Antidunes are nearly symmetrical, sinusoidal bed forms formed by near-critical flows, and comprise all bed profiles in phase with surface gravity waves in the overlying flow. This definition applies regardless of bed-form propagation direction or mode of formation. They occur in a wide range of depositional environments but are ubiquitous in the swash zones of fine-grained beaches. Antidunes are a common but little-recognized feature of washover fans, where they generate distinct sedimentary structures that are well preserved in the stratigraphic record.

On washovers at Seabrook Island, South Carolina, antidune trains form at the fan apex, in phase with an undular hydraulic jump. This jump marks the transition within the overwash surge from supercritical flow of the berm crest to subcritical flow on the fan itself. Bed-form distribution on the fan is controlled not only by this transition but also by downfan energy dissipation within subcritical portions of the flow. From berm crest to fan terminus (i.e., downstream) the lateral sequence of bed geometries is: flat, erosional bed; antidunes; flat bed with primary current lineation and rhomboid rill marks; flat, featureless bed; rhomboid to cuspate ripples; undulatory, linear ripples; washed-out ripples; flat bed. Heavy minerals are concentrated near the fan apex owing to selective downfan transport of quartz. Landward fan migration results in a genetic sequence of sedimentary structures in which all of these features are preserved.

Streamwise boundaries of the antidune field are abrupt. Within the field itself, both crest amplitude and crest spacing decrease downfan with decreasing velocity. Bedding geometry is controlled by bed-form scale, by the pulsing nature of the flow (which tends to wash out bed forms at the end of each rock event), and by eolian deflation during neap tides and fair weather. Upstream antidunes produce thin lenses of backset laminae which are commonly truncated by flat beds or superposed backsets. These lenses grade downstream into thinner lenses with lower angle backsets, and finally into zones of very low-angle truncation surfaces.

Orthoquartzitic washovers in the Carboniferous of Kentucky and the Ordovician of South Africa display well-preserved antidune formset geometries. Although the very well-sorted, monomineralic nature of these sandstones renders internal stratification nearly invisible, backset laminae are apparent. Pleistocene washovers in South Africa exhibit antidune bedding types influenced by grain size. Fine to medium-grained sand is organized in en echelon lenses of backset laminae interbedded with flat beds. Coarse sand and granules occur as flow-perpendicular ribbons with lenticular cross sections and spacing similar to antidune spacings on modern fans.

Many published photographs of flat beds contain unrecognized examples of antidune stratification. In many places, the antidune cross-laminae would be impossible to detect without heavy minerals or other markers to accentuate bedding. However, in apparent massive beds, x-ray radiographic techniques have revealed cross-laminae with antidunal affinities. Moreover, antidunes may be responsible for much of the low-angle truncation normally associated with flat-bedded facies.

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History of Development and Depositional Environment and Upper Cherokee Prue Sand, Custer and Roger Mills Counties, Oklahoma

In western Oklahoma the uppermost sand member of the Cherokee Group, the True sand, was first drilled and found productive in two discoveries, completed in 1980, in west-central Custer County and in central Roger Mills County, Oklahoma. For 1½ to 2 years these two discoveries, some 18 mi (29 km) apart, were thought to be stratigraphic equivalents of two separate sand bodies occurring parallel to the classic northwest-southeast-trending systems of the Anadarko basin. Energy Services has drilled eight productive Prue sand wells in this area and has been instrumental in establishing that the 1980 Prue discoveries are actually part of a predominantly east-west-trending system that extends some 40 mi (64 km) across the west-central part of western Oklahoma.

At present, some 40 productive wells will ultimately produce more than 100 bcf of gas and 3 million bbl of condensate from an average depth of 11,500 ft (3,500 m). Sand porosities range from 3 to 18% with most producing wells having porosities in the 12 to 15% range. Because Prue sand is slightly overpressured (a pressure gradient of .53 psi/foot), the reserves are generally better than normal-pressured wells at this depth.

Log and sample data from the 40 producing Prue wells and numerous surrounding nonproductive tests, along with the one core of the sand, give a fairly good picture of the sand geometry and depositional history.

The sand body is over 40 mi (64 km) in length, 1 to 1.5 mi (1.6 to 2.4 km) wide, and 60 ft (18 m) thick. The east-west trend of the sand is parallel to the present-day structure at the top of the Cherokee Group as well as to the interval isopach of the Cherokee Group. The majority of the open-hole logs and samples show a fining-upward sequence, where most of the clean productive interval is at the basal to middle part of the sand. Study of the core shows the interval to grade from a medium to fine-grained sand, highly laminated and cross-bedded with black shale, to a slightly coarser grained nonstructured interval and back into a highly laminated cross-bedded sandy black shale interval. The interval is topped by a 10 ft (3 m) thick black shale layer that is a predominant bed throughout the whole area. We interpret the sand morphology as that of a submarine offshore bar sand that was deposited in shallow water but never emerged above sea level to form a barrier island of beach-type environment.

The existence of a shaly limey interval for 500 ft (152 m) above the Prue sand along with the excellent preservation and consistency of the Prue sand geometry indicate that the Prue was never reworked and was likely deposited in a trangressive or at least a subsiding basin environment.

These conclusions have implications that may assist in the exploration of other Pennsylvanian sands in this area.

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Transverse Structural Styles and Subduction-Related Deformation in Sumatra Fore-Arc Basin, Western Sunda Arc, Indonesia

The western Sunda Arc of Indonesia is a continental-margin arc-trench system characterized by oblique subduction along an irregular crustal edge and by transcurrent faulting within the arc terrane. Offscraping and accretion of material along the base of the landward trench slope have led to formation of a prominent outer-arc ridge that has trapped sediment in basins between the volcanic arc and the trench. Sedimentary strata deposited in these fore-arc basins record the Neogene and Quaternary evolution of the arc-trench system and preserve many of the original structural and stratigraphic relationships.

Along the active Sumatra margin, the combination of compression and transcurrent faulting has led to the development of relatively shallow transverse structures that subdivide the fore-arc region into several discrete sedimentary basins. Multichannel seismic reflection profiles reveal the structural style of two prominent transverse highs that separate Nias basin from the deeper