Logarithms of the reflectance values form a linear trend with depth. Extrapolation of this trend to 0.20% $R_o$, a value thought by some to mark the normal surface intercept, reaches only 460 m (1,509 ft) above present ground, instead of the 1,500 m (4,921 ft) predicted on the basis of postulated erosion. Such a deep intercept would indicate that maximum temperatures were attained much more recently than the volcanism (and subsequent to removal of 1,040 m [3,412 ft] of sediment). If the plot is extended up to the +1,500 m (+4,921 ft) pre-erosion level, the intercept is only 0.08% $R_o$, leading to an unlikely paleotemperature situation.

Time-*independent* models of the general dependence of reflectance on temperature yield a paleotemperature gradient of about 115°C/km and surface intercepts (20°C) of −350 to +250 m (−1,148 to +820 ft) relative to the present ground level. These models require that a strong heating occurred at the site at nearly the present time, and are not in accord with available facts.

Time-*dependent* models give a paleotemperature gradient of 50° to 65°C/km in the sampled interval (41 to 54°C/km in the overlying non-coaly section). Intercepts of 20°C are +1,300 to +1,700 m (+4,265 to +5,577 ft) above the present ground. These models agree logically with the present 46°C/km gradient across the sampled interval and the removal of 1,500 m (4,921 ft) of overburden, with maximum temperature just a bit after maximum burial. Of the three approaches tried, the time-dependent model is the only one which works in this situation.

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## Hummocks—Do They Grow?

Now that hummocky cross-stratification is being more widely recognized in the stratigraphic record, investigators are speculating on the hydraulic conditions under which it forms. An accurate knowledge of the geometry of hummocky lamination is necessary if we are going to determine how it is produced.

I maintain that most if not all hummocky lamination is produced where sediment is draped over a scoured hummock-and-swale surface. As pointed out by several early workers, laminae thicken into the swales so that as sediment accumulates, hummocky laminae flatten out within a liminaset. Laminae tend to be parallel to the basal scoured surface. Although very low-angle tangential laminae are not uncommon, their relationship to the lower bounding surface is typically one of onlap. Several well-exposed hummocks in the Cape Sebastian Sandstone and Coaledo Formation, southwest Oregon, will be used to document my case.

It is imperative to recognize that hummocky bedsets consist of several to innumerable laminasets bounded by low-angle truncations. In some places the lower bounding surface of a hummocky bedset is essentially flat (but scoured), and the basal laminae are nearly horizontal. Laminasets above this basal set may show more curvature, but I maintain that they are bounded by scoured surfaces and that the apparent progression upward from flat to hummocky lamination does not reflect growth of hummocks. Hamblin and Walker in 1979 suggested that basal flat lamination was produced by a density-flow mechanism before storm waves resculpted the sea floor. An alternative explanation may be that the scouring ability of a single storm (or several storms in succession) may have varied with time, in some places beginning with conditions that produced a relatively flat sea floor.

Is there any convincing evidence that hummocks grow, i.e., that they develop by thickening of laminae beneath the crest? Thus far, only Hunter and Clifton in 1982 have convincingly illustrated, with a photograph, an example of laminae that thicken to form a hummock. Is this example a fluke? Can we find more? Until there is further documentation of "growing" hummocks, I suggest that we avoid theorizing about how hummocks grow.

If, as I maintain, hummocky cross-stratification is essentially a scour-and-drape phenomenon, can we define its hydraulic significance? In the case of (smaller-scale) vertically climbing, current-ripple lamination, most workers believe that laminae form by fallout from suspension without traction. In the example of hummocky stratification, some authors have observed parting lineation separating hummocky laminae, which would argue *for* traction; others have noted the absence of parting lineation.

Can we explain the geometry of a hummocky scoured surface by the nature of the waves about it, i.e., are there predictable hydraulic conditions under which hummocky cross-stratification forms? Can we treat hummocks as bed forms that grow and/or migrate? Do observations concerning vertically climbing ripples in an unidirectional flow apply to conditions beneath a storm-wave surface? How important is unidirectional flow during formation of hummocky cross-stratification? Careful observation and documentation of the geometry of hummocky cross-stratification are necessary in our search for the answer to these questions.

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## An Incipiently Drowned Platform Deposit in Cyclic Ordovician Shelf Sequence: Lower Ordovician Chepultepec Formation, Virginia

The Chepultepec interval, 145 to 260 m (476 to 853 ft) thick, in Virginia contains the Lower Member up to 150 m (492 ft) thick, and the Upper Member, up to 85 m (279 ft) thick, of peritidal cyclic limestone and dolomite, and a Middle Member, up to 110 m (360 ft) thick, of subtidal limestone and bioherms, passing northwestward into cyclic facies. Calculated long term subsidence rates were 4 to 5 cm/1,000 yr (mature passive margin rates), shelf gradients were 6 cm/km, and average duration of cycles was 140,00 years.

Peritidal cyclic sequences are upward shallowing sequences of pellet-skeletal limestone, thrombolites, rippled calcisiltites and intraclast grainstone, and laminite caps. They formed by rapid transgression with apparent submergence increments averaging approximately 2 m (6.5 ft) in Lower Member and 3.5 m (11.4 ft), Upper Member. These submergence increments may have resulted from small (about 1 m; 3.2 ft) relative sea level rise, coupled with subsidence due to loading by water and accumulating sediment. Progradation of tidal flat facies did not occur until subsidence had ceased. Tidal flats were shifted westward from 70 to 380 km (43 to 236 mi) after each submergence event, but in peritidal sequences, had sufficient time to prograde back into the shelf.

Deposition during Middle Member time was dominated by skeletal limestone-mudstone, calcisiltite with storm generated fining-upward sequences, and burrow-mixed units that were formed near fair-weather wave base, along with thrombolite bioherms (subwave base to wave agitated shallow water settings). Locally, there are upward shallowing sequences, (subtidal cycles) of basal wackestone/mudstone to calcisiltite to bioherm complexes (locally with erosional scalloped tops). Apparent submergence increments during Middle Member deposition averaged 7.0 m (23 ft), ranging up to 23 m (75 ft) in southeastern belts. Following each submergence, carbonate sedimentation was able to build to sea level prior to renewed submergence. Large submer-