chlorite in red beds. Reduction and dissolution of hematite pigment in red beds may have supplied the necessary iron.

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SOFT-SEDIMENT FAULTS AS INDICATORS OF PALEOSLOPE ORIENTATION

The Tesnus Formation in the Marathon region, Texas, consists of interbedded sandstone turbidite and shale of a late geosynclinal filling phase. Deposition was on an unstable slope as indicated by the occurrence of deformational features of preconsolidation origin including rolled sandstone bodies (tens of feet long), sandstone dikes (up to 1 in. wide and 5 ft long), diapiric structures, and numerous normal faults of small displacement.

Throw on these microfaults is less than 1 in. and averages 0.25 in. The displacement is seen only on the undersides of sandstone beds and cannot be traced through the beds in which they occur. The faults intersect the base of beds at an average angle of 55° from the base, whereas most fractures of postconsolidation origin are oriented normal to the base. The measured intersections with the base of beds of 100 faults show that their mean orientation is 97° to the direction of paleoslope as indicated by flute casts. The standard deviation is 15°. Hence, the faults generally parallel paleoslope contours. Of hundreds of faults examined, more than 95% were downthrown down the paleoslope.

Each individual fault has a fault zone less than 1 mm wide. Petrographic evidence for a soft-sediment origin includes (1) boundaries between fault zones and country rock are not sharp, (2) fractured grains are not present in the fault zones, and (3) all healed fractures of postconsolidation origin cut the fault zones.

Soft-sediment faults have been found useful for providing current directions for sole markings, such as groove casts, which normally give only orientation. If used carefully, the faults also can provide paleoslope information where sole markings are absent.

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PORE-WATER CHEMISTRY OF CARBONATE SEDIMENTS FROM HARRINGTON SOUND, BERMUDA

The interstitial waters of some anaerobic carbonate mud from Harrington Sound, Bermuda, have been analyzed for several organic and inorganic chemical species. The pore-water chemistry is controlled by production of these species because of the action of anaerobic bacteria on organic matter in the sediment.

Interstitial waters from a series of shallow cores (approximately 1 m) were analyzed for the following aqueous species: pH, HCO_3^-, $SO_4^=$, NH_4^+, HS^-, CH_4, N_2, Ca^{+2}, Mg^{+2}, and SiO_2. The insoluble organic matter was analyzed for organic C and N. Some observed concentration ranges are NH_4^+:O to 1 meq/l; HS^-:O to 1 meq/l; HCO_3^-:2.7 to 8.0 meq/l. The decrease in $SO_4^=$ concentration varies from 0 to 2 meq/l. The abundance of all the dissolved organic species consistently increases with depth, with concurrent decreases in pH, $SO_4^=$, Ca^{+2}, and Mg^{+2}. The C:N ratio in the metabolized organic matter is approximately 8. The ratio of CO_2/H_2S introduced into the pore waters is 5. This cannot be explained solely by the action of sulfate-reducing bacteria.

The data are consistent with a theoretical model of organic decay in a closed chemical system, in which the components of the aqueous phase maintain near-equilibrium with the minerals present.

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CARBONATE FACIES AND PALEOGEOGRAPHY OF ROBINSON MEMBER, MINTURN FORMATION, EAGLE BASIN, COLORADO

The Robinson Limestone Member is one of eight carbonate members of the 5,000 ft thick, predominantly sandstone, Minturn Formation (Desmoinesian) in the study area west of the Gore Range in Central Colorado. The Robinson Limestone Member consists of three limestone units (lower, middle, and upper) interstratified with marine and nonmarine sandstone beds. Total thickness of the Robinson ranges from 200 to 400 ft.

The areal distribution and the thicknesses of four time-transgressive facies which make up each of the Robinson limestone units imply an asymmetrical deposition basin with a relatively deep marginal trough along the east side.

From east to west the facies are (1) an oölite facies composed of superficial oölites, pseudo-öolites and oncolites in micro-spar or micrite; it is interpreted to be a shallow-water, high-energy deposit on the east edge of the marginal trough; (2) a tubular foraminiferal facies composed mainly of tubular Foraminifera micrite; (3) a phylloid algae facies of biomicrite containing abundant *Archaeolithophyllum, Eugonophyllum,* fusulinids, and *Komia;* the phylloid algae facies is interpreted to be a deeper water deposit near the middle of the trough; (4) a stromatolite facies of stromatolites, laminated micrite, and vuggy ostracod-bearing intramicrudite, which indicate quiet-water deposition near the western margin of the trough. The overall patterns of the limestone facies and sandstone beds indicate intervals of rapid marine transgression followed by relatively slow depositional regression.

Bioherms as thick as 80 ft are in the areas of phylloid algae and stromatolite facies. Nonphylloid algae appear to be the major components of these bioherms. However, recrystallization and dolomitization make recognition of the algae types difficult.

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CONTINENTAL RISE OFF EAST COAST OF NORTH AMERICA: SHALLOW STRUCTURE

The continental rise off the east coast of North America is a broad sedimentary apron 200–500 km wide, 1,200–5,200 m below sea level, with an average gradient of less than 1°. Continuous seismic-profiler recordings indicate that the rise is a prism of sediments lying on a strong and nearly level reflecting layer known as Horizon A. This horizon is believed to be the top of a turbidite sequence delineating an abyssal plain that covered most of the North American basin near the end of the Cretaceous Period. Progradation