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XIII. BOTTOM WATER TEMPERATURE IN THE SOUTH OF THE NOVA-CANTON TROUGH, CENTRAL EQUATORIAL PACIFIC (GH82-4 AREA)

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This report presents vertical temperature profiles of bottom water in the south of the Nova-Canton Trough. Flow direction of the bottom water mass is estimated from the temperature field.

Measurements

The study area is located just south of the Nova-Canton Trough (Fig. XIII-1). The Manihiki Plateau, one of major midplate swells in the Pacific, occurs south of this area. Bottom water temperature was measured in deep-sea basins at depths between 5200 to 5800 m.

All measurements were carried out simultaneously with piston coring and heat flow measurements. A thermograd-meter (GH80-1 Type, Matsubayashi, 1982) mounted inside a head weight of a piston-corer stores temperature data sets in every minute when the corer is heaved at a velocity of 60 m/min. for about 15 minutes (about 1000 m from the sea-floor) after its completion of geothermal gradient measurement in sediments. Because the GH80-1 Type thermograd-meter is designed for the purpose of temperature difference measurement, the accuracy in the temperature difference determination is within 0.01 °C, while the accuracy of the absolute temperature value is about 0.2°C. The bottom water temperature profiles presented in Figure XIII-2 can be compared with each other with the accuracy of within 0.01 °C because the same thermistors were used throughout the measurements and the physical characteristics of these thermistors did not change.

Discussion

Observed temperatures of all sites are superimposed on Figure XIII-3. The open circles indicate the sites located on the eastern part of the study area including the detailed survey area (same as in Fig. XIII-1). A temperature minimum exists at a depth of about 5000 m. The rate of increase in temperature below this minimum is nearly equal to the adiabatic temperature gradient, about 0.0013 °C/m for the bottom water of this area (Bryden, 1973).

Below the depth of about 4800 m, bottom water temperatures of the eastern part of the survey area are clearly higher than those of the western part. Matsubayashi and Mizuno (1982) detected this tendency as the difference of the potential temperature between the two sites (H15 and H17) just outside (east and southwest) this study area.

Keywords: bottom water, AABW, PBW, Hakurei-Maru, Nova-Canton Trough

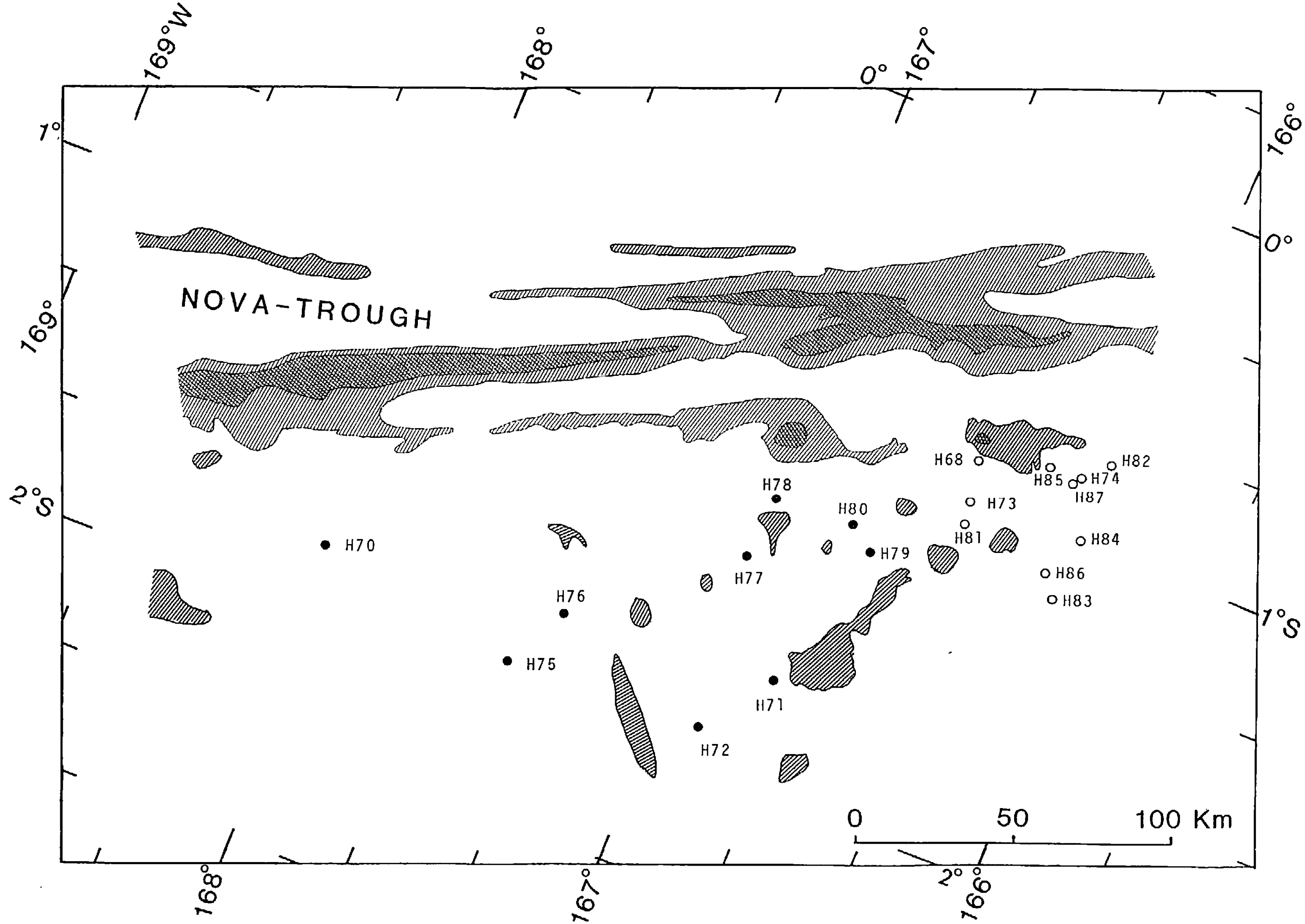

Fig. XIII-1 Location of bottom water temperature measurements and simplified topography. Open and solid circles correspond to those of Fig. XIII-3. Shaded areas are shallower than 5000 m. Darker areas are shallower than 4000 m.

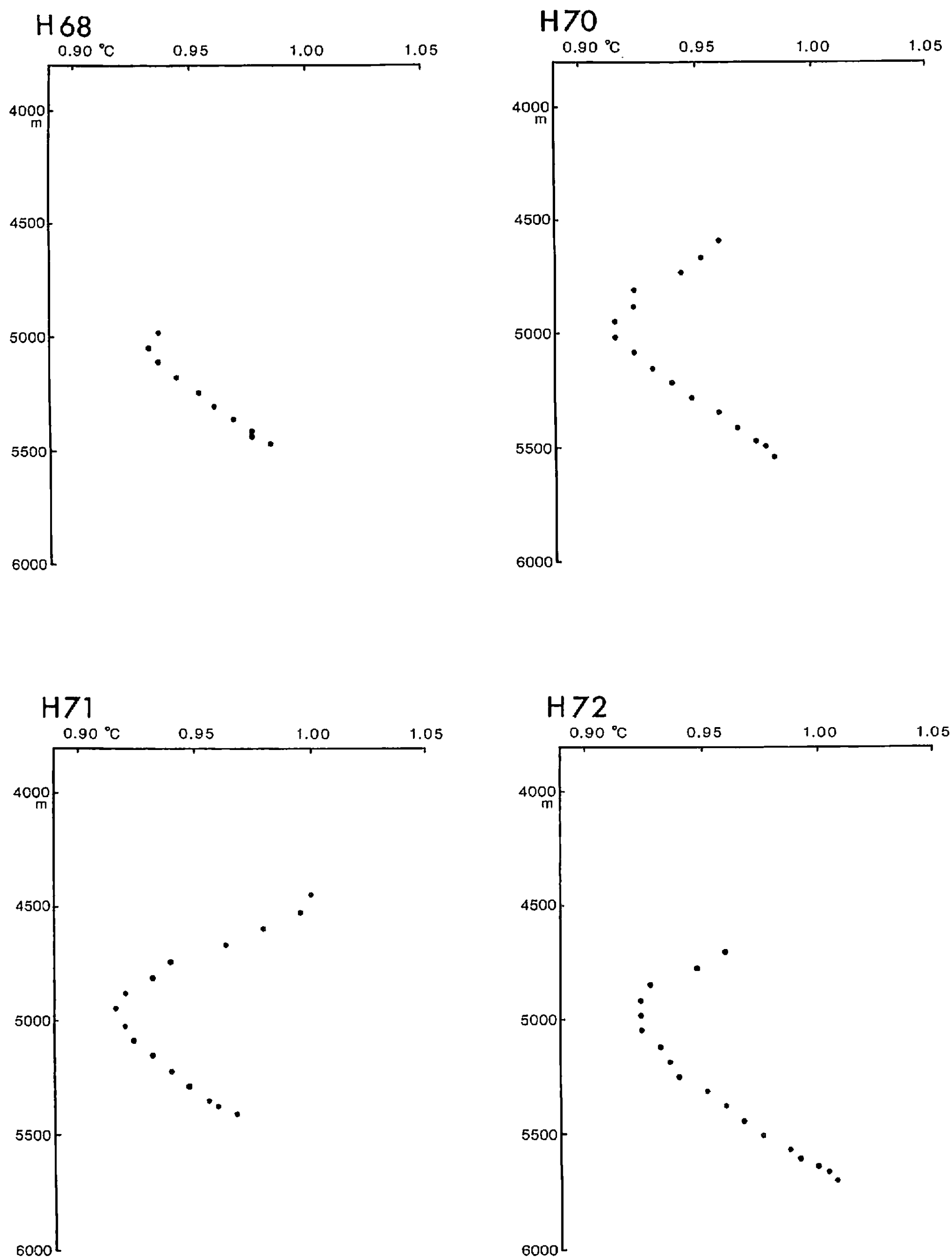

Fig. XIII-2 Vertical temperature (in situ) profiles of bottom water.

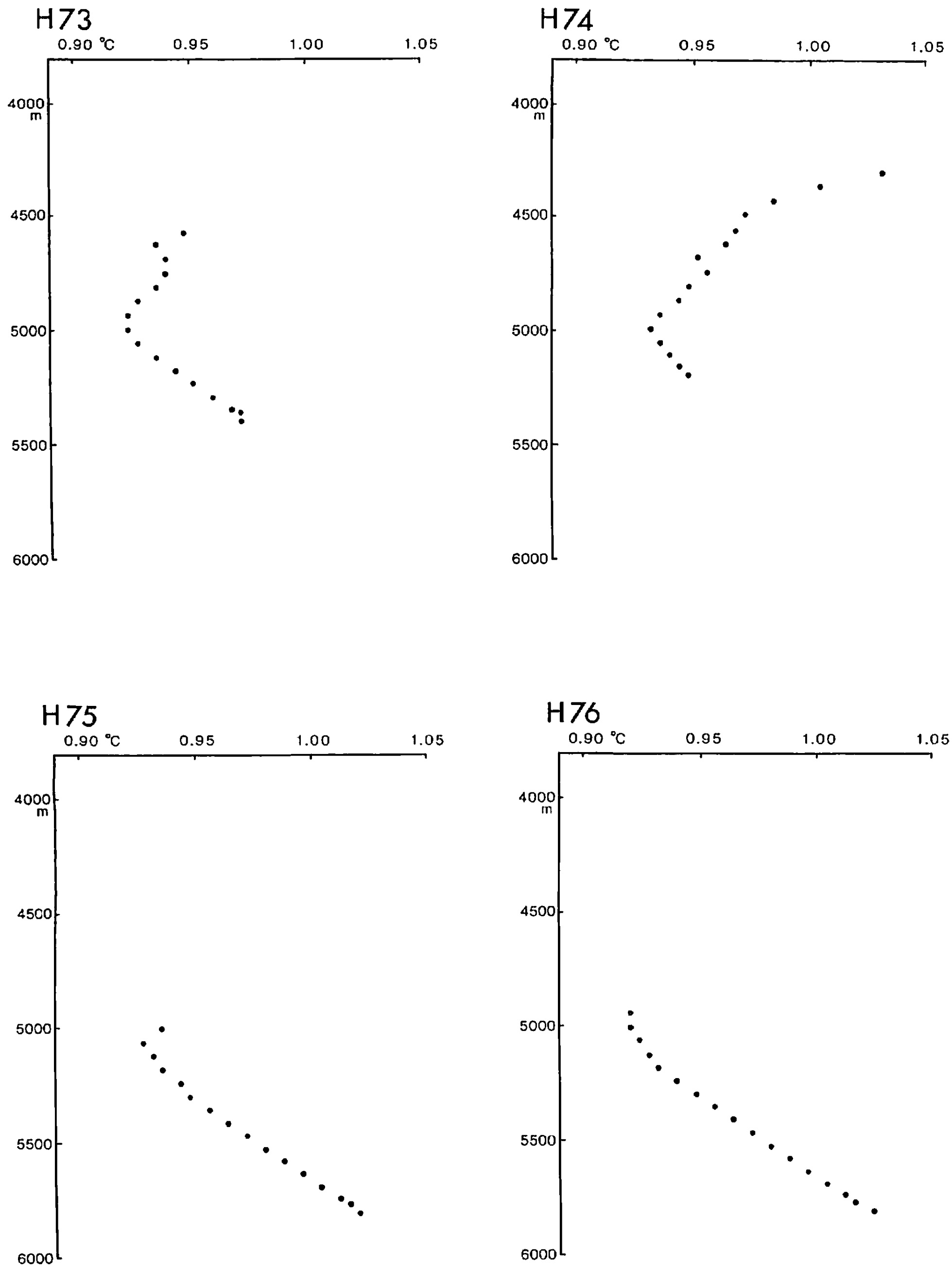

Fig. XIII-2 (continued)

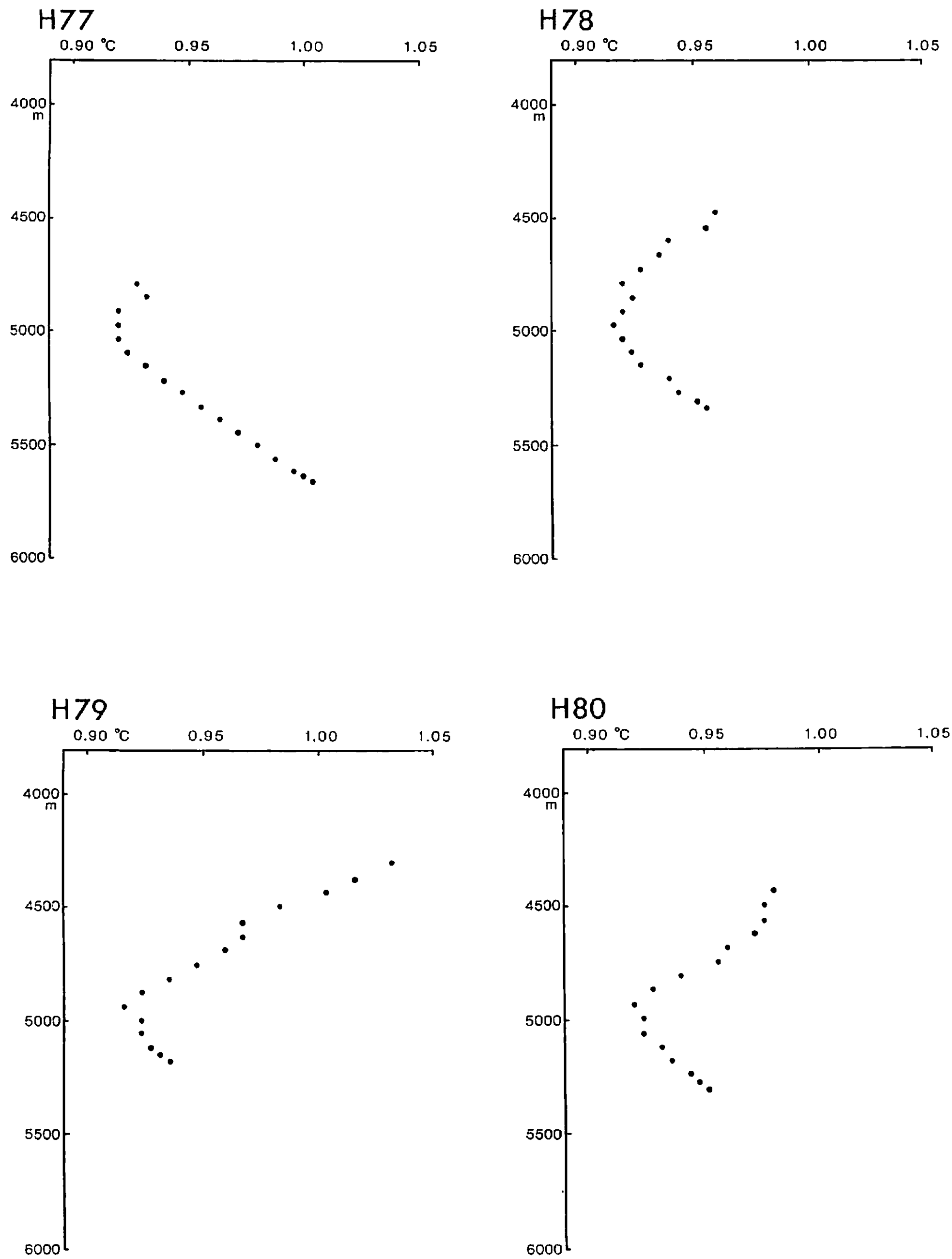

Fig. XIII-2 (continued)

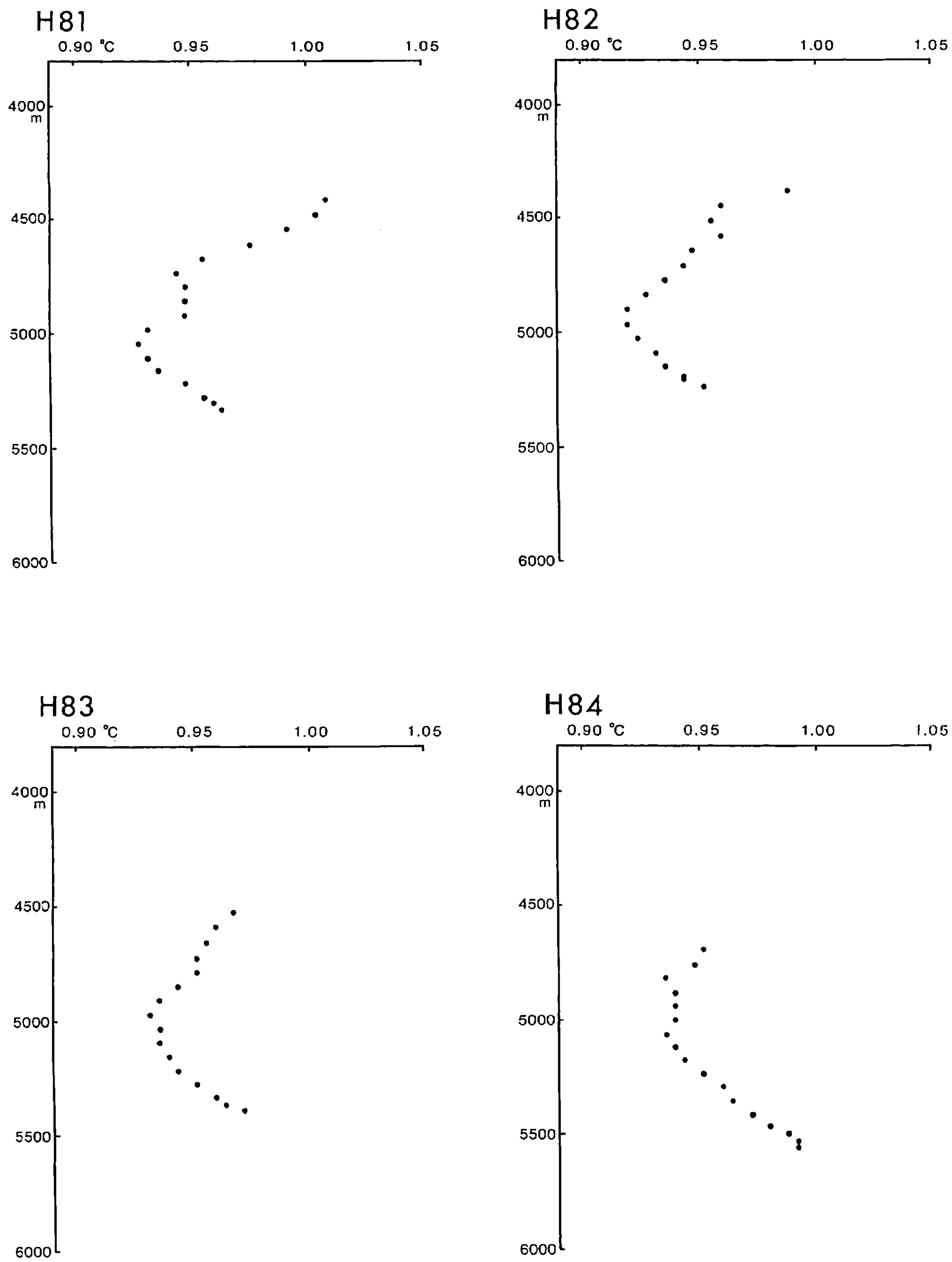

Fig. XIII-2 (continued)

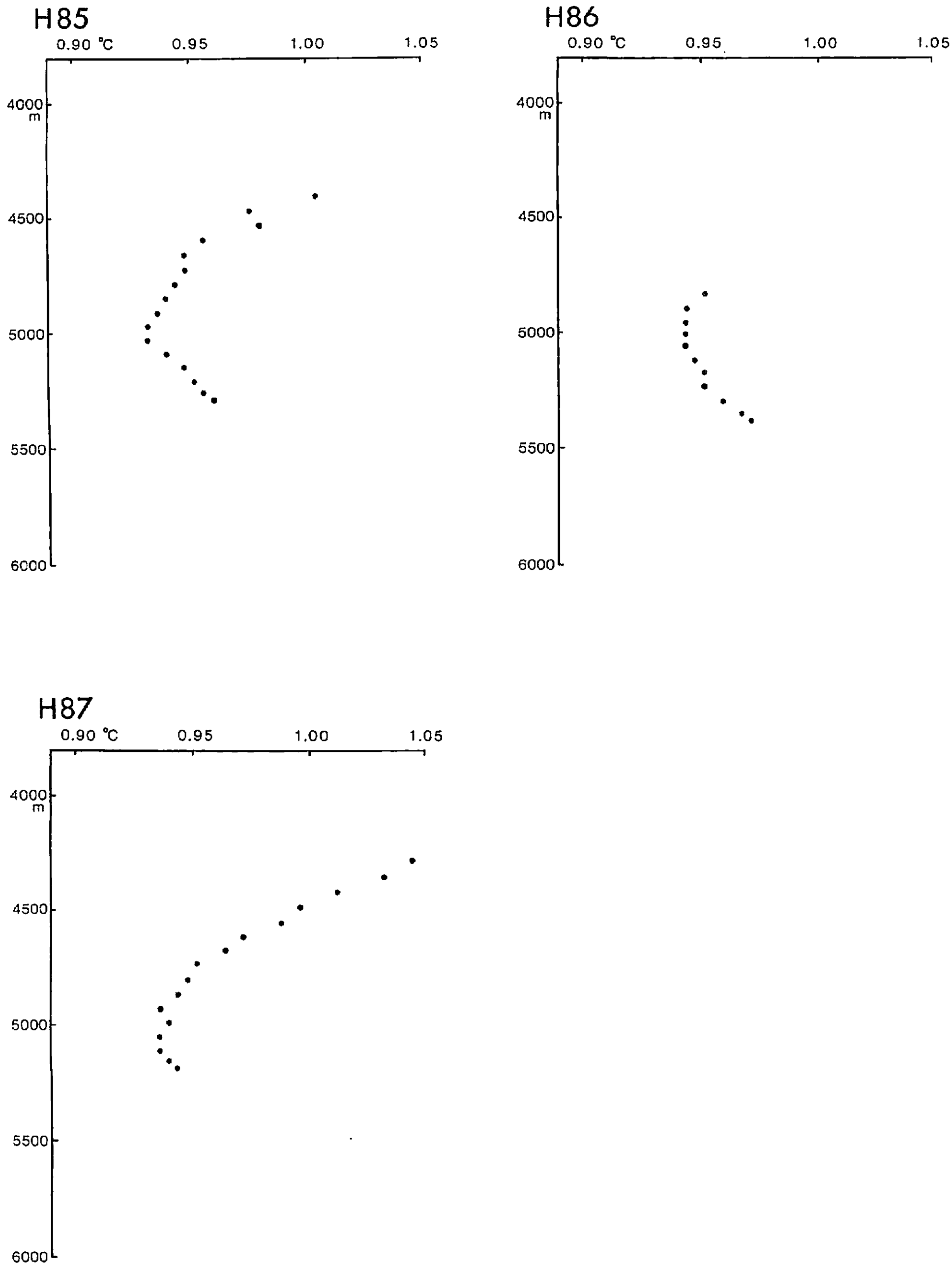

Fig. XIII-2 (continued)

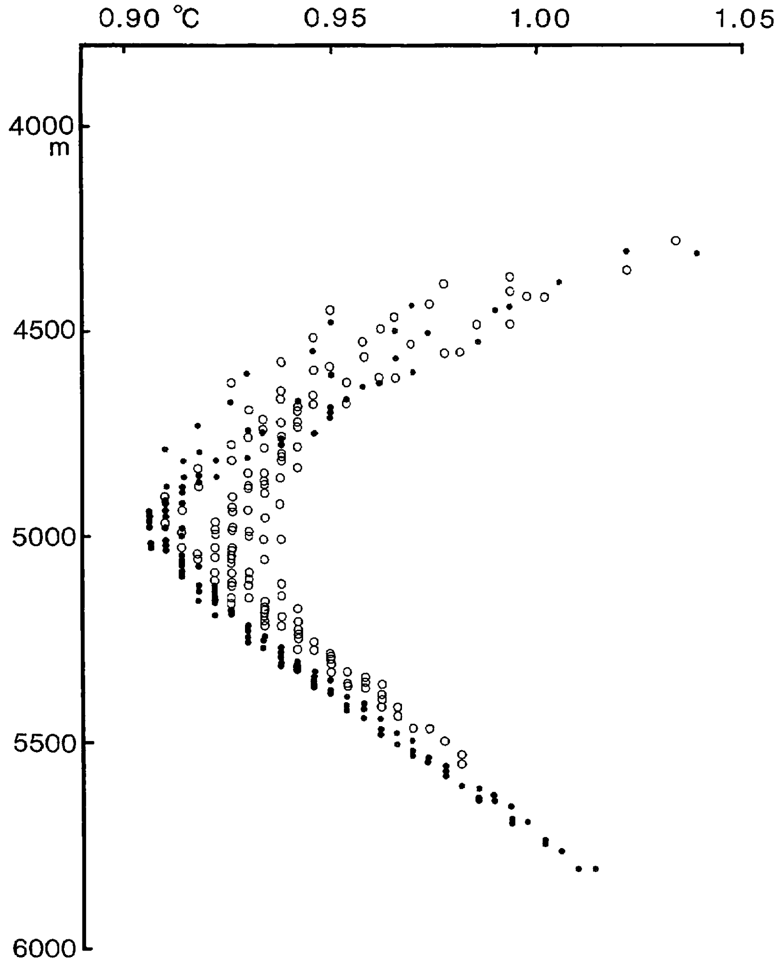

Fig. XIII-3 Temperature data at all sites are superimposed. Open circles are from the eastern part of the study area, and solid circles are from the western part (see Fig. XIII-1).

Cold bottom water, the Pacific Bottom Water (PBW) originating from the Antarctic Bottom Water (AABW), becomes warmer as it flows through mixing with warmer shallower water and heat flow from the sea-floor. Therefore the slow eastward drift of the bottom water can be estimated from the temperature field in the study area. Upon entering the Tokelau Basin through the Samoan Passage (Reid and Lonsdale, 1974), the PBW flows as the western boundary current mainly northwestward (Lonsdale, 1981). A part of the PBW, however, drifts eastward slowly on the topographically shaped pathway between the Manihiki Plateau and the ridge (shaded in Fig. XIII-1) just south of the Nova-Canton Trough.

Above the depth of about 4800 m, on the other hand, no regional variation in bottom water temperatures can be observed. In this study area, flow direction of the PBW above 4800 m, which is less affected by the topography, may be different from that of below 4800 m, while the benthic front, the boundary between the PBW and the Pacific Deep Water (PDW), is around 4000 m (Craig *et al.*, 1972).

The depth of the temperature minimum, about 5000 m, is much deeper than that of about 4500 m in the GH81-4 area in the Central Pacific Basin north of the Nova-Canton Trough at 3°N and 169°W (Yamazaki, 1986). A probable explanation of this phenomenon is that the influx of cold bottom water in the GH82-4 area would be lesser than that of GH81-4 area because the former is out of the main flow of the PBW.

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