water volume in the borderland bounded above by the air-sea interface and below by the sediment-sea interface clarifies the situation.

Carbonate deposition (output) totals approximately 125×10^{10} g/yr. The major carbonate mineral is Mg-calcite$_{(<4)}$, with some Mg-calcite$_{(<4)}$, aragonite, and dolomite. Noncarbonate dilution totals about 800×10^{10} g/yr.

Other mechanical transfer is primarily river input (15×10^{10} g/yr) of Mg-calcite$_{(<4)}$ and some dolomite. Neither aerial nor ocean current transfer affects the budget significantly.

Biologic transfer involves primarily input of $CaCO_3$. Foraminifera produce about 250×10^{10} g/yr of Mg-calcite$_{(>4)}$ and aragonite. Production of 400 (g/m^2)/yr by macrobenthos in shallow, hard-bottom areas is comparable to tropical, nonreef production rates.

Chemical transfer involves solution (output) of about 200×10^{10} g/yr $CaCO_3$ on basin floors. Apparently all carbonate minerals except dolomite undergo solution.

These input and output estimates balance to within about 10%.

Rivers entering the borderland supply only enough dissolved calcium for 30% of the $CaCO_3$ deposited.

Of the $CaCO_3$ input to the borderland, over half dissolves, the remainder is deposited. The $CaCO_3$ deposition rate is sufficient to extract some dissolved calcium from seawater flowing through the borderland.

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SILICOFLAGELLATE BIOSTRATIGRAPHIC ZONATION OF DEEP-SEA SEDIMENTS

Silicoflagellates have been recognized in land outcrops and deep-sea sediments, but they have not been accepted widely as biostratigraphic indicators. In order to evaluate their occurrences and to establish a workable biostratigraphic framework, approximately 100 deep-sea sediments were studied. These were from a broad geographic area and were of Cretaceous (Cenomanian) and the middle Eocene to Holocene ages. The samples chosen were dated by other planktonic microfossils, thus making cross correlation possible.

The complete absence of silicoflagellates in the few JOIDES samples examined from the Upper Cretaceous and the lack of samples from the Paleocene through the early Eocene interval prevent a complete zonation. Three zones are recognized from the middle Eocene to the top of the Oligocene. There was a sharp decrease in the silicoflagellate population in the Oligocene. In the Miocene evolutionary diversification of taxa permits greater biostratigraphic resolution; 7 zones have been recognized. A massive extinction of silicoflagellates occurred toward the end of the Miocene, with only a few species continuing into the Holocene. The brief recurrence of *Mesocena* cf. *elliptica* at the Jaramillo event within the Matuyama Reversed Epoch both in low and middle latitudes of the Pacific marks a biostratigraphic datum within the Pleistocene. Determining the first appearance of many Holocene taxa will add further resolution within the Quaternary interval.

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MULTIPLE ORIGIN OF HEMIPELAGIC MUD FILL IN MEDITERRANEAN BASIN

Mud, predominantly silty clay, accounts for at least 95% of the Holocene fill of the western Alboran basin in the western Mediterranean Sea, 110 km east-southeast of the Strait of Gibraltar. This mud has a multiple origin; it is not deposited from a simple rain of pelagic material onto the basin floor. The mud distribution is closely related with topography, as determined from cores and high-resolution seismic records. Total thickness of the Holocene section is approximately 2 m on basin slopes, but increases to over 4 m (sedimentation rates up to 30 cm/1,000 years) in the near-horizontal basin plain at a depth of 1,500 m. Thickest mud deposits are localized in lows where thin sand layers most abound, and major mud transport paths appear to be similar to sand dispersal patterns. Mud is hemipelagic in composition: lutite with planktonic and benthonic Foraminifera, deep- and shallow-water ostracods, and plant fibers. Components are, at least in part, nearshore in origin.

X-radiographs show that 10–20% of the mud in the cores is parallel- and cross-laminated, indicating the importance of bottom traction transport. Bottom currents also have truncated the top of sand layers and concentrated microfossils in thin laminae. A few graded mud units are probably *mud turbidites*. The predominant "trigger mechanism" of the fine-grained turbid flows is floods that seasonally inject material at fluvial point sources along the mountainous Moroccan and Spanish margins. Homogeneous mud layers with scattered microfossils, comprising more than half of the Holocene fill, reflect a more regular deposition from less dense suspension layers. The suspensate is also in part extrabasinal, derived from low-density Atlantic surface water entering at the Strait of Gibraltar and denser Mediterranean water circulating at depth.

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PALEOECOLOGIC AND BIOSTRATIGRAPHIC IMPLICATIONS OF EOCENE PLANKTONIC FORAMINIFERAL ASSEMBLAGES, CALIFORNIA

Correlations and age assignments based on the system of benthic-foraminiferal faunizones and provincial stages developed for the California region are contravened by those based on planktonic species, notably within the Eocene. For example, the Ulatisian and Narizian provincial stages are presently assigned to the middle and upper Eocene, respectively. Our data indicate that strata containing Ulatisian benthic-foraminiferal assemblages range in age from late early Eocene to early middle Eocene whereas Narizian sequences are of early to late middle Eocene age and further, that the "Ulatisian" Rose Canyon and the "Narizian" Cozy Dell formations are correlative. Significantly, none of the Narizian sequences for which planktonic foraminiferal data are available are of late Eocene age. Inasmuch as the presently available stages and faunizones are time-transgressive, it is urged that this system no longer be used for West Coast Paleogene correlations.

The development of a faunizonal succession based on planktonic foraminiferal species provides an adequate chronostratigraphic framework for paleogeographic interpretation, but the absence or rarity of thermophilic species important in standard faunizonations necessitates use of regionally dominant forms.

Delineation of dominance and diversity trends reveals modification by shifting watermass boundaries of planktonic-foraminiferal assemblages occurring over