The Lower Cretaceous Grand Rapids Formation in the Wabasca Oil Sand Deposit of north-central Alberta contains approximately 10.5 billion cu m (66 × 10^9 bbl) of viscous, low gravity bitumen in the subsurface. It represents a progradational clastic sequence building northwest into the Boreal Sea during early Albian time. The formation measures up to 90 m thick and consists of three progradational sandstone units (C, B, and A members in ascending order), separated by two marine shale/siltstone units, indicative of marine transgression.

Sequences of lithologies, sandstone geometry, and sedimentary structures indicate that each sandstone member represents a variety of depositional environments. Each shows a shallowing-upward trend from nearshore marine below effective wave base to lower and upper shoreface facies. Tidal inlet, beach, and possibly coastal dune environments are found in the upper parts of the A and B sandstones. Variations between localities indicate that upper shoreface to ?dune environments laterally grade into lagoonal and/or terrestrial environments. Coals, which locally cap the A and B sandstones, indicate back-barrier lagoon or interchannel marsh deposits. Local chert pebble beds found in the upper shale/siltstone sequence and in the basal part of the A sand are interpreted as possible major storm deposits.

On a regional scale, the Grand Rapids Formation of the Wabasca area appears to represent a barrier island coastal complex possibly adjacent to deltaic or delta plain sequences.

KRAUSE, F. F., Petroleum Recovery Inst., Calgary, Alberta, Canada

Evolution of a Mixed Carbonate/Terrigenous Platform: Lower Cambrian Continental Terrace Wedge of Mackenzie Mountains, Northwest Territories, Canada

Rocks of the Sekwi Formation and underlying siltstones of G.S.C. units 10A and 13 exposed in the western Mackenzie Mountains define a continental terrace wedge that evolved during the Early Cambrian on the northwestern flanks of the North American continent. Growth of the continental terrace wedge can be categorized by three phases of platform up-, out- and in-building. *Phase 1*—Continuous out- and up-building, and evolution from a ramp to a platform configuration. Growth culminated in middle and upper *Nevadella* zone rocks with prominent karst surfaces, abundant intraclast pebbles in oolite shoal deposits and a switch in composition of slope and fan deposits from carbonates to terrigenous clastics. *Phase 2*—Coincided with transgression of the shelf near the *Nevadella* and *Bonnia-Olenellus* zone boundary. Maximum platform out-building occurred at this time and climaxed with subaerial exposure of mid-*Bonnia-Olenellus* zone rock. Slope deposits changed from carbonate to terrigenous sedimentation. *Phase 3*—Renewed slow up- and in-building that led to eventual drowning of the platform by latest *Bonnia-Olenellus* zone time. Sedimentation patterns on this platform are reciprocal. Periods of sea-level highstand are characterized by abundant limestones, whereas periods of sea-level lowstand are marked by terrigenous influxes. These two stages of sea-level stand are highlighted in compositional differences of carbonate breccia deposits. During sea-level highstands, breccias contain predominantly ribbon and nodular limestone clasts. They reflect conditions of early lithification of the sea floor and non-equilibrium compaction of these deposits with subsequent sliding and downslope transport. In contrast during sea-level lowstands breccias consist preferentially of shelf and shelf-margin derived clasts.

KROHN, M. DENNIS, and JEFFREY D. PHILLIPS, U.S. Geol. Survey, Reston, VA

A Principal Component Enhancement for Landsat Images: Possible Structural Applications in Vegetated Virginia Piedmont

Digital processing algorithms that specifically display spectral differences are needed for better use of Landsat images in vegetated areas. A modified principal-component (PC) enhancement was applied to a Landsat scene of eastern Virginia: a second inverse rotation was applied to the uncorrelated axes, so that the image presentation of the PC data resembles the color relationships in a false color composite. Fieldwork showed that several types of coniferous and deciduous oak forests could be readily distinguished on the image.

An E-W elongate zone, 45 km long by 20 km wide along the James River west of Richmond, was defined on the image based on the distribution of a chestnut oak (*Quercus prinus*) forest. In this area, chestnut oak has a strong affinity for weathered coarse upland gravel deposits. Although such Miocene(?) gravel deposits are scattered throughout the image area, nowhere else are they concentrated into a linear zone. In addition, several other structural features coincide with the linear segments of the James River drainage: (1) a series of offsets in the gravity gradient map, (2) an inland extension of the offshore Norfolk fracture zone, and (3) a zone of seismicity near the James River. Such cross-strike features had an important role in the thin-skinned tectonics of the Valley and Ridge and may have important applications for the extension of the Eastern Overthrust belt postulated beneath the Piedmont.

KUEHL, STEVEN A., CHARLES A. NITTROUER, and DAVID J. DEMASTER, North Carolina State Univ., Raleigh, NC

Regional and Fine-Scale Strata Formation in a Major Accretionary Environment: Amazon Continental Shelf

Investigation of Amazon shelf sedimentation demonstrates that strata is presently accumulating on the inner shelf ($<$60 m water depth) in the form of a subaqueous delta (composed primarily of silt and clay) which is prograding over relict basal sands. Seismic reflection records (3.5 kHz) reveal regions of topset, foreset, and bottomset stratigraphy. The formation of fine-scale ($<$ 50 cm) strata was examined using x-radiographic and radiochemical (e.g., ^{210}Pb, ^{137}Cs, ^{234}Th) techniques on more than 60 box cores from the deltaic deposit. On the basis of sedimentary structure, three distinct sedimentary environments have been delineated within the topset region: (1) interbedded mud and sand in a corridor extending from the river mouth across the inner shelf, (2) faintly laminated muds to both flanks of this corridor, and (3) bioturbated muds comprising the remainder of the deltaic deposit. The interbedding of mud and sand may result from short-term fluctuations in a turbulent jet emanating from the Amazon River mouth. Faintly laminated muds are deposited from suspension on the flanks of the turbulent jet and have the highest accumulation rates found on the inner shelf ($>$2 cm/year). Where accumulation rates are reduced, bioturbated muds are present. ^{234}Th data from the bioturbated muds indicate rapid mixing down to 5 cm with a mixing coefficient of about 30 cm^2/year. Observations of sedimentation on the foreset and bottomset regions are not as comprehensive because of their relatively small areal extent. However, accumulation rates are found to decrease from topset ($>$2 cm/year) to bottomset ($<$0.5 cm/year) regions. With decreasing sediment accumulation rate the effects of biological mixing on preserved strata become more pronounced.

KUMAR, MADHURENDU BHUSHAN, Louisiana State Univ., Baton Rouge, LA