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Surface Waters in the North of the Coral Sea

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Abstract

North of New Guinea, the eastward flow is not fast enough to bring the diluted water from the westernmost Pacific to the Coral Sea where, in the north, from February to June, the surface salinity is less than 34·5‰. This low salinity is always associated with a west wind component bringing rainfall. The surface salinity chart in January–February 1971 shows a salinity minimum isolated from its once supposed western origin by saltier water in the north of New Guinea. These features suggest local formation of this low salinity.

Introduction

Many Japanese ore carriers load nickel ore in New Caledonia to Japan, and, since August 1969, four ships have made regular surface observations every 60 nautical miles, measuring temperature and salinity along a route passing through the Coral Sea and crossing the equator at almost 150°E. From these data, surface salinity has already been studied at the equator and in the North Equatorial Counter-Current zone (Donguy and Henin 1974).

Jarrige (1968) described the South Equatorial Counter-Current at 170°E. and pointed out that the upper part of the flow is always associated with a salinity minimum. He suggested that the origin of this diluted water is the westernmost part of the equatorial Pacific, particularly the Celebes Sea. Donguy *et al.* (1970) in an earlier paper give the same origin of the low salinity water north of the Coral Sea. Nevertheless, this point disagrees with several features.

Surface Salinity in the North of the Coral Sea

From 4 years' data (August 1969–August 1973) collected by the Japanese ore carriers, the surface salinities have been averaged each month between 20°S. and 10°N. The results (Fig. 1) establish clearly that low values (less than 34·5‰) appear consistently from February to June between 5°S. and 12°S. approximately. The hypothesis that this low salinity water is brought by advection to the Coral Sea along the north coast of New Guinea from the westernmost part of the equatorial Pacific is not consistent with two facts, one in connection with the continuity, the other one with the time needed.

The surface salinity chart in January–February 1971 for this area (Fig. 2) drawn from all data available (ships of opportunity, ORSTOM cruise 'FOC 1' (ref. NODC 350058)) shows clearly that the low salinity water (less than 34·4 north of 15°S.) is isolated: in the westernmost part of the Coral Sea, the salinity at this time is 35·0‰

and, north of New Guinea, it is more than 34·8‰. So there is a discontinuity between the Coral Sea and the hypothetical western source of low salinity.

The maximum rainfall in the Philippines occurs in January (Fig. 3). Assuming instant dilution of the seawater, the velocity of the low salinity water arriving in

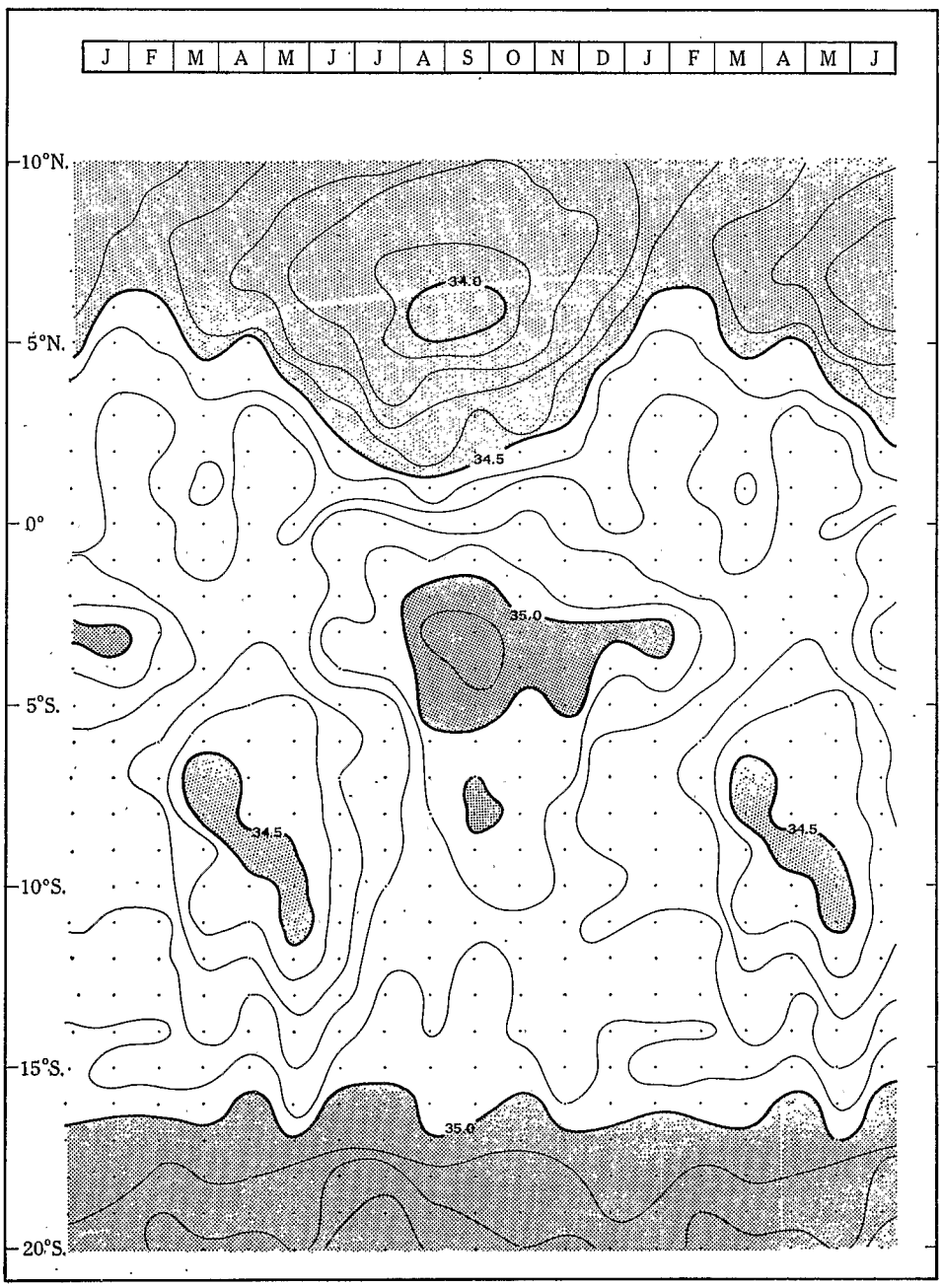

Fig. 1. Mean salinity along the track of the ships from data collected between 20 August 1969 and 10 August 1973.

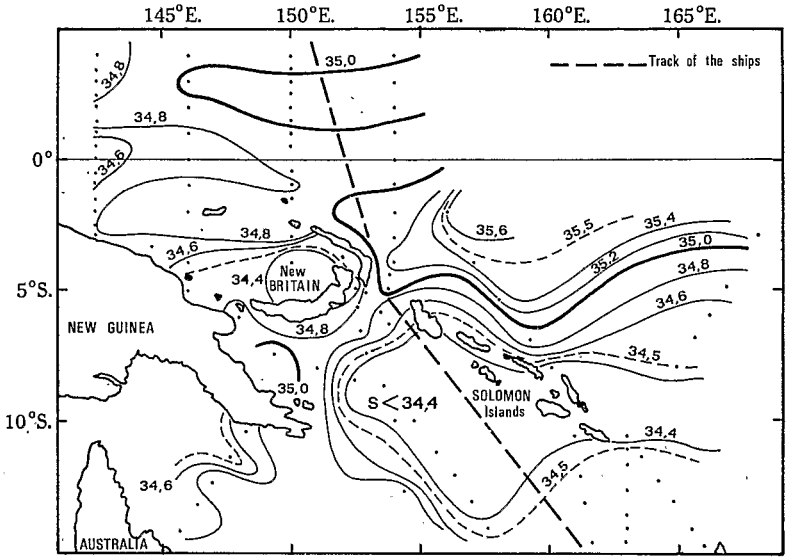

Fig. 2. Surface salinity chart in January–February 1971.

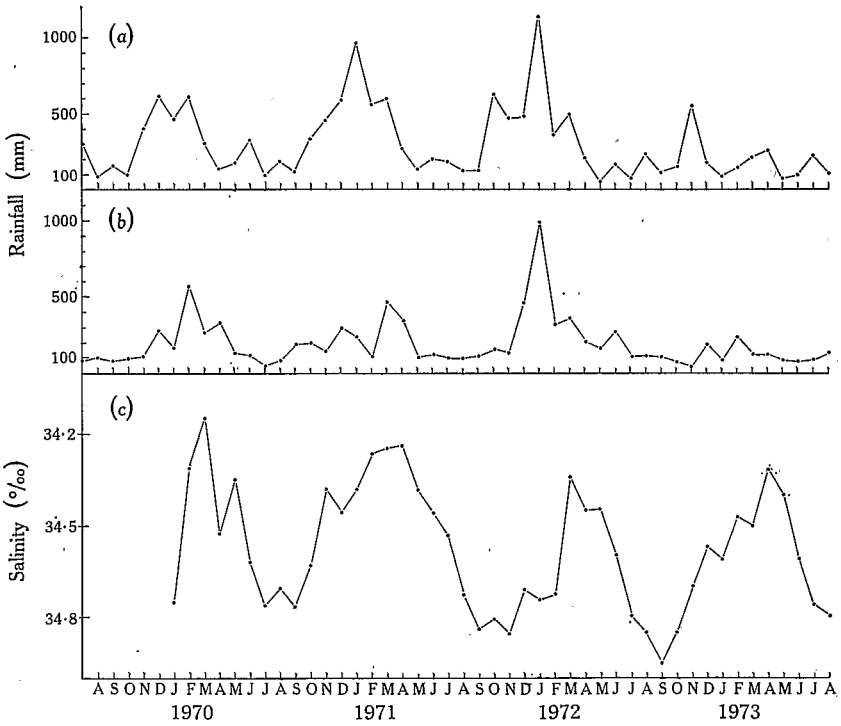

Fig. 3. Rainfall at (*a*) Surigao (Philippines) (9°48′N., 125°30′E.) and (*b*) Honiara (Solomon Islands (9°25′S., 159°58′E.) and (*c*) salinity minimum in the Coral Sea from August 1969 to August 1973.

February at 158°E. would be 2·5 knots. This is twice the velocity observed north of New Guinea.

Consequently, the western origin of the low salinity water in the Coral Sea does not seem possible. The study of the variations in the surface salinity at 10°S. in relation with local wind leads to another explanation.

In Fig. 4 have been included:

The surface salinity in the Coral Sea at about 10°S., 158°E. from August 1969 to June 1973;

the zonal and meridian components of the wind at Honiara (Solomon Islands) from the 'Tropical Strip Surface Charts' supplied by the National Climatic Center, Asheville, USA.

The low salinities (<34·5‰) occur generally, after some delay, with a west component wind bringing rainfall. In 1970, the wind appeared from January to April and the diluting from February to June. It prevailed from October 1970 to April 1971, and the low salinity was observed from November to June. In 1972, it occurred from January to April and the diluted water appeared from March to June. Finally, in 1973, there was a south-west wind from January to March and low salinity from February to May. Therefore, the diluted water occurs almost 1 month after the start of the west wind component and persists 2 months after the winds have changed. This feature compares with the 3 months' delay calculated by Hires and Montgomery (1972) between the maximum rainfall and the spreading at the sea surface of an homogenous salinity minimum. Consequently, the diluted water in the north of the Coral Sea would be due to local precipitation.

Conclusion

It does not seem possible that the low salinity water found in the Coral Sea from February to June comes from the westernmost part of the Pacific Ocean by advection along the New Guinea coast. This water has probably a local formation by dilution following heavy rainfall during the west wind period.

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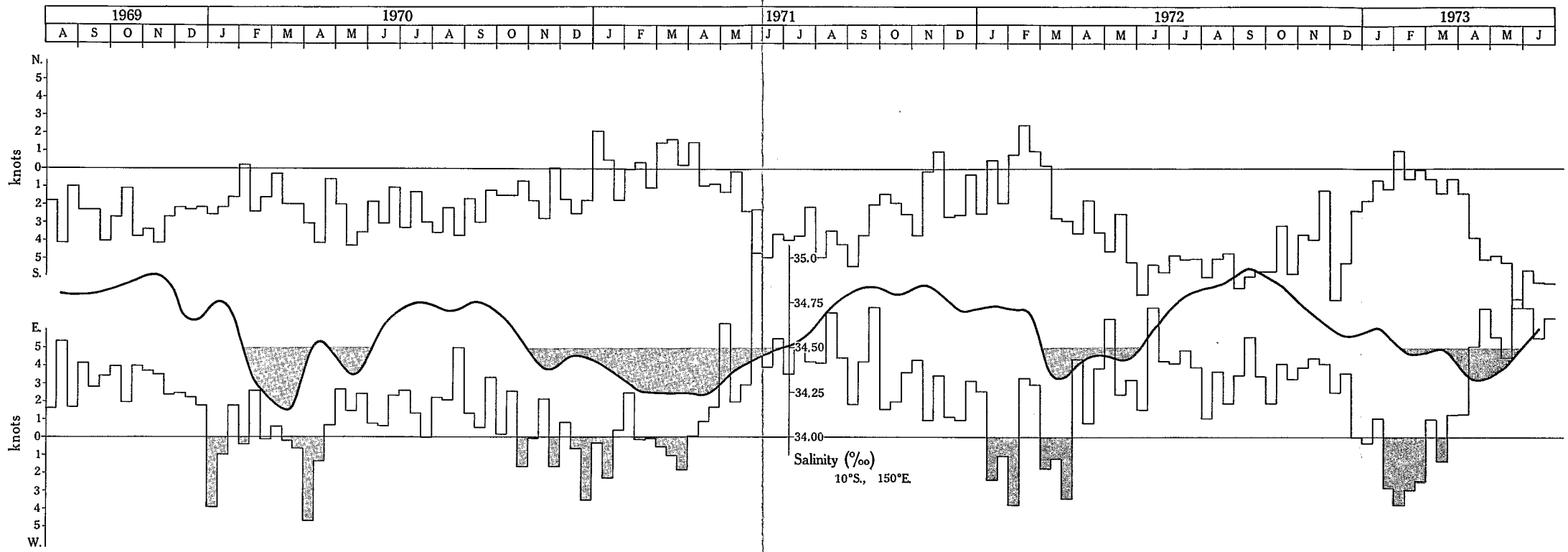

Fig. 4. Surface salinity in the Coral Sea from August 1969 to June 1973 and components of the wind at Honiara (Solomon Islands).