currents, and density gradients indicate the existence of a well-organized band of currents that run essentially parallel to the coast. An analytical model is formulated that successfully predicts the strength and location of this coastal boundary current system as a function of wind speed and direction, water depth, and local density gradients. The analytical prediction of the cross-shore current structure agrees well with the field observations in delineating the presence of convergences and divergences that will act to restrict the seaward migration of fine-grained terrigenous particulates and thus preserve the identity of the two contiguous facies. Variations in the model inputs (e.g., rainfall runoff, wind regime) allow estimates of how such systems operated in different geological regimes, and consequently how such facies relations evolved in climatic regimes different from that of the present time. An understanding of the physical processes that control the siliciclastic-carbonate interface on the eastern Nicaragua shelf emphasizes the delicate balance that exists between terrigenous or carbonate dominance over the shelf.

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Middle Ordovician Knox Unconformity, Virginia Appalachians: Transition from Passive to Convergent Margin

The Knox unconformity, central and southern Appalachians, is one of the major targets for petroleum exploration in the Appalachians, as well as being closely associated with base metal mineralization. It developed on Lower to Middle Ordovician Knox/Beekmantown carbonates, and marks transition from passive margin carbonate deposition to deposition in a foreland basin (convergent margin), possibly during global sea level lowering.

Erosional relief on the unconformity is over 140 m (460 ft) in southwest Virginia, decreasing to 20 m (66 ft) or less in northern Virginia. Decrease in relief is accompanied by rapid depositional thickening of Lower Ordovician and earliest Middle Ordovician units into the Pennsylvania depocenter. Paleokarst features include topographic highs (tens of meters relief), breccia, and mud-filled sinkholes and caves that extend to 65 m (215 ft) below the unconformity, and sub-unconformity intraformational dolomite breccias that formed after dissolution of limestone interbeds. Coarse detritus on the unconformity surface formed thin to thick veneers of regolith that were locally reworked by fluvial and marine processes. Dolomite detritus also was deposited in alluvial fan and playa mud flats in lows on the unconformity surface. Under the luminoscope, the detrital dolomite is evidenced by corroded nonluminescent detrital cores overgrown by luminescent dolomite. The unconformity influenced the regional distribution, composition, and thickness of some post-unconformity peritidal carbonates and may have localized some Middle Ordovician downslope buildups. The unconformity also localized deposition of Pb-Zn ores, which commonly are associated with unconformity related intraformational breccias that remained open during deeper burial diagenesis.

Development of regional unconformities on shelf sequences of passive margins immediately beneath foreland basin sequences is common in other orogens, reflecting gentle warping of the shelf prior to foundering and burial beneath synorogenic clastics. Such unconformities may localize hydrocarbons and base metal deposits (Pb-Zn) by developing permeable zones adjacent to the unconformity.

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Facies Cycles and Related Main Depositional Environments in Ancient Turbidite Systems

Ancient turbidite depositional systems—not necessarily equivalent to deep-sea fans—can be defined as systems where channel-fill sediments are replaced in a downcurrent direction by nonchannelized sandstone lobes. Facies types and facies sequences that characterize channels and lobes have become sufficiently understood within the last 10 years to permit their relatively east recognition in both field and core analyses.

Channel-fill sequences may differ considerably from one system to another. However, two main types of channel-fill sequences, which may be intergradational, can be recognized in most ancient systems. The first type represents channel-levee complexes, and is made up of highly lenticular bodies of coarse-grained sediments originally deposited in channel-axis zones, and of thin-bedded mudstones and fine-grained sandstones produced by overbank processes both within the channels and in adjacent interchannel regions. The second type consists essentially of broadly lenticular bodies of thick-bedded, graded sandstones that are commonly characterized by an abundance of rip-up shale clasts and scoured surfaces. Most individual sandstone beds typically thin toward and onlap onto channel walls. Both types of channel-fill deposits develop facies sequences with an overall thinning- and fining-upward character. In addition, each sequence is typically bounded by a basal erosional surface.

Lobe sequences are characteristically expressed by an alternation of thick-bedded nonchannelized sandstone bodies, commonly between 3 and 15 m (10 and 50 ft) thick, and thinner bedded and finer grained deposits. Also in this case, facies types and facies associations may vary considerably from one system to another. The loci of maximum sand deposition of the lobe environment can either prograde basinward, particularly in small sand-rich systems, or shift laterally with time in systems which develop essentially through vertical aggradation processes. In both places, the resulting facies sequences do not show significant erosional boundaries and can be generally described as thickening upward. Minor thickening-upward sequences, commonly consisting of a limited number of sandstone beds, are virtually ubiquitous within lobe sandstone units and are thought to represent compensation features produced by the progressive smoothing out of the depositional relief during the process of lobe upbuilding.

The transition between channels and lobes is still very poorly understood in both modern and ancient turbidite depositional systems. However, evidence provided by ancient sequences suggests that, at least in some systems, the transition is characterized by an abundance of coarse-grained, cross-stratified, and megaripple-shaped sandstone beds that represent either the bypassing zone of turbidity currents still moving basinward or the most proximal depositional product of the same currents before they develop complete Bouma sequences.

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Paleogene Oxygen Isotope Record for DSDP Sites 511 and 512, Sub-Antarctic South Atlantic Ocean: Paleotemperatures, Paleooceanographic Changes, and Eocene/Oligocene Boundary Event

An Eocene-Oligocene oxygen and carbon isotope history based on planktonic and benthic foraminifers from Deep Sea