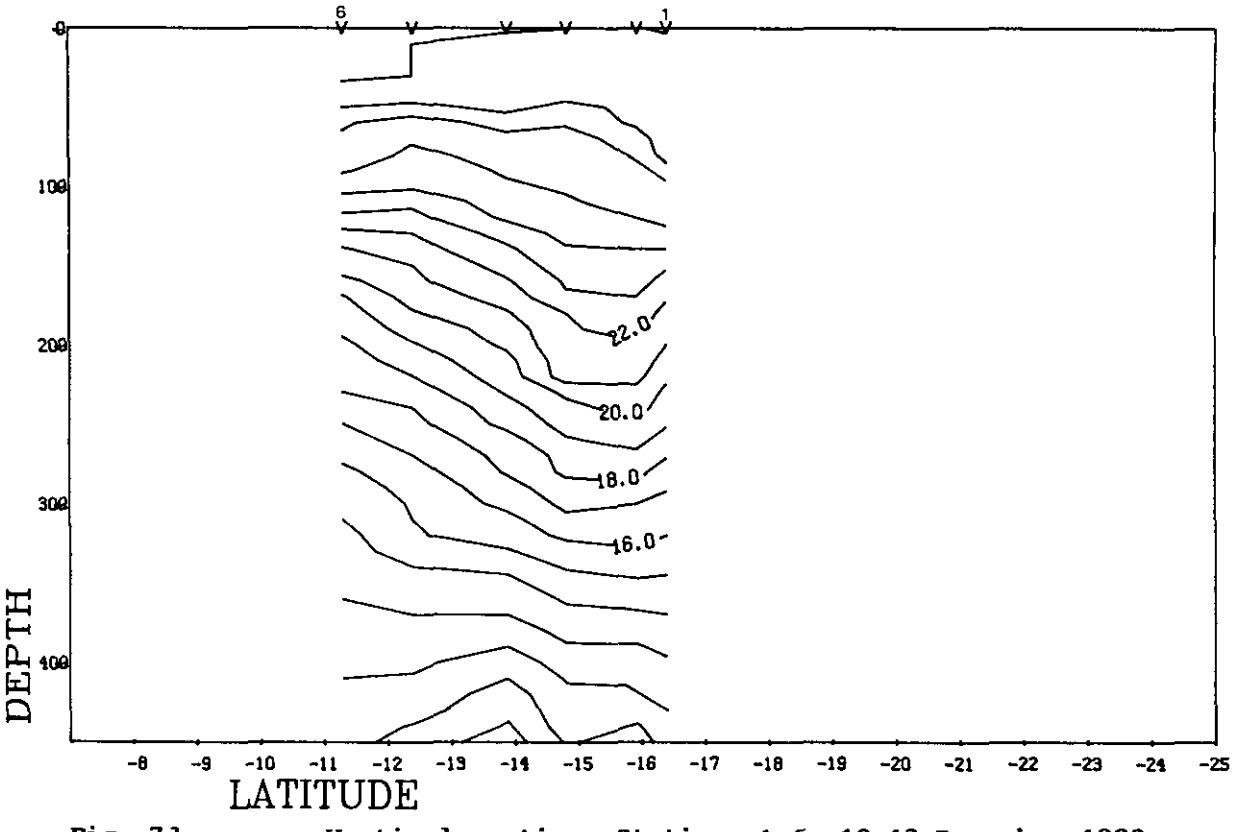
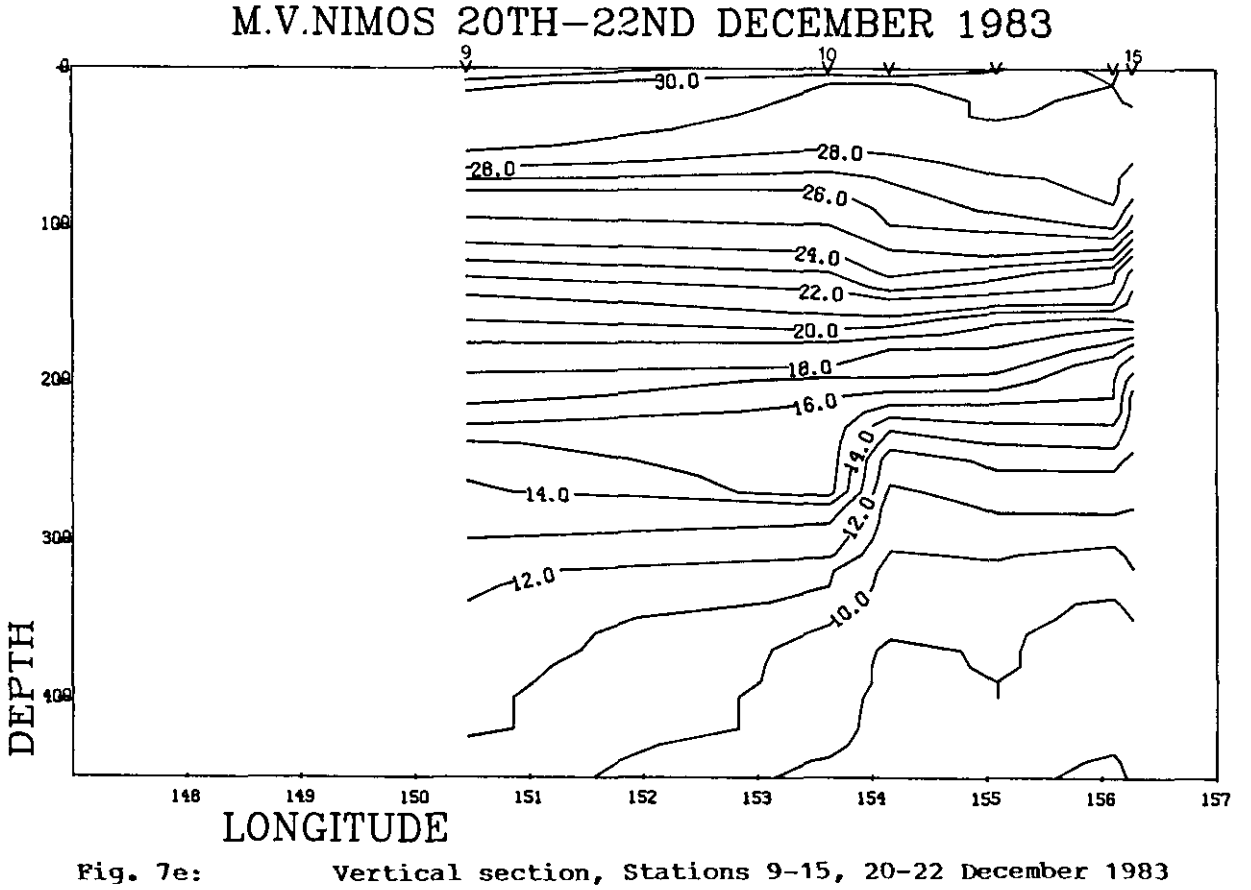


Fig. 7d: Vertical section, Stations 1-6, 12-13,December 1983



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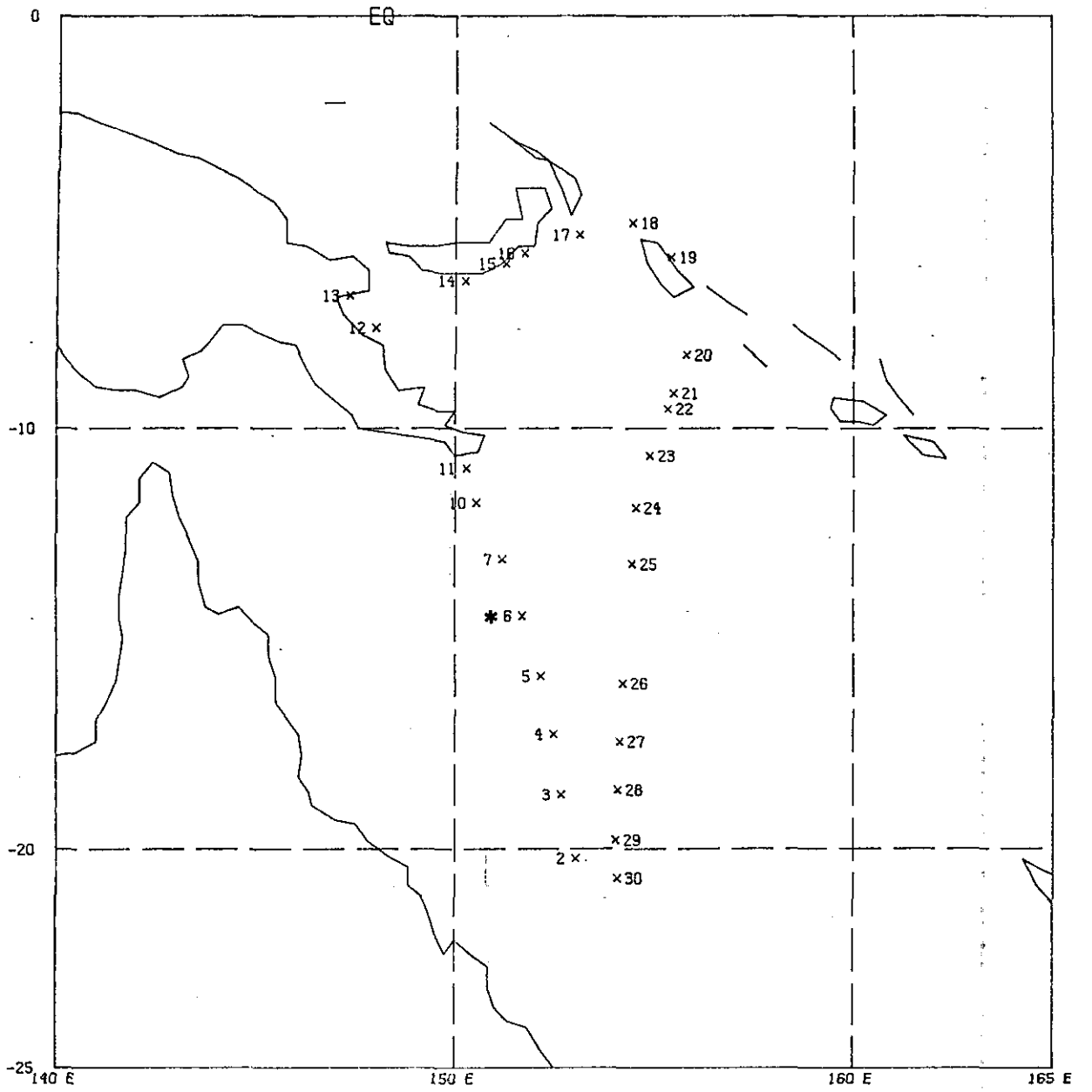

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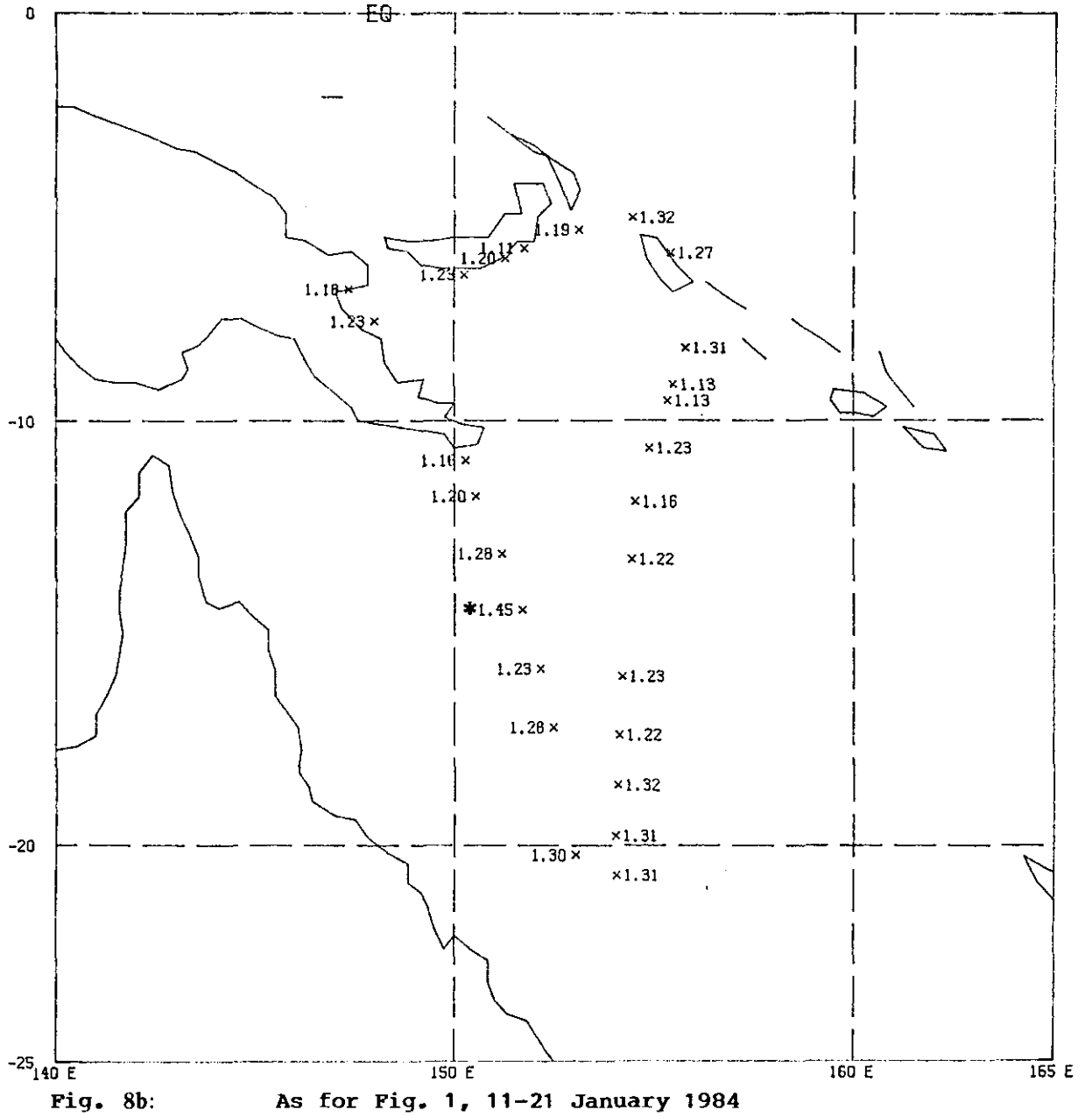

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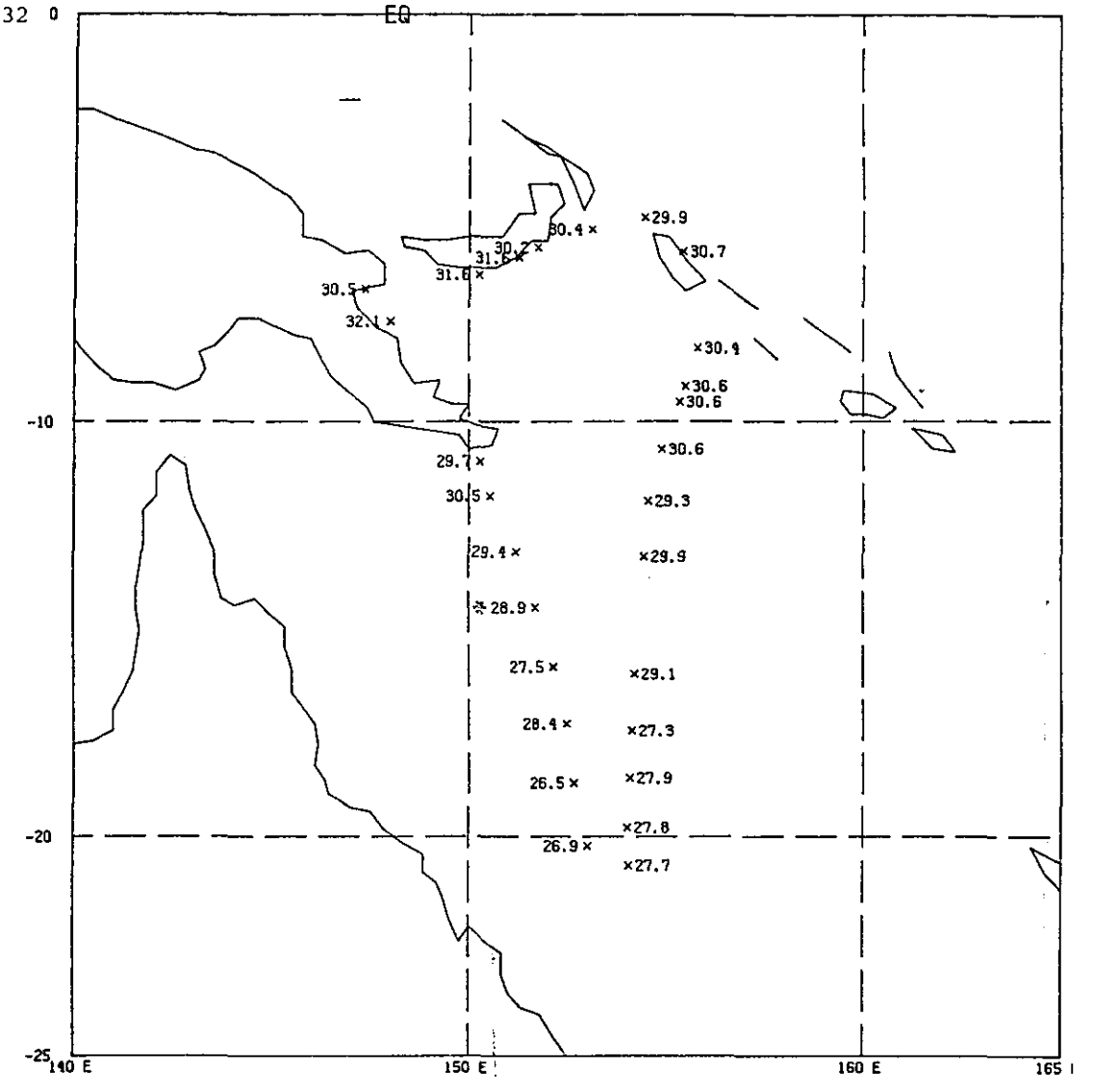

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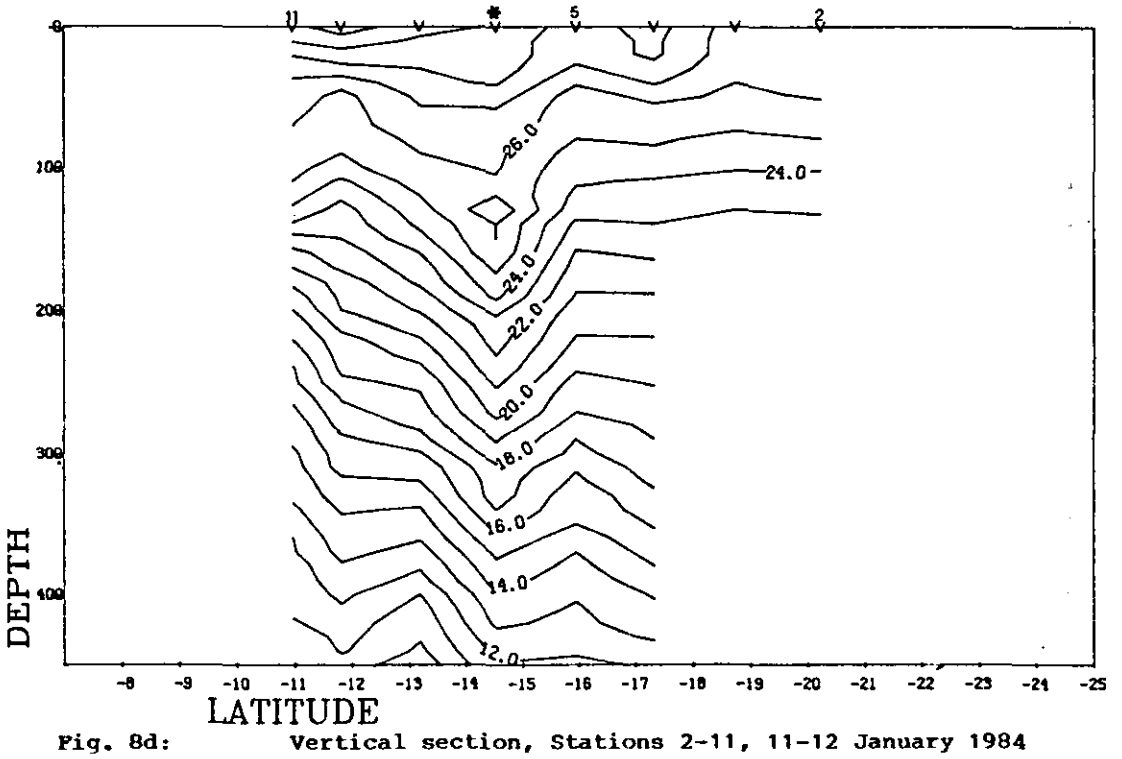

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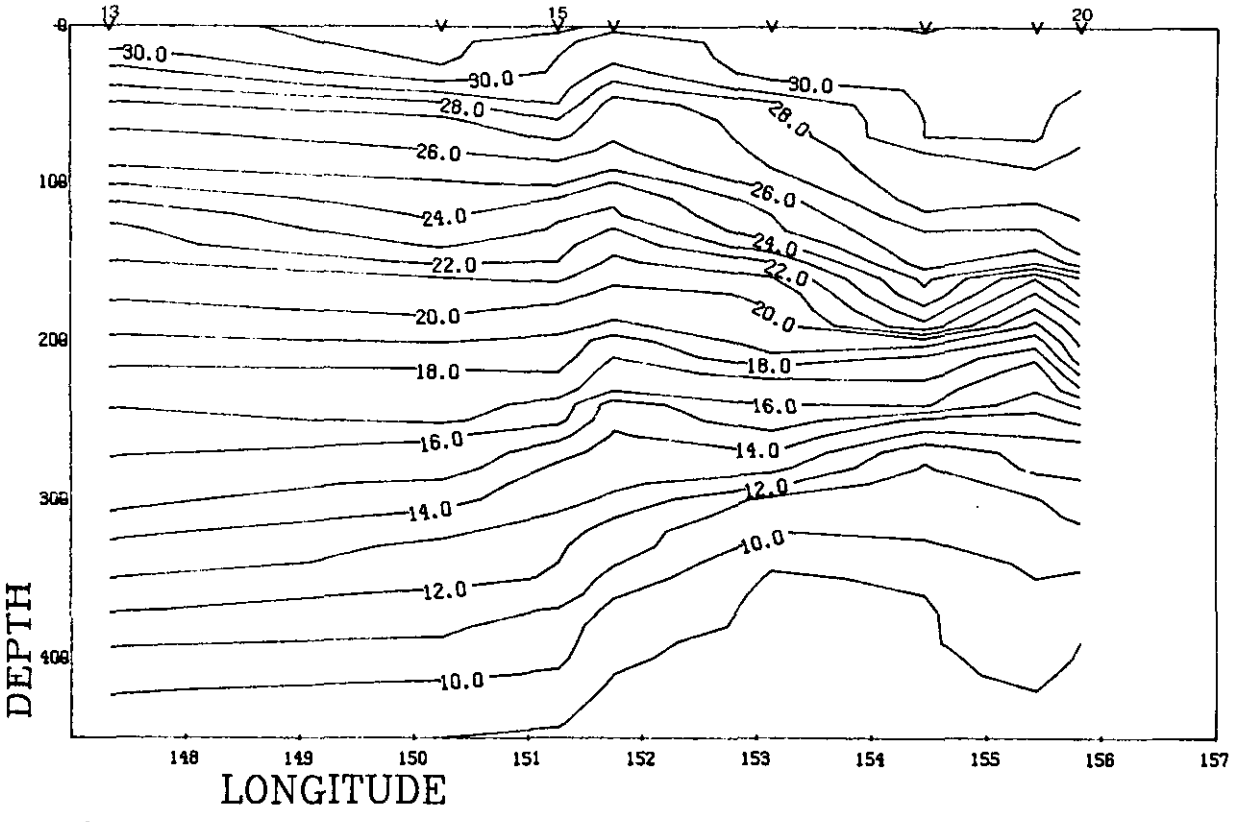

Fig. 8e: Vertical section, Stations 13-20, 16-18 January 1984

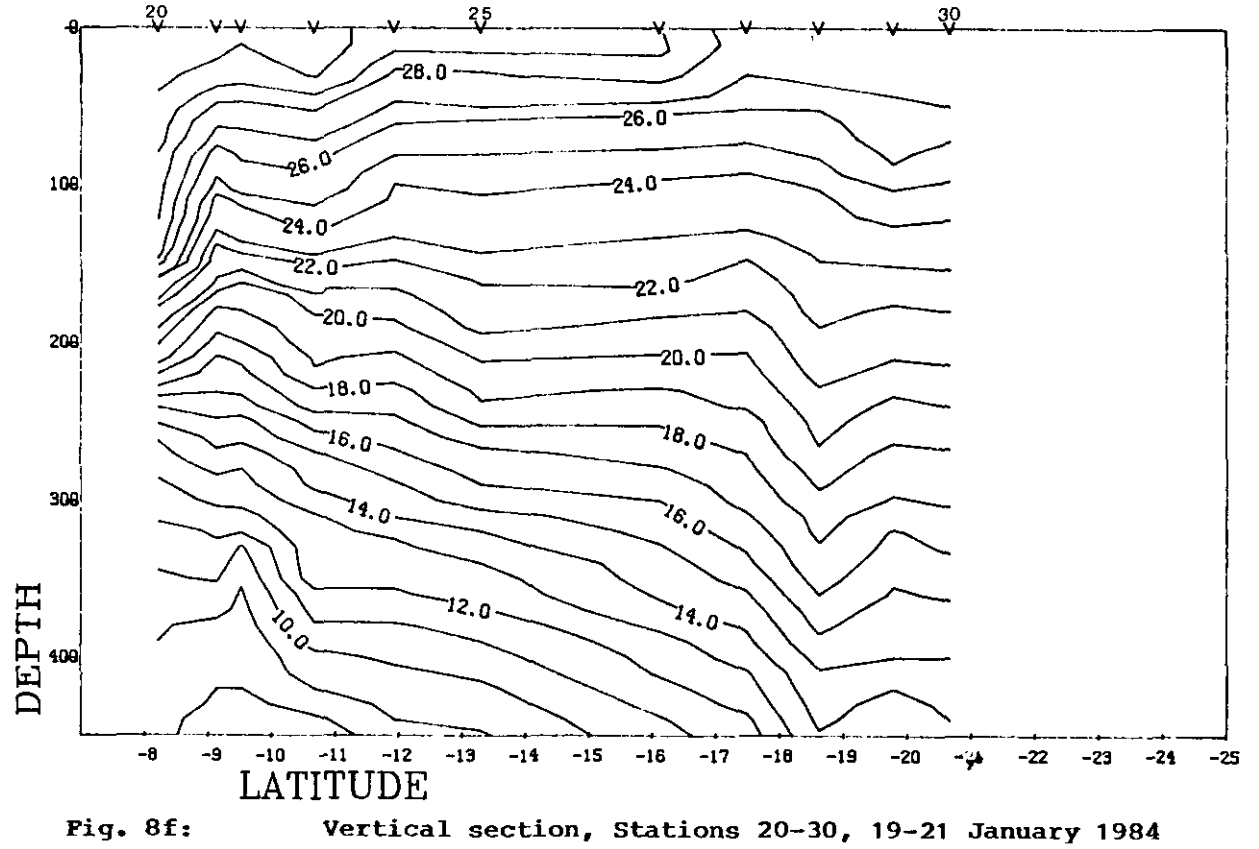

Fig. 8f: Vertical section, Stations 20-30, 19-21 January 1984

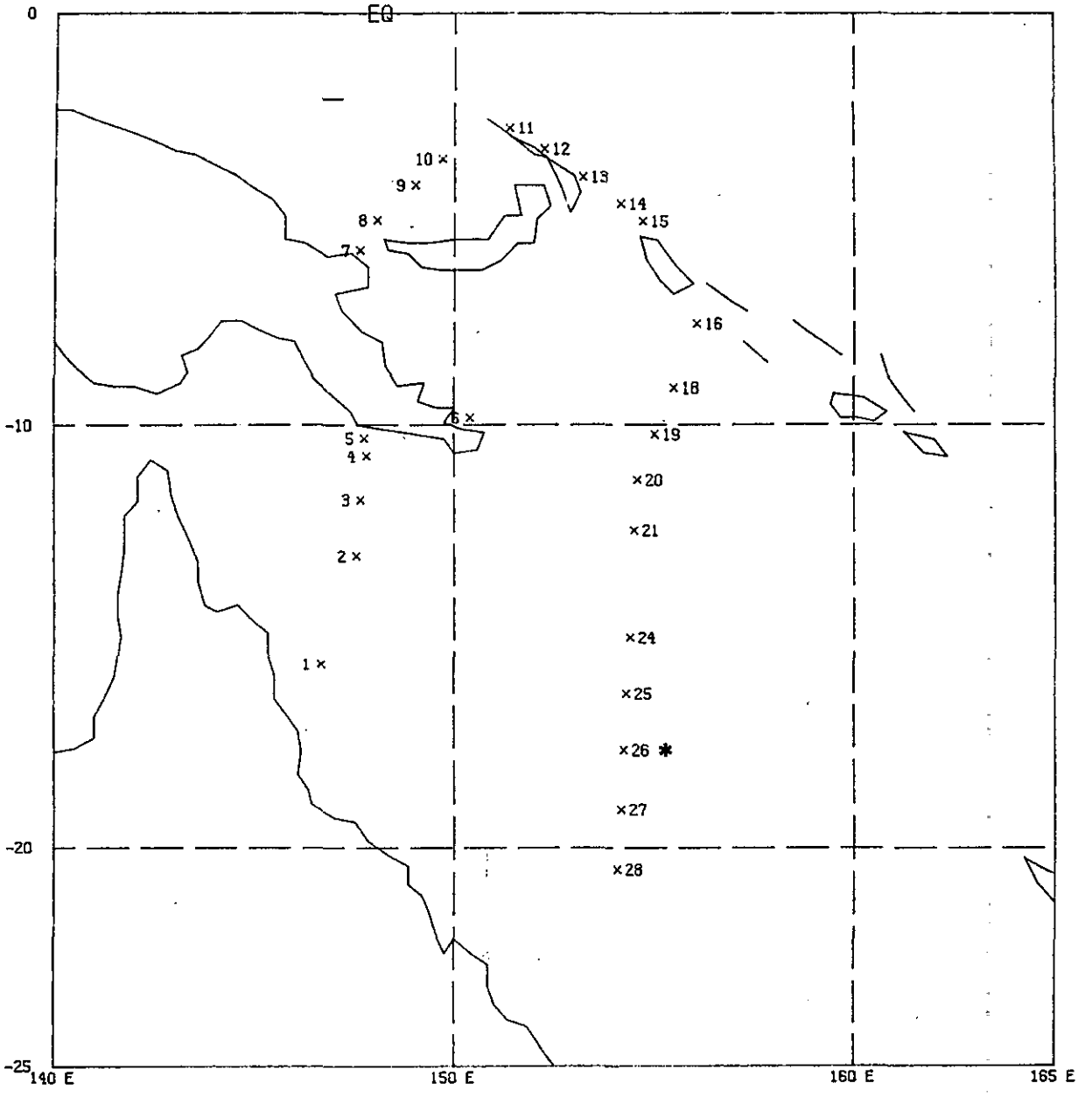

Fig. 9a As for Fig. 1, 6-9 February 1984

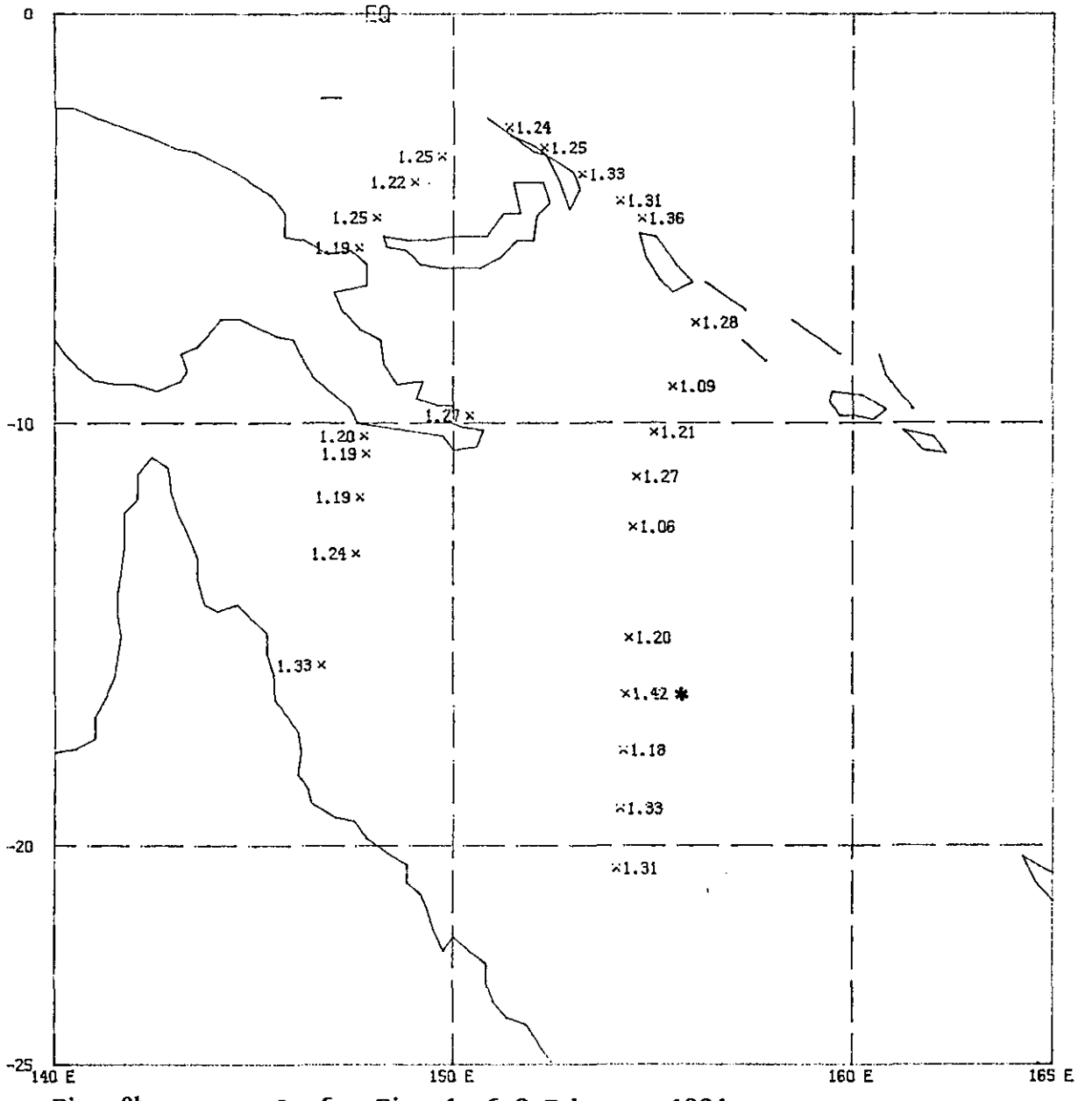

Fig. 9b: As for Fig. 1, 6-9 February 1984

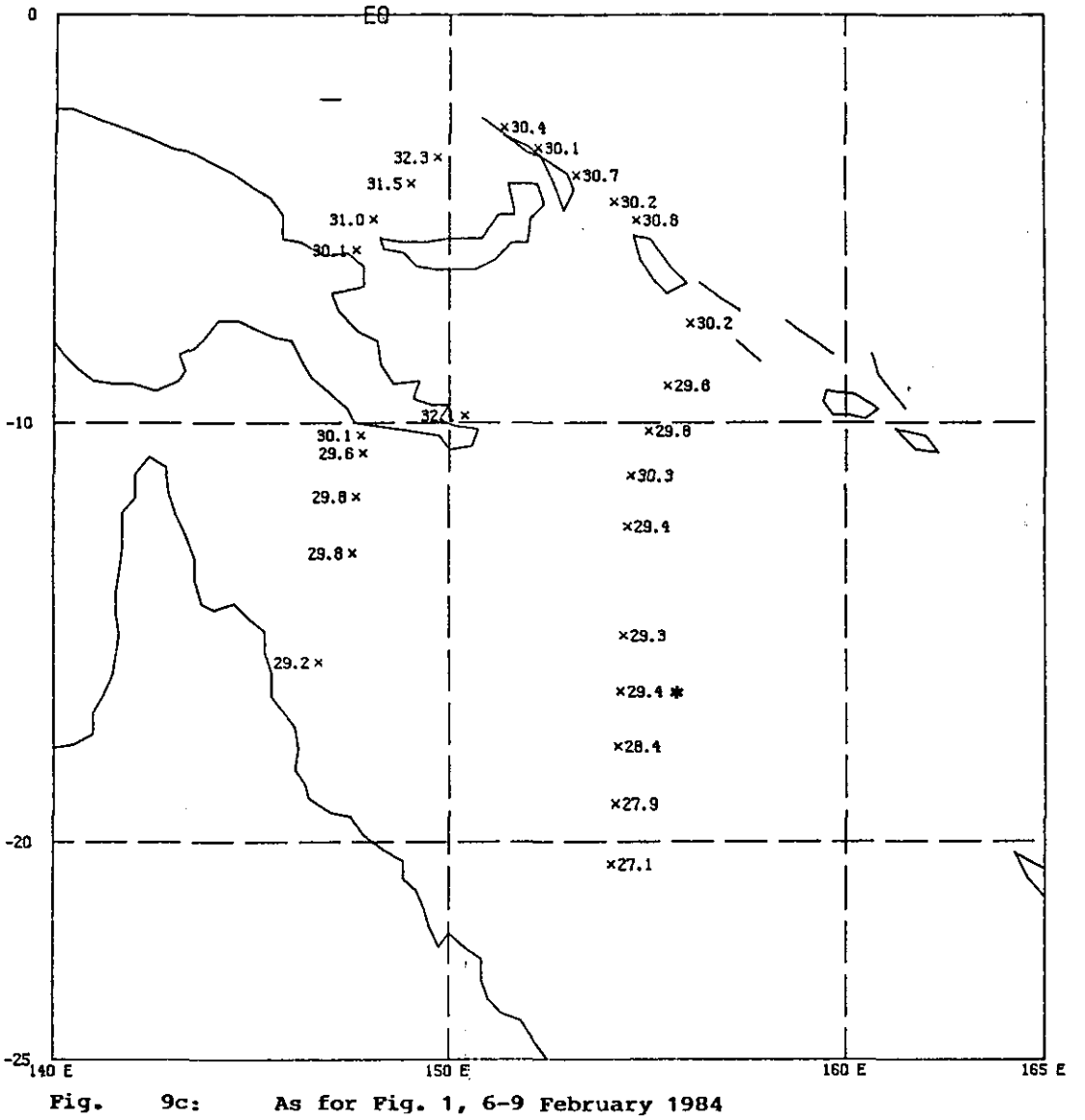

Fig. 9c: As for Fig. 1, 6-9 February 1984

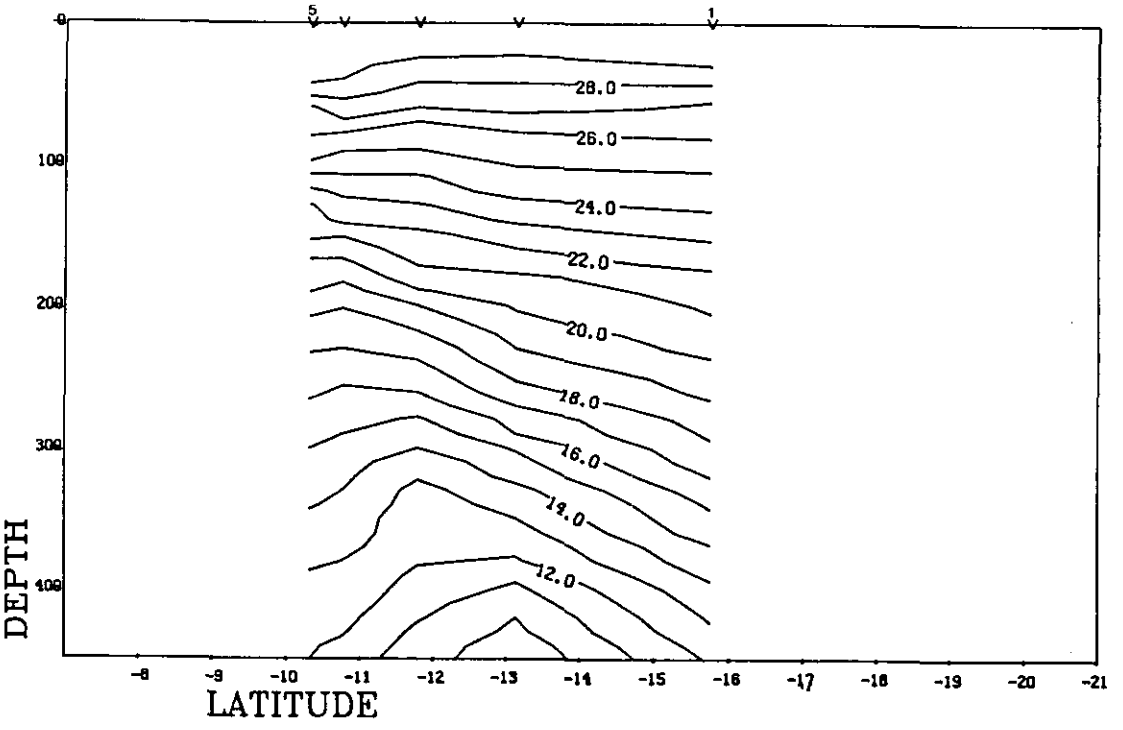

Fig. 9d: Vertical section, Stations 1-5, 6-7 February 1984

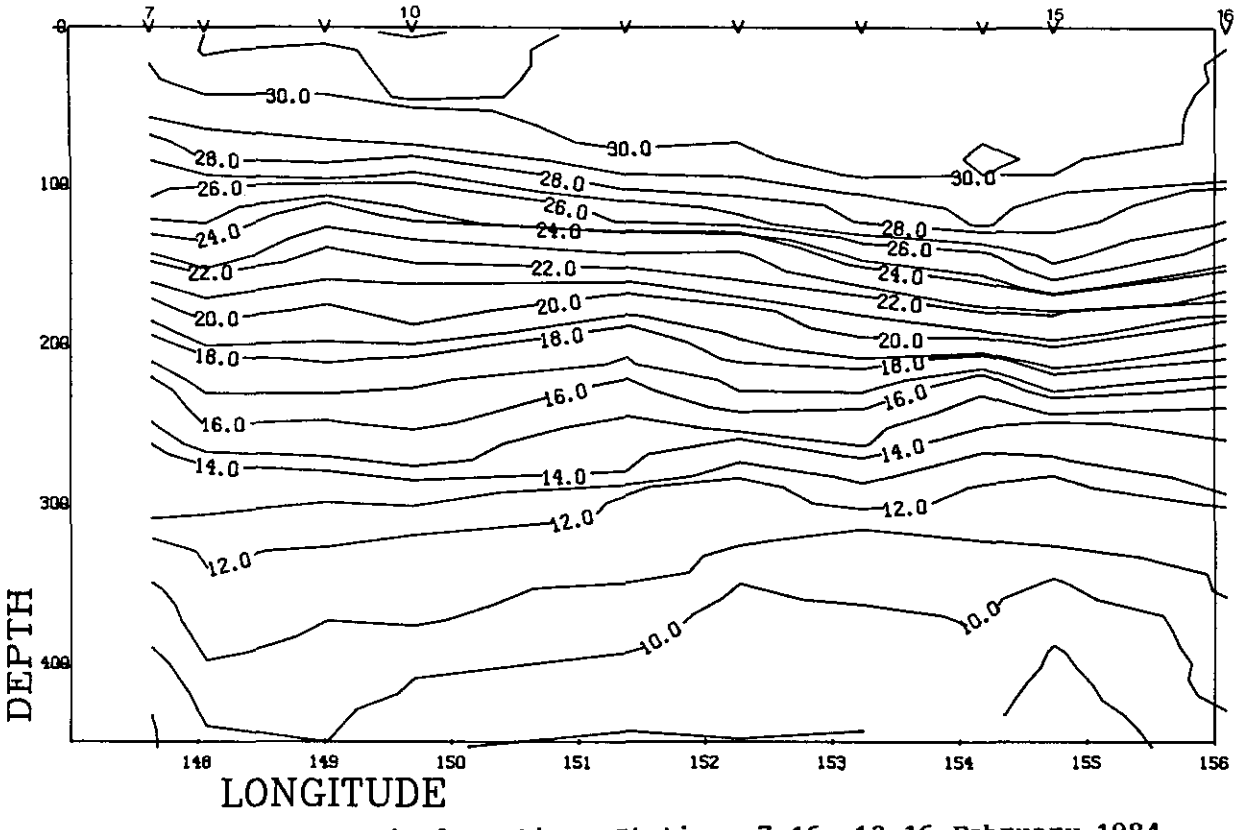

Fig. 9e: Vertical section, Stations 7-16, 12-16 February 1984

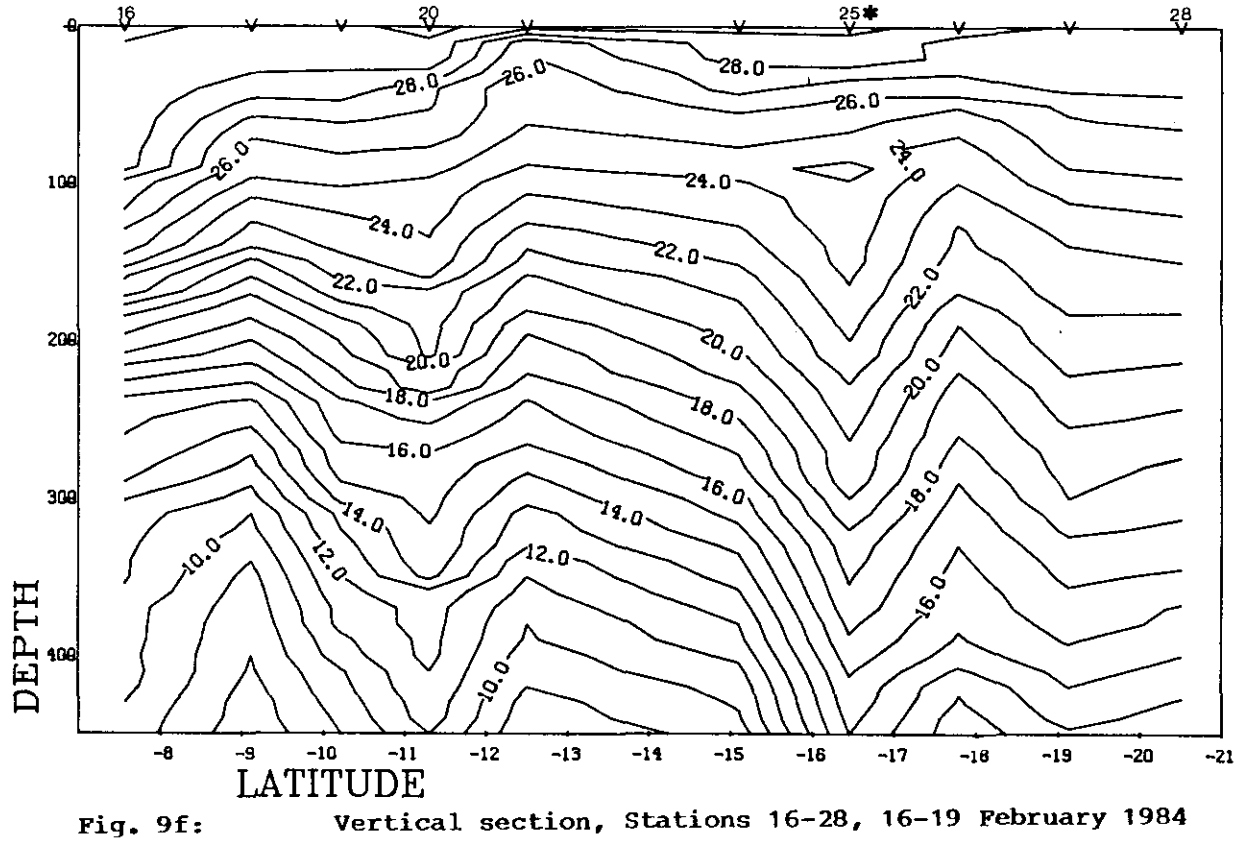

Fig. 9f: Vertical section, Stations 16-28, 16-19 February 1984

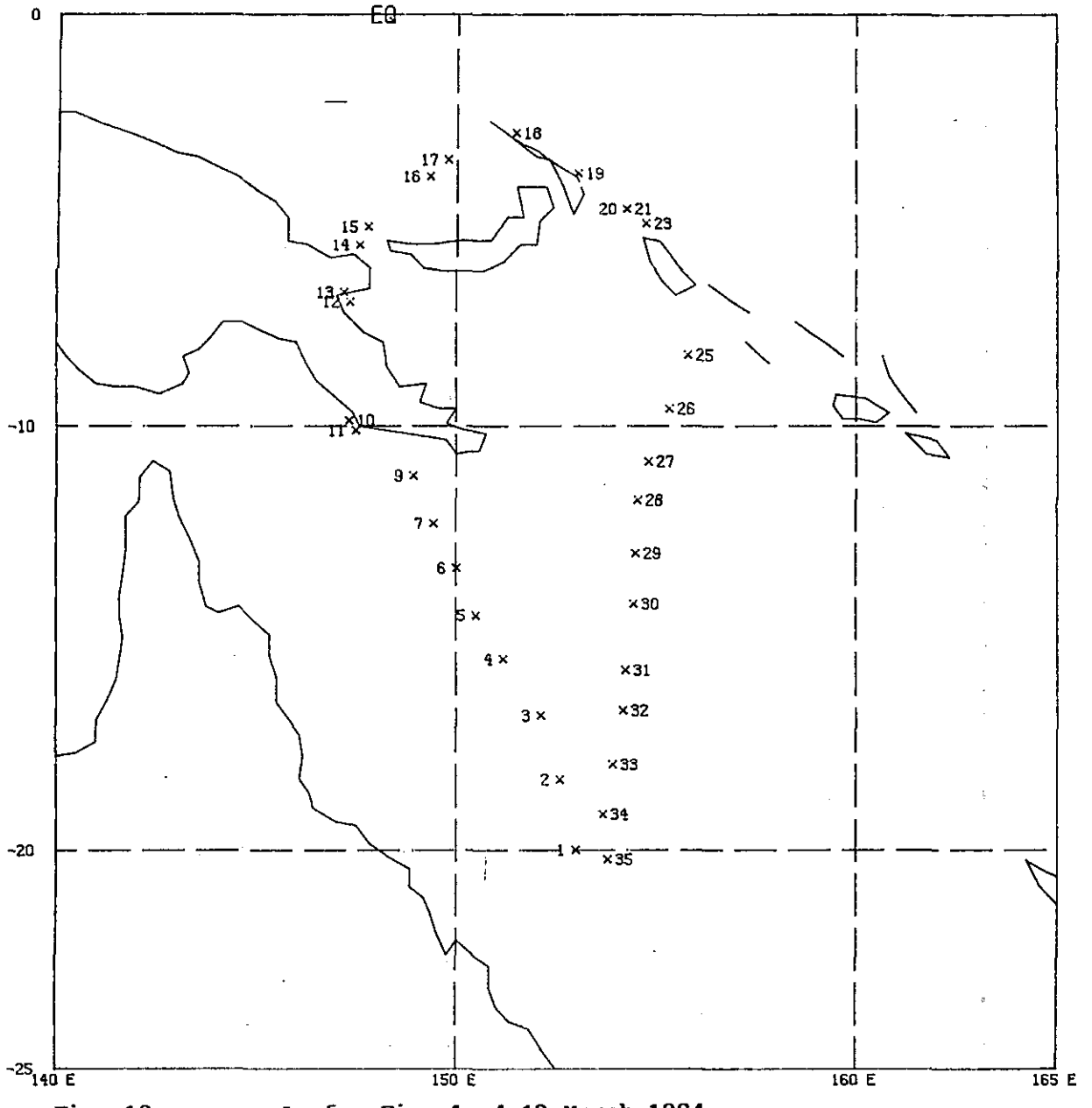

Fig. 10a As for Fig. 1, 4-18 March 1984

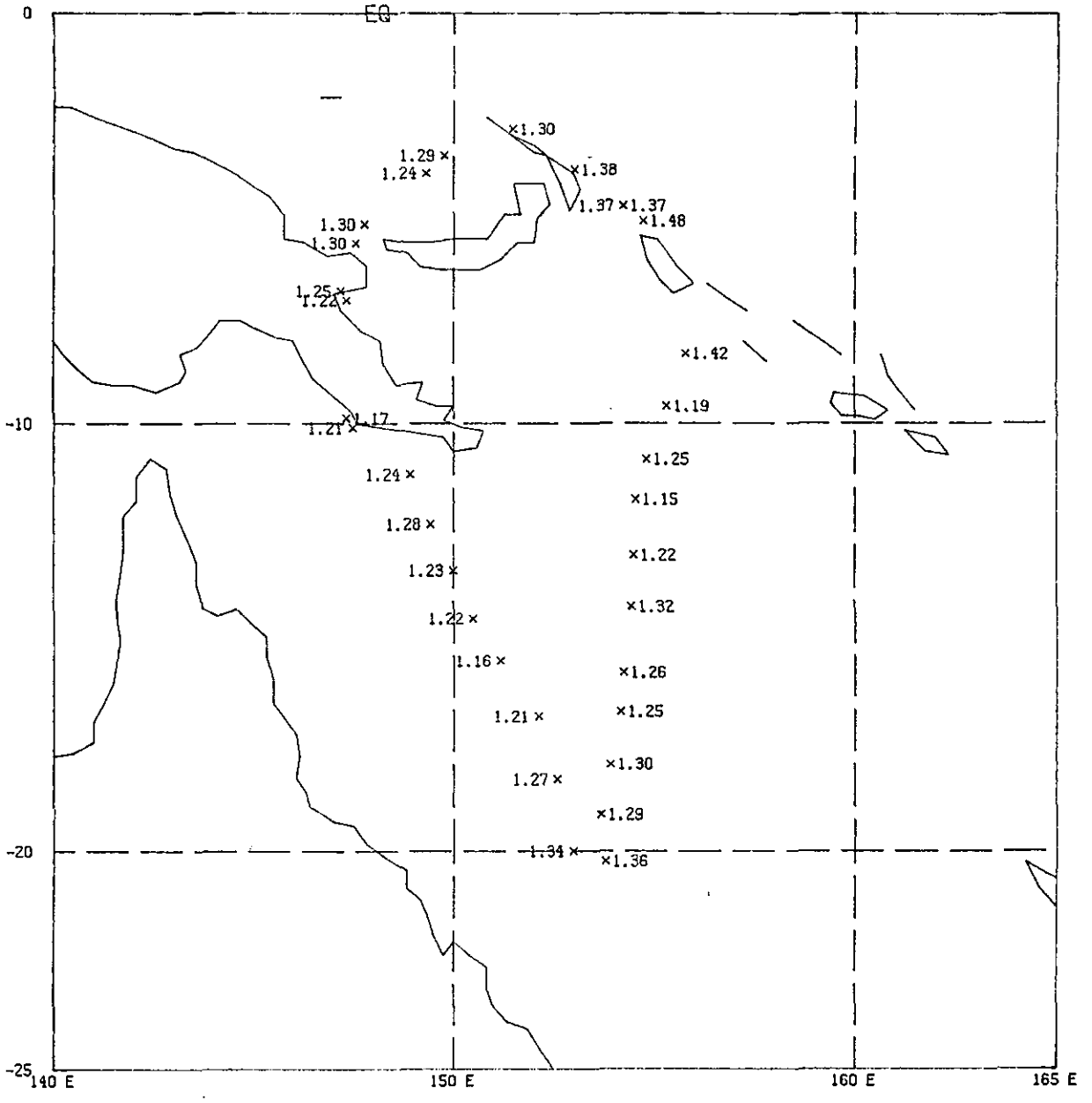

Fig. 10b: As for Fig. 1, 4-18 March 1984

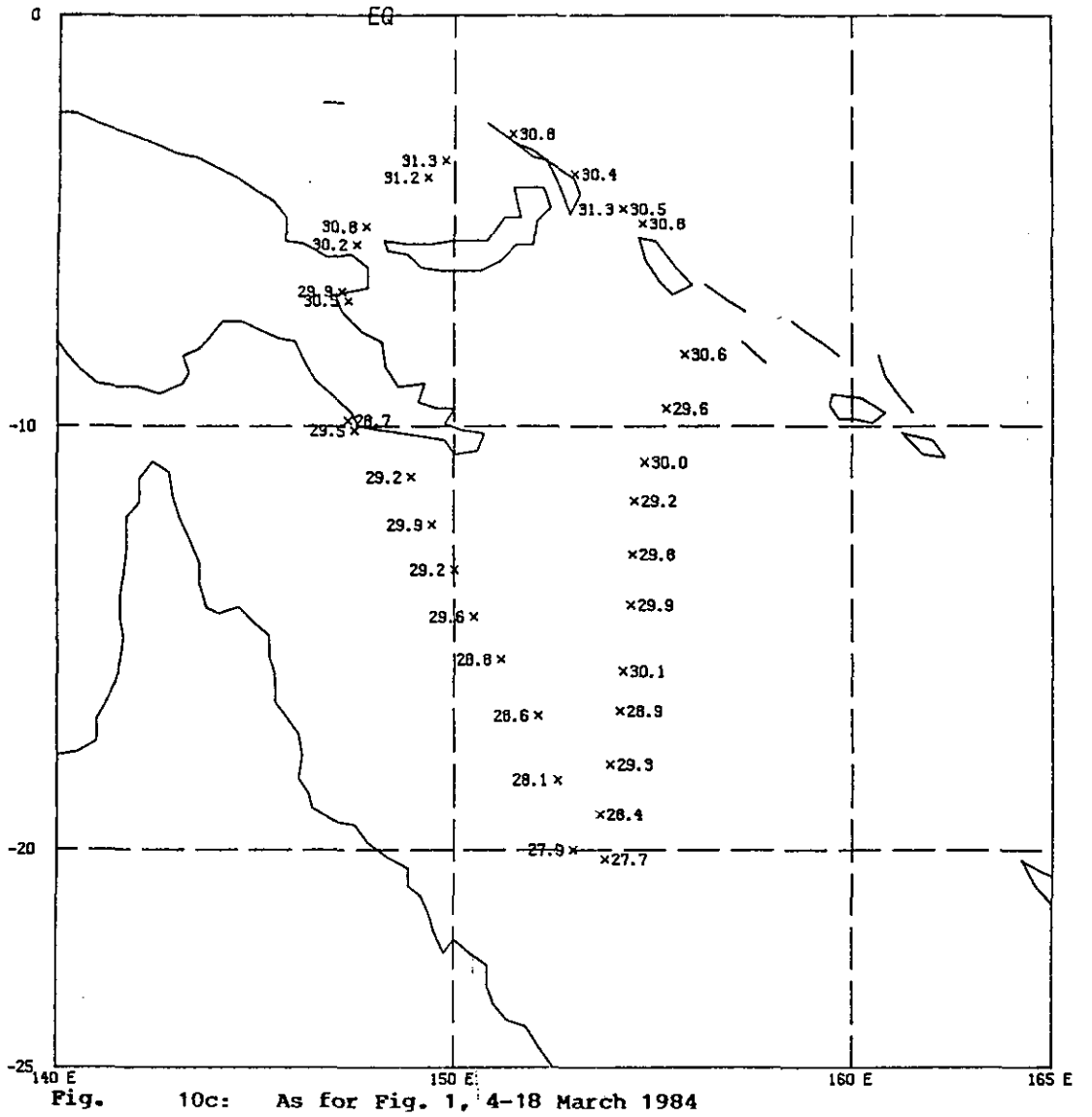

Fig. 10c: As for Fig. 1, 4-18 March 1984

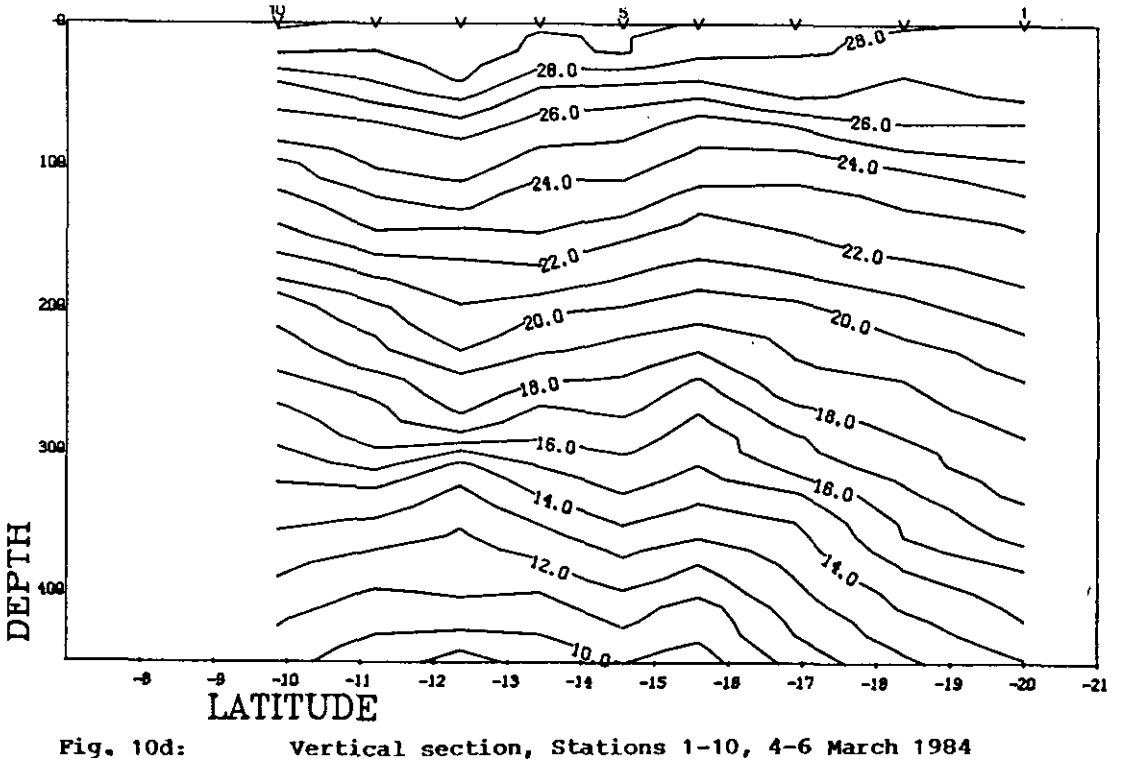

Fig. 10d: Vertical section, Stations 1-10, 4-6 March 1984

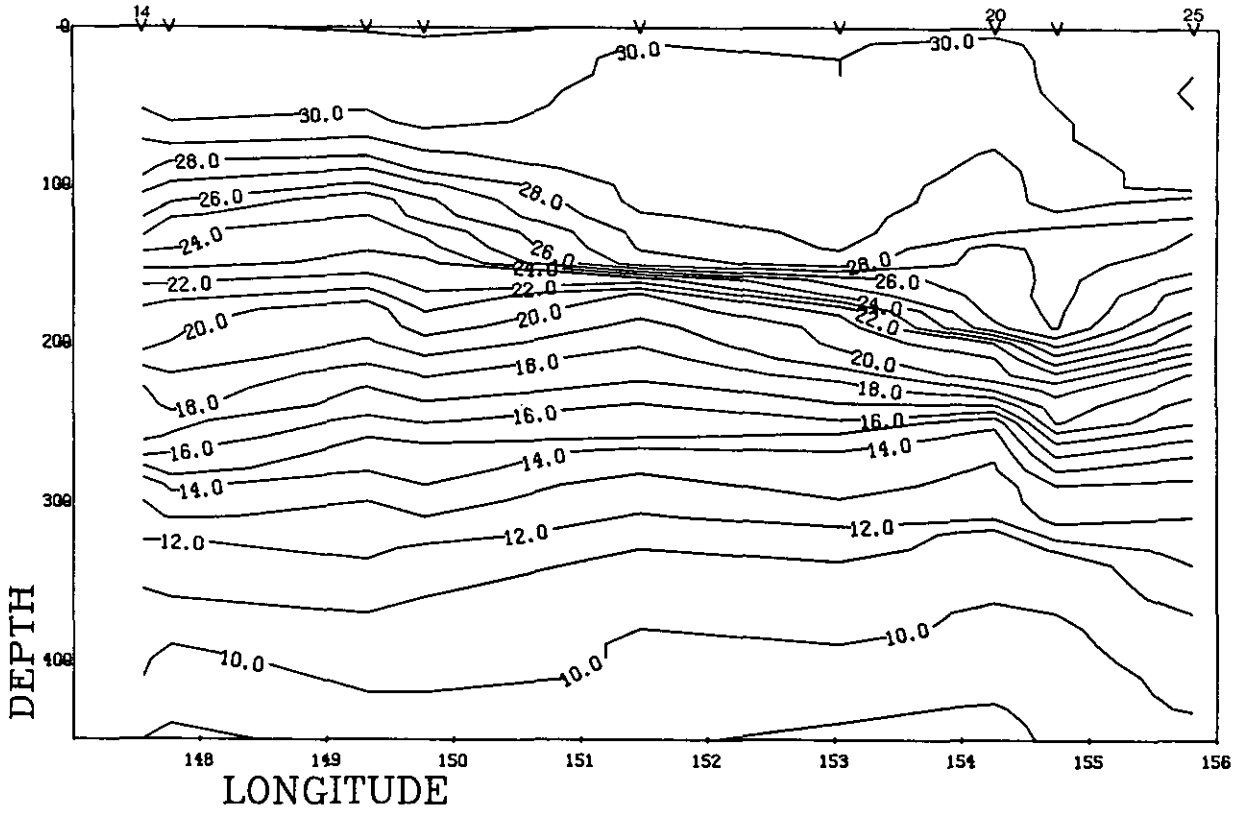

Fig. 10e: Vertical section, Stations 11-16, 11-16 March 1984

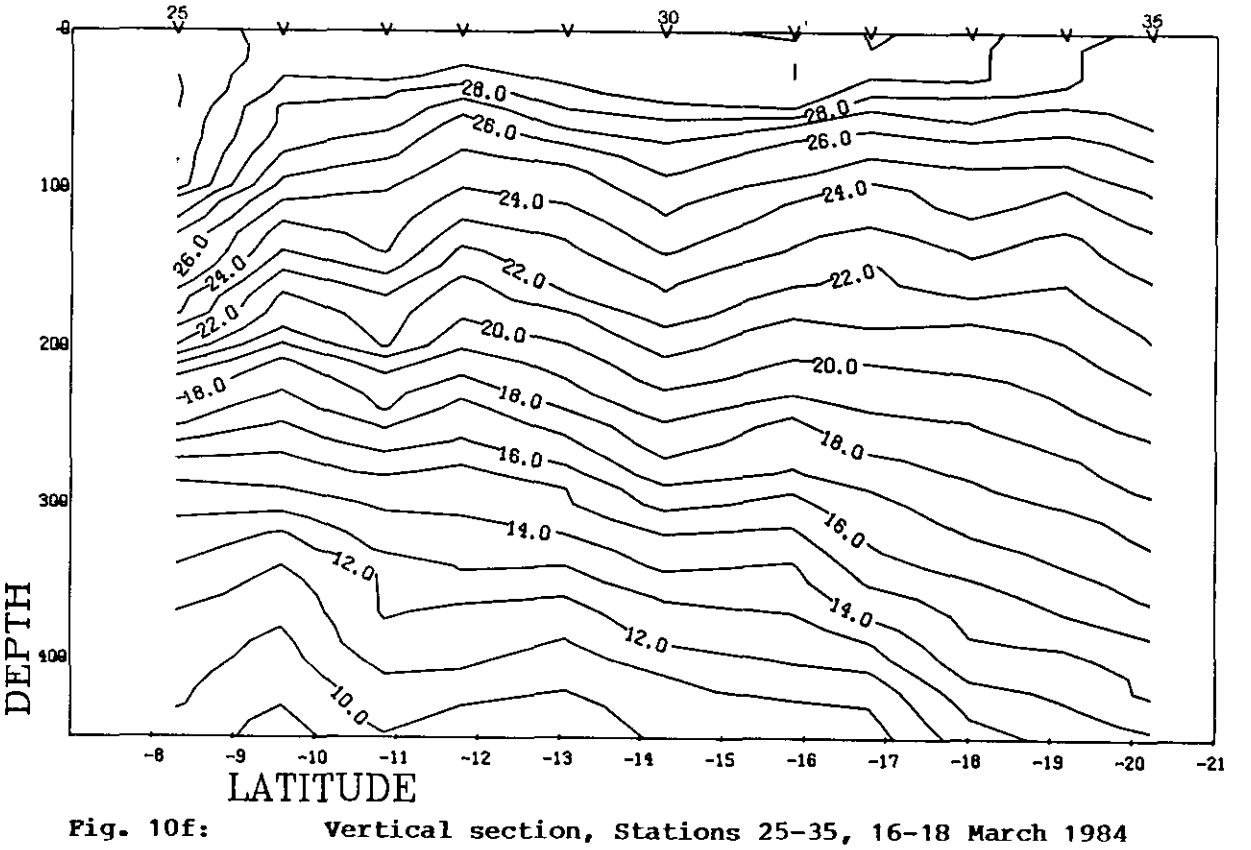

Fig. 10f: Vertical section, Stations 25-35, 16-18 March 1984

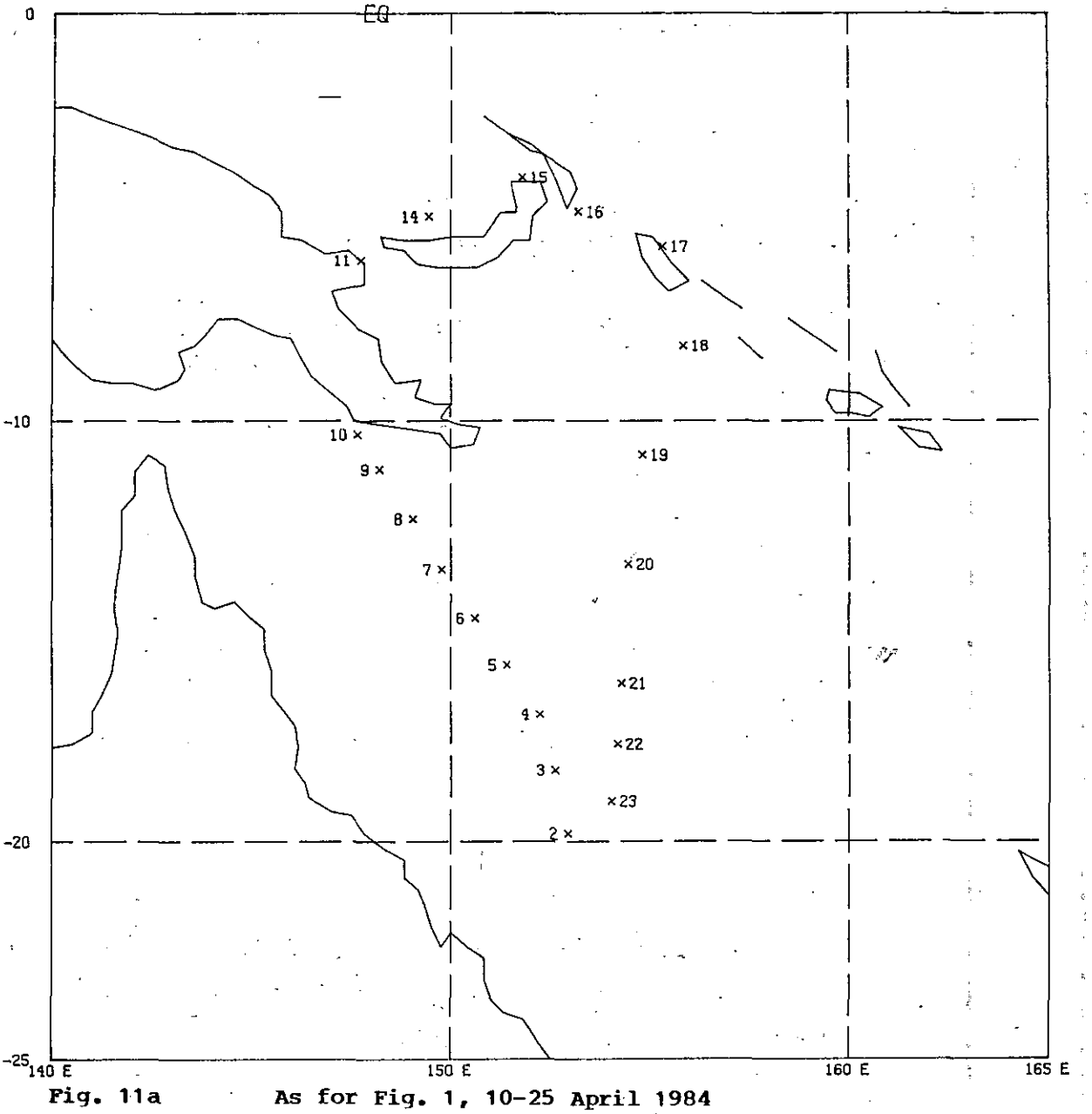

Fig. 11a As for Fig. 1, 10-25 April 1984

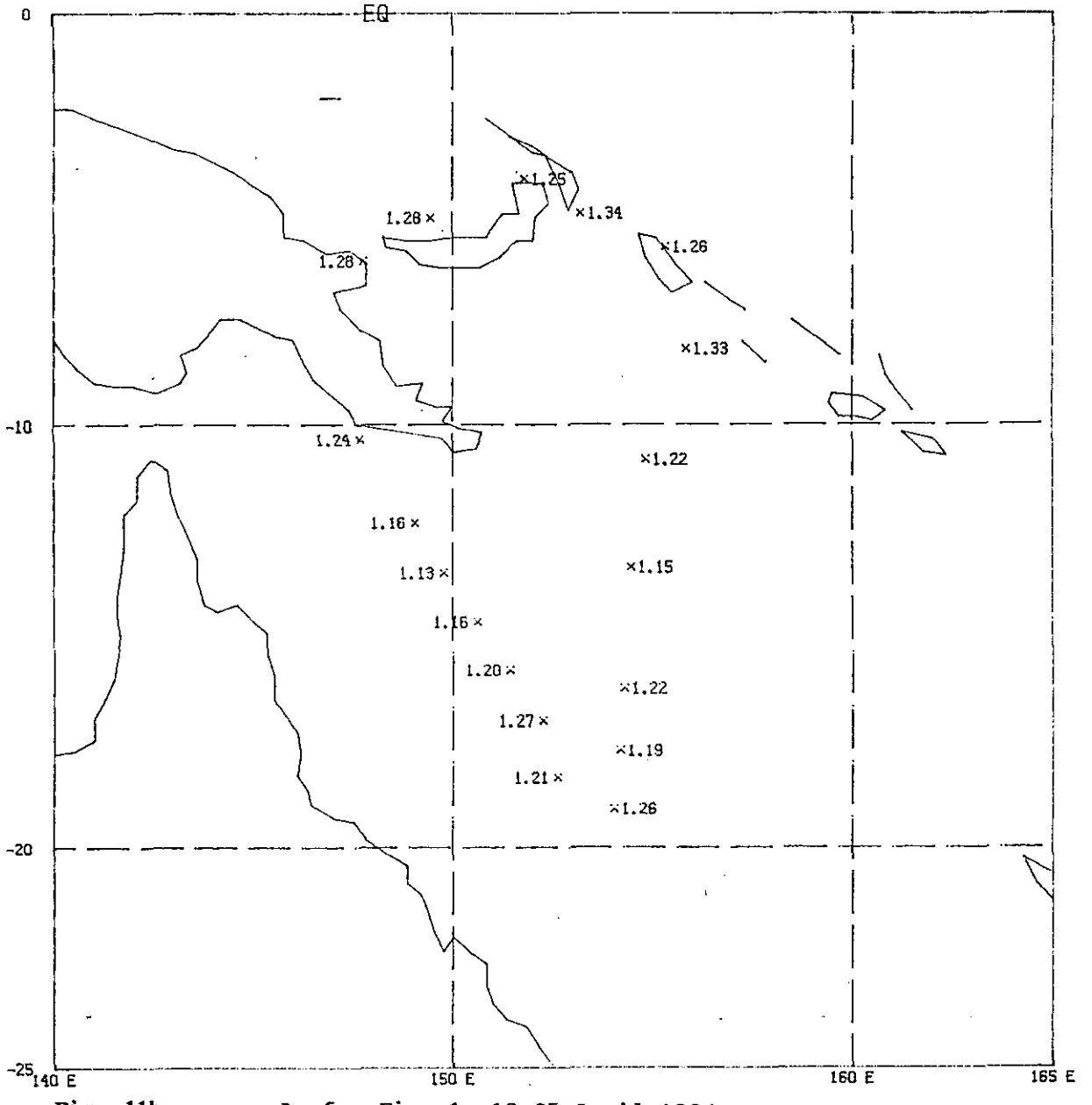

Fig. 11b: As for Fig. 1, 10-25 April 1984

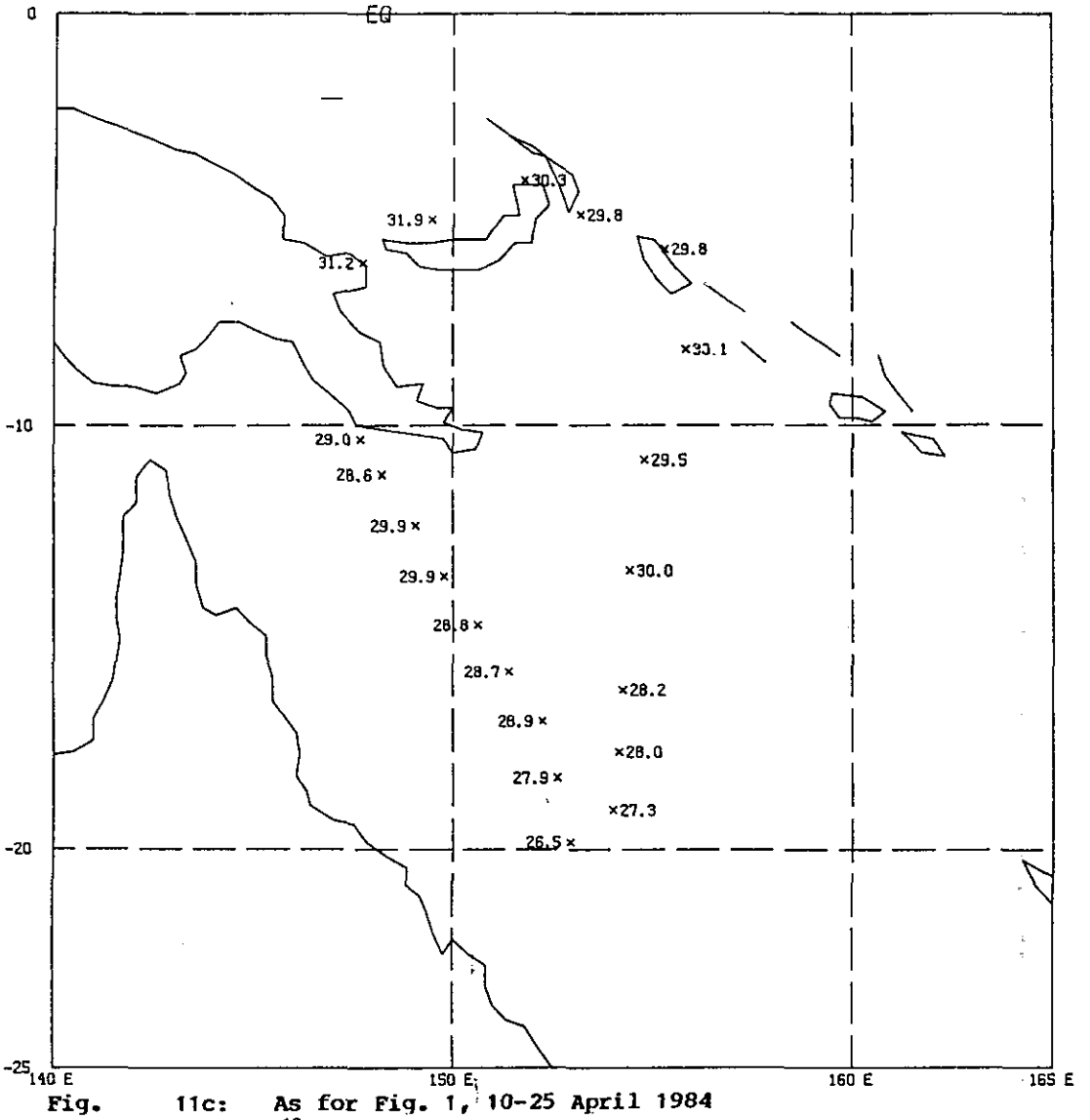

Fig. 11c: As for Fig. 1, 10-25 April 1984

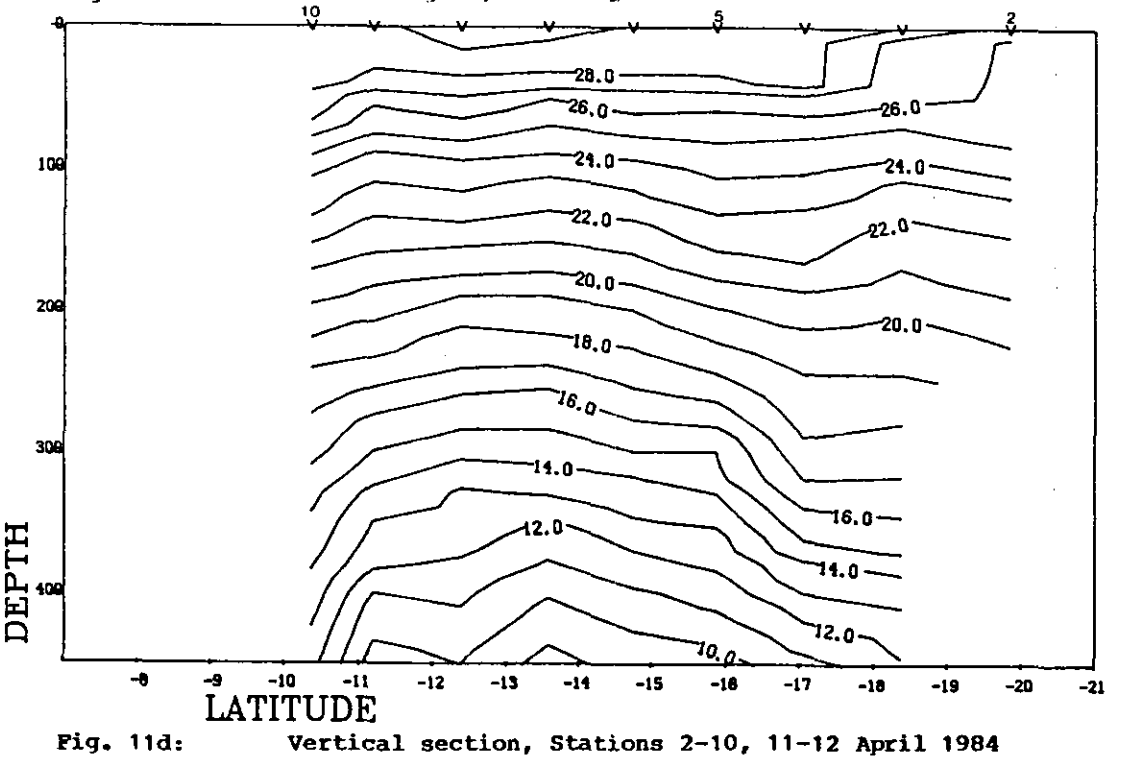

Fig. 11d: Vertical section, Stations 2-10, 11-12 April 1984

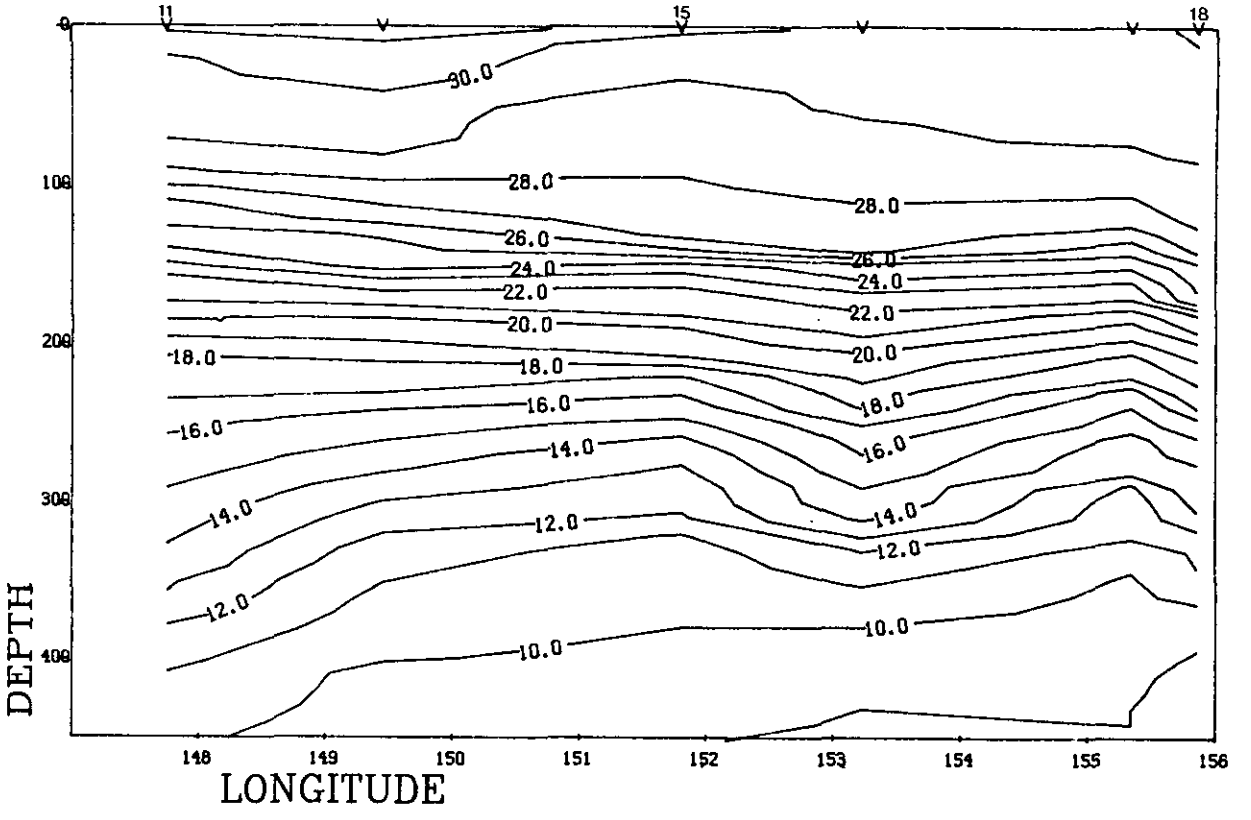

Fig. 11e: Vertical section, Stations 11-18, 18-23 April 1984

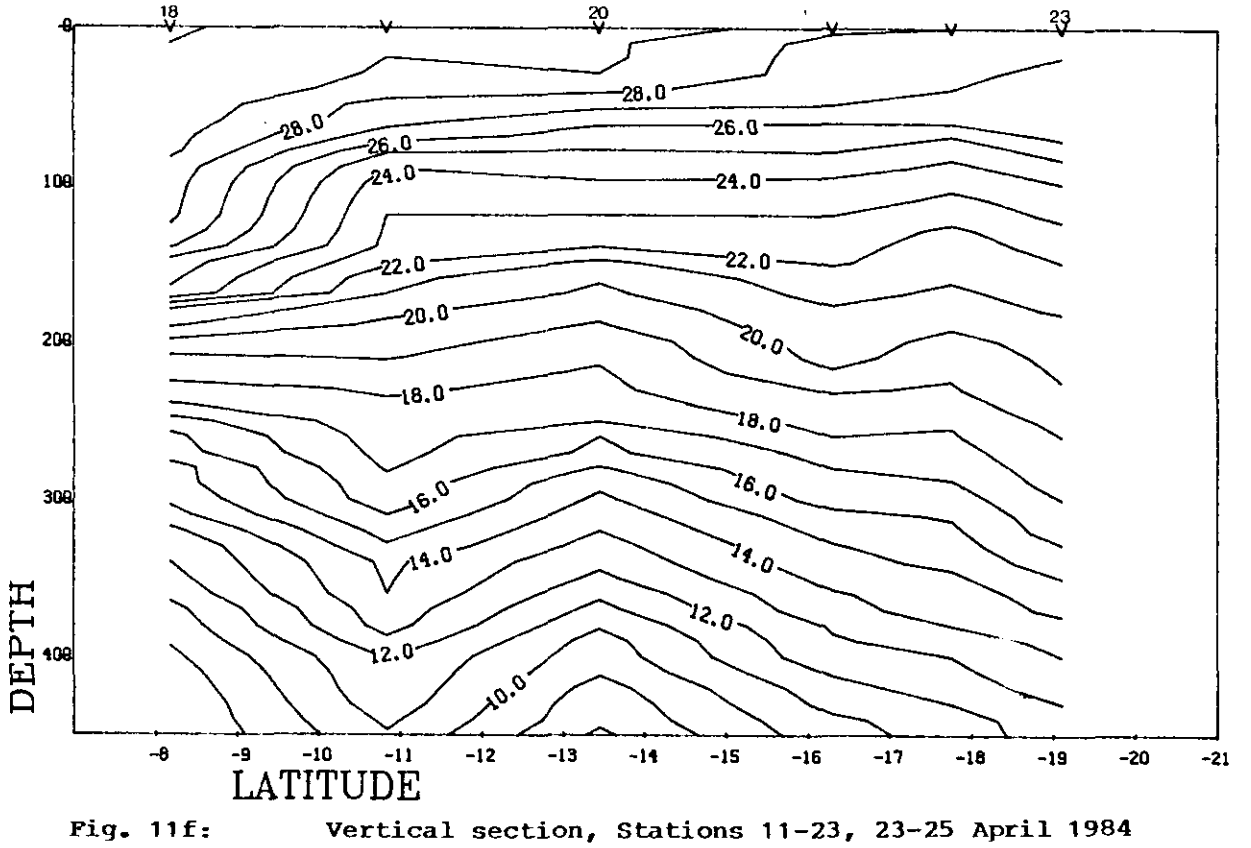

Fig. 11f: Vertical section, Stations 11-23, 23-25 April 1984

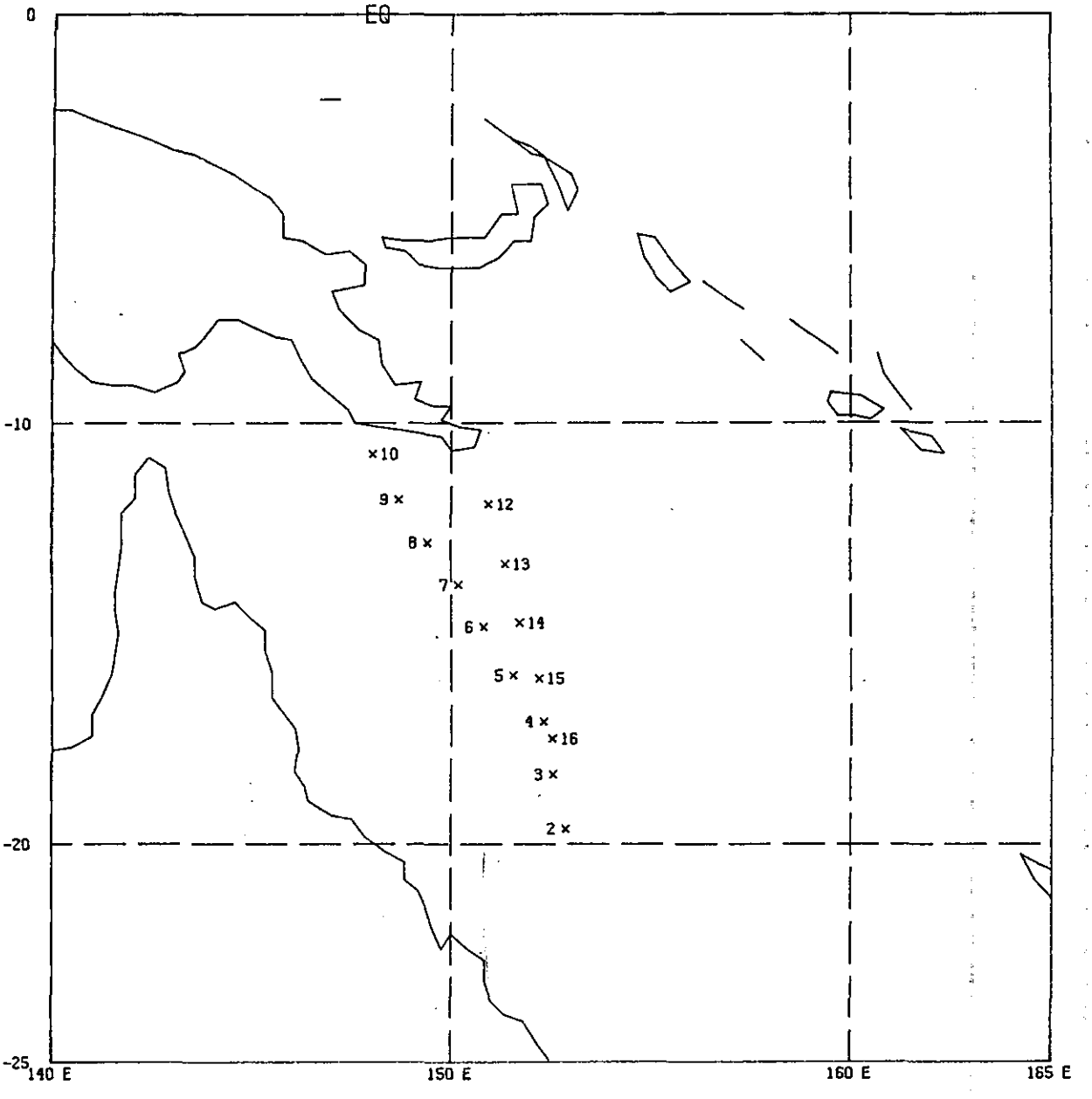

Fig. 12a As for Fig. 1, 15-26 June 1984

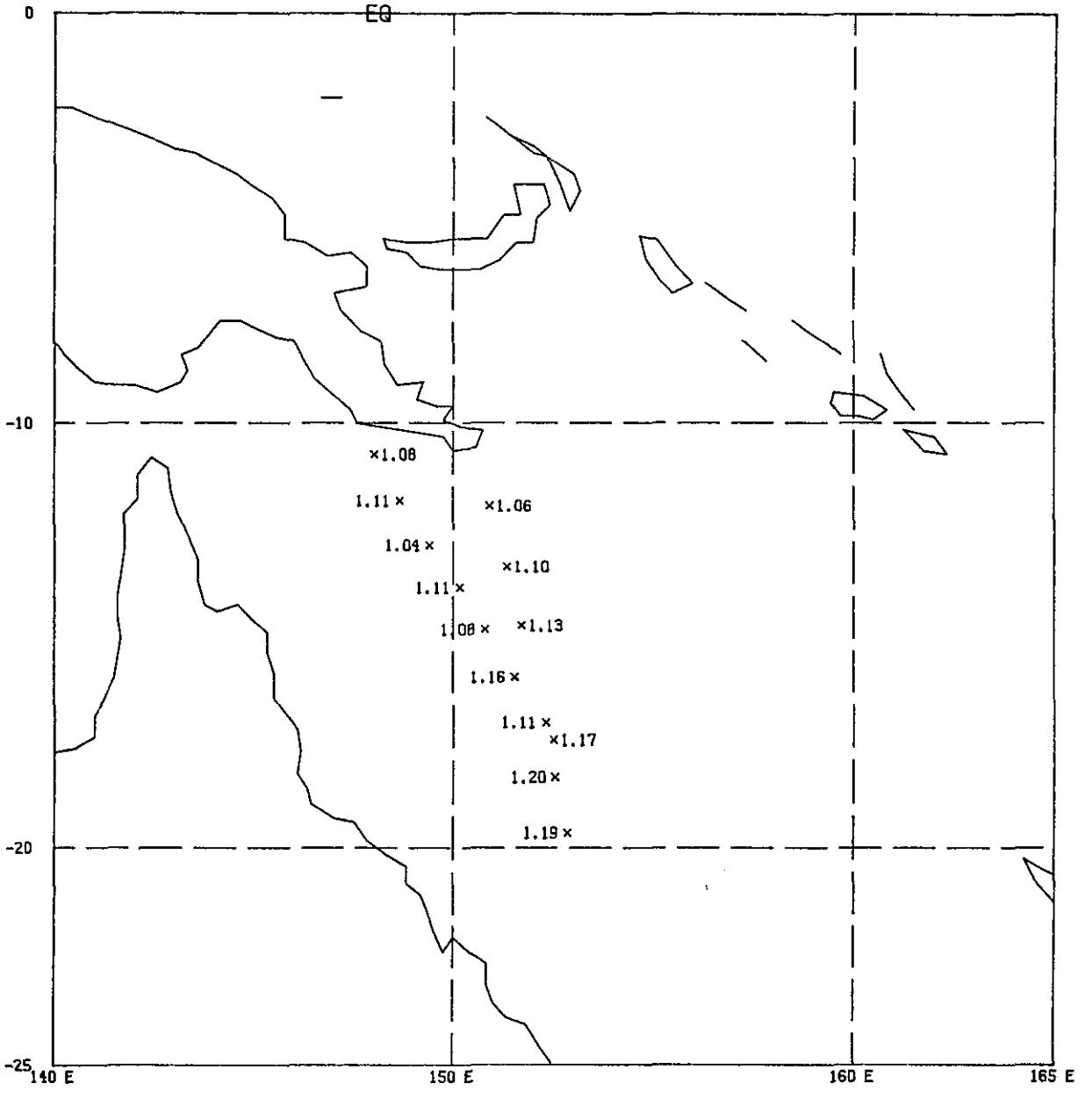

Fig. 12b: As for Fig. 1, 15-26 June 1984

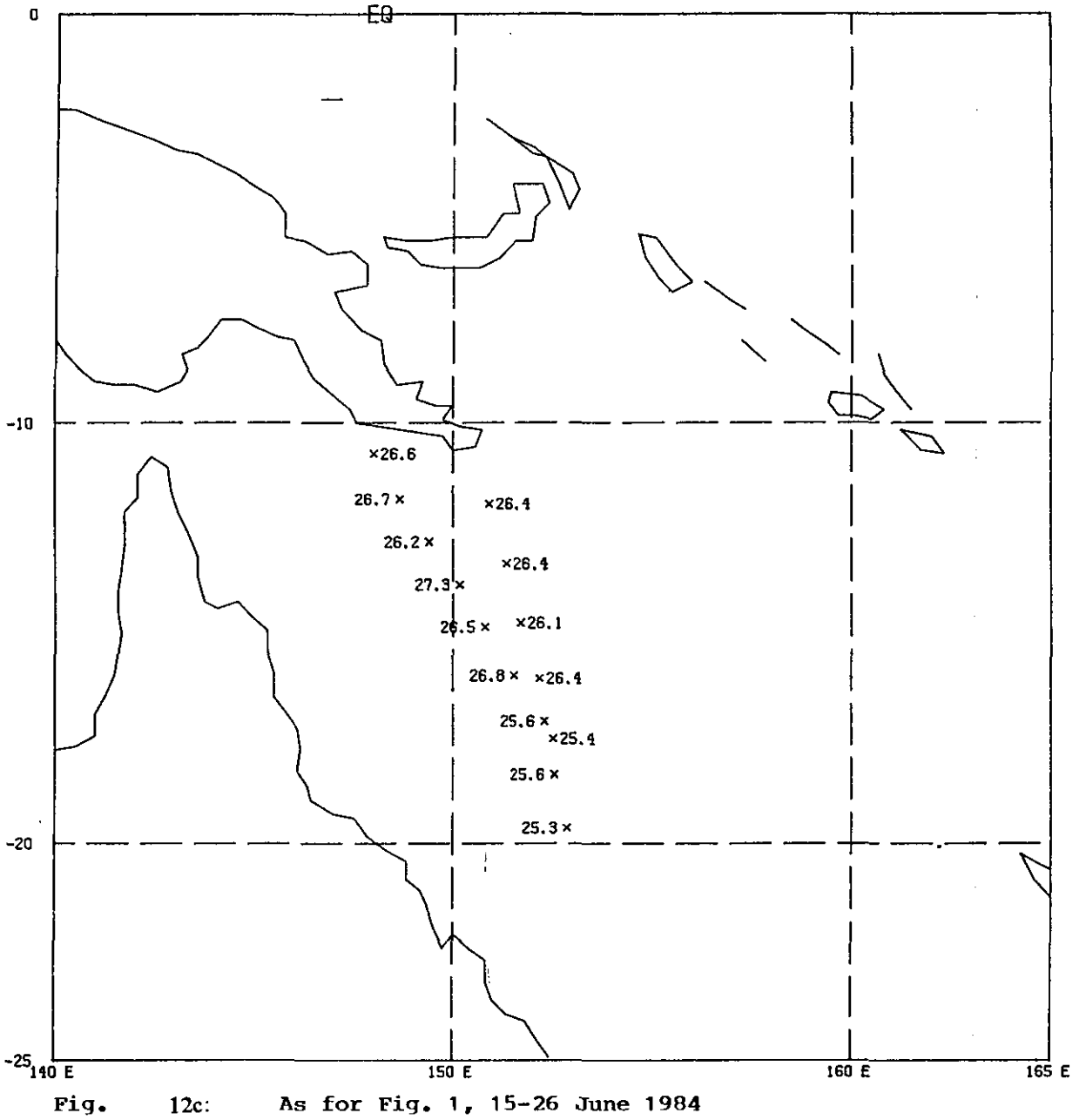

Fig. 12c: As for Fig. 1, 15-26 June 1984

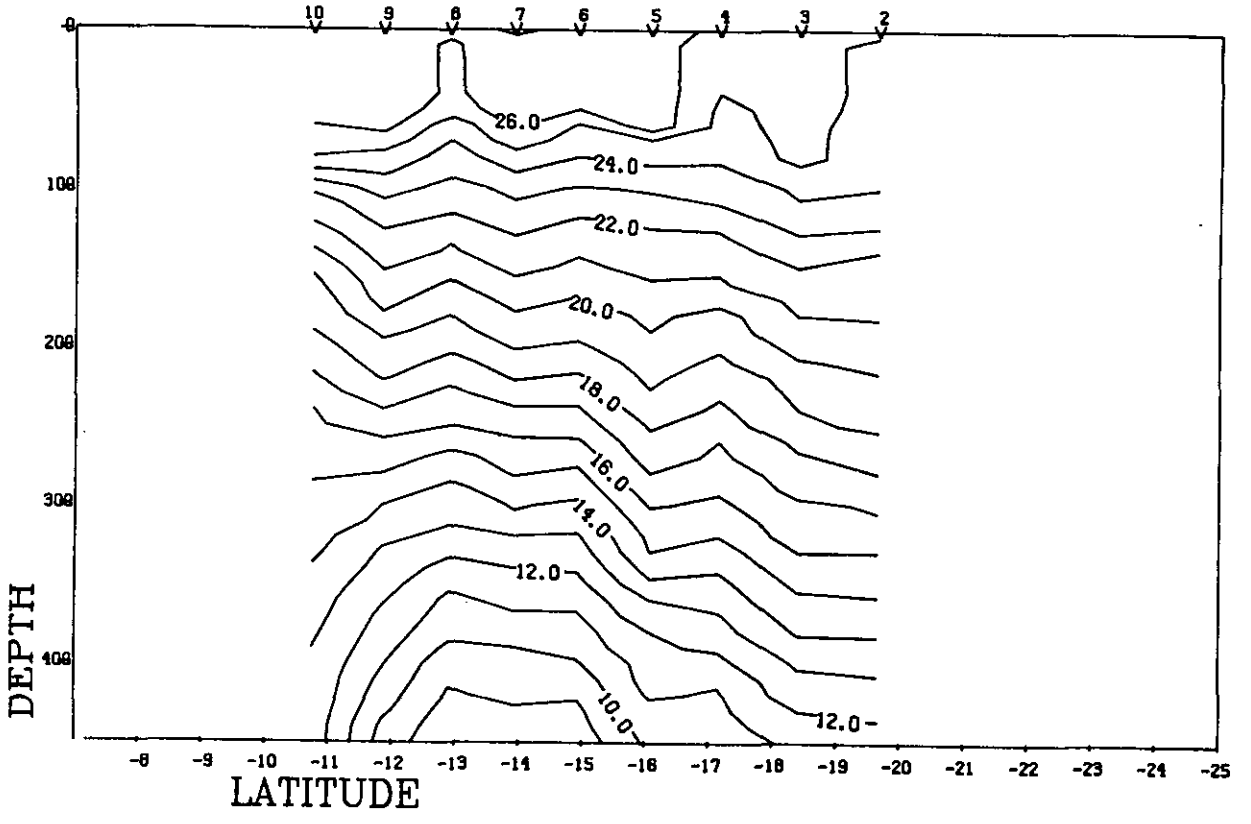

Fig. 12d: Vertical section, Stations 2-10, 15-17 June 1984

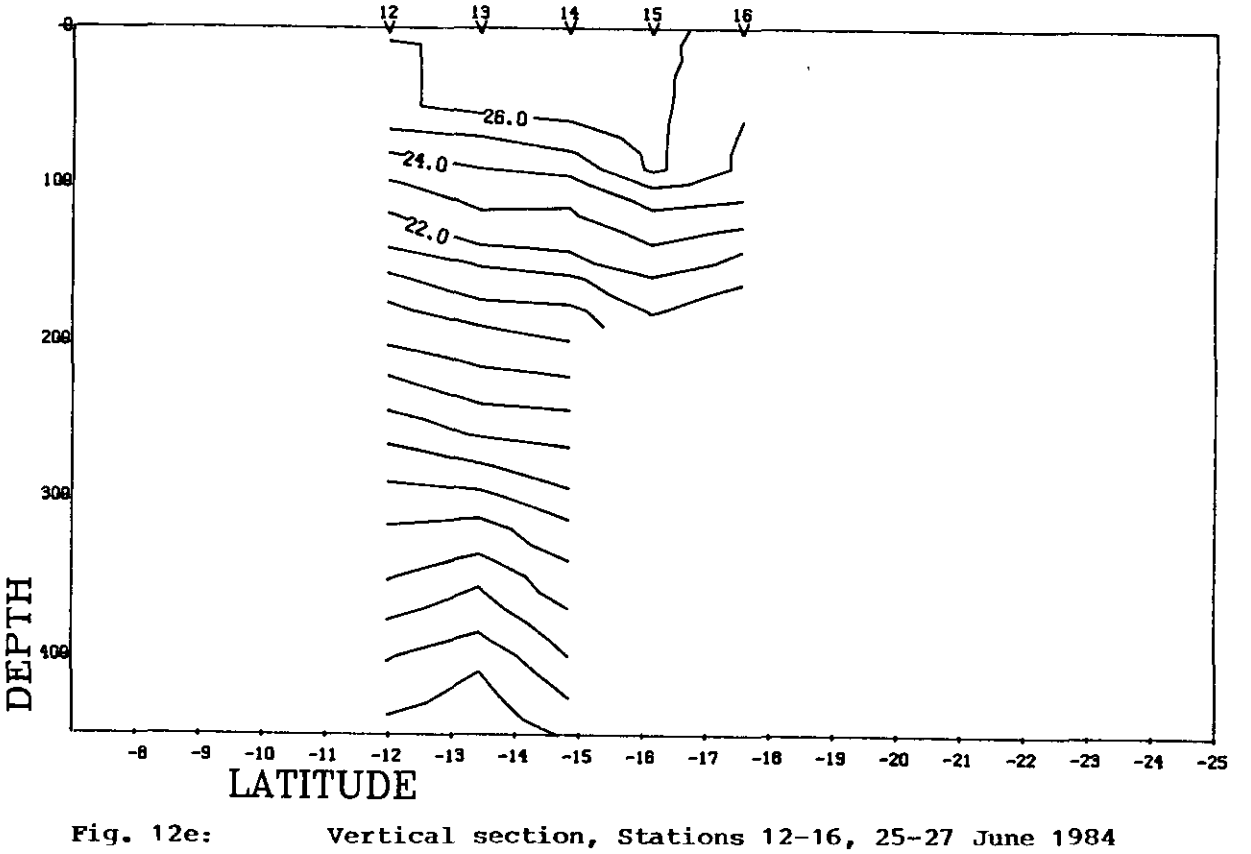

Fig. 12e: Vertical section, Stations 12-16, 25-27 June 1984

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