

15. VALIDATION OF MIDDLE PLIOCENE TO PLEISTOCENE PALEOMAGNETIC REVERSAL RECORD USING DIATOM AND SILICOFLAGELLATE DATUM LEVELS

Lloyd H. Burckle, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York

The purpose of this report is to interpret the paleomagnetic reversal record in DSDP Site 397 using diatom datum levels. Diatomaceous sediment is present at this site down to at least the middle Pliocene. Below that, few or no diatoms were observed. Three diatom datum levels and one silicoflagellate datum level are included here. All of these datum levels are found in the North Pacific, while three occur in the tropical Indo-Pacific. These datum levels have been directly tied to the paleomagnetic reversal record (see, for example, Donahue, 1970; Burckle, 1972, 1977; Burckle et al., in press; Burckle and Opdyke, 1977; Koizumi, 1973, 1975).

The youngest datum level, *Rhizosolenia curvirostris*, has been tied to the upper part of the Brunhes Normal Epoch. Donahue (1970) gives an age of approximately 260,000 years B.P. for this last occurrence. Subsequent work by Koizumi (1975) and Robertson (1975) confirm the presence of this datum level in the upper Brunhes, as do the results of Burckle and Opdyke (1977) and Burckle et al. (in press). All of these authors have tied the last appearance of *R. curvirostris* to the paleomagnetic reversal record. Since this species is reported only from the North Pacific, its presence in the equatorial Atlantic is not considered typical. Therefore, it is very likely that its last appearance between the North Pacific and equatorial Atlantic is diachronous.

Nitzschia reinholdii is a cosmopolitan form which ranges from the late Miocene (Magnetic Epoch 6) to the middle Pleistocene; Koizumi (1975) was the first to demonstrate that this form disappears in the lower part of the Brunhes Normal Epoch. Subsequent work by Burckle and Opdyke (1977) and Burckle et al. (in press) have verified this datum level. In the author's unpublished notes, an equatorial Atlantic core contains the last appearance of this species in the lower part of the Brunhes. Recent work (Burckle and Opdyke, 1977) has extended this datum level into the equatorial Indo-Pacific where paleomagnetic control indicates a last appearance in the lower part of the Brunhes.

The last appearance of *Mesocena elliptica* has long been used as a middle Pleistocene datum level in the equatorial Pacific (see for example, Muchina, 1963). Hays et al. (1969) were the first to demonstrate that this datum occurred between the top of the Jaramillo Event and the base of the Brunhes Epoch. Subsequent work has shown that this datum level can be used over a fairly broad area. Burckle (1971), Burckle and Opdyke (1977), and Kazarina (1975), for example, have demonstrated its usefulness in the equatorial Indian

Ocean while Burckle and Opdyke (1977) have extended it into the North Pacific. Recently Burckle (1977) using second-order correlation, has related this datum level to the initiation of Isotopic Stage 22 (Shackleton and Opdyke, 1976).

The last datum, the *Thalassiosira convexa* last appearance datum, was also originally described by Soviet workers in the equatorial Pacific (see Muchina, 1963). Hays et al. (1969) established that this datum occurs between the top of the Gauss Epoch and the base of the Olduvai Event. Extensive work by Donahue (1970), Burckle (1972), Burckle and Opdyke (1977), Koizumi (1973, 1975), and Kazarina (1975) indicate that this datum is a broadly distributed isochron.

When the above-mentioned datum levels are applied to DSDP Site 397 (Figure 1), it can be seen that they provide a reasonable interpretation of the paleomagnetic reversal record. The upper normal section is the Brunhes and the lower "split" normal section is the Gauss. Because of the lack of diagnostic diatoms in the Matuyama, I was not able to identify the normal events. However, it appears likely that the lower normal event in the Matuyama is the Olduvai.

Although it goes beyond the scope of this report, one additional point should be made. *Rhizosolenia curvirostris* is wholly a Pleistocene form which has been reported from the North Pacific (Donahue, 1970; Jousé, 1971; Koizumi, 1973, 1975; Burckle and Opdyke, 1977; Burckle et al., in press). In addition, my unpublished notes record its occurrence in the easternmost equatorial Pacific. Koizumi (1975) and Burckle et al. (in press) provide evidence that this form first appears in the early Pleistocene, somewhat midway between the top of the Olduvai and the base of the Jaramillo Event. Its distribution pattern in the Northern Hemisphere and its presence (reported here) in the eastern equatorial Atlantic suggest that the only way it could have gotten from one ocean to the other is via the Arctic Ocean. This suggests that the Arctic Ocean was partially or totally ice free sometime during the Pleistocene.

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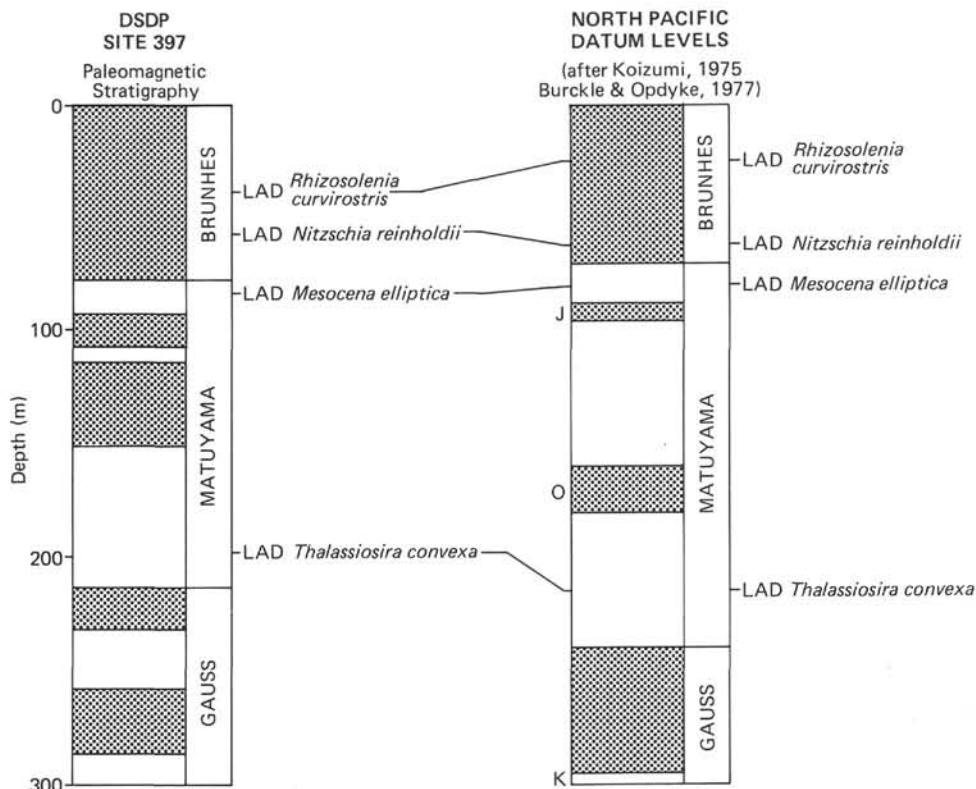


Figure 1. Correlation of diatom datum levels between the North Pacific and DSDP Site 397.

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