Quadrant II – Transcript and Related Materials

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NOTES:

Although there is no generally accepted classification of sedimentary structures, the four main groups are

1. Primary structures: erosional, depositional,
2. Secondary structures: chemical, biogenic structures.

PRIMARY (MECHANICAL) STRUCTURES

DEPOSITIONAL STRUCTURES

BEDDING AND LAMINATION:

The characteristic feature of sedimentary rocks, their stratification or bedding, is produced mostly by changes in the pattern of sedimentation, usually changes in sediment composition and or grain size. Bedding generally is defined as a sedimentary layering thicker than 1 cm. Finer-scale layering, only millimetres thick, is termed lamination.

MASSIVE BEDDING: Beds are rarely without some sort of internal fabric or structure. Those which are apparently structureless have been termed as massive. Internal laminations have been revealed by X-ray photographs of such seemingly homogenous beds. Truly massive beds are therefore probably rare.

LAMINATIONS: Commonly 0.5 to 1.0 mm thick. They may be continuous and distinct or discontinuous and obscure. Laminations are caused by variations in the rate of supply or deposition of different materials like shift in the depositing current to climatic causes and also aperiodic storms or floods. Shales are noted for the excellence of their laminations, the most perfect examples of laminated shales are commonly lacustrine. Thinner the lamination, slower is the rate of accumulation.

CROSS BEDDING is considered to be an internal feature of a bed, whereas ripple marks are treated as a surface or bedding plane structure. Cross bedding is the product of migration of mega ripple or sand wave; ripples produce a small scale cross bedding on migration. Cross bedding or cross lamination has received more attention than all other sedimentary structures combined. Lending it to quantification and is particularly useful in paleocurrent analysis. Cross bedding is a structure characteristic of sands—noncohesive granular materials. A cross bedded layer may vary in thickness from 3mm to over 30mm.

There are two general types of cross bedding. One is simple tabular set, with foresets approximating planes. The other is a trough- shaped set of cross strata which are usually curved surfaces. In tabular-shaped cross strata the traces of foresets are straight lines whereas in case of trough shaped are curved and concave down current.

Dune migration produces large scale cross strata while ripple migration produces small scale cross-stratification. In case of planar cross-bedding there is an initial up-current dip, and the foresets dip down current.

The regular, linear ripples or sand waves produce the simple tabular cross stratification. The linguloid wave forms produce the trough cross stratification. If there are bipolar tidal currents, then herringbone cross-bedding can form.

RIPPLE MARKS are small scale structures, the wavelength of which is only a few centimeters, and height is measured in millimetres. These are a very common feature of both modern sand flats and of bedding planes of many ancient sandstones. When a current flowing over a bed of sand reaches a certain velocity, sand grains begin to move promptly and a rippling appears on the surface of the sand. These current ripples consist of numerous long, essentially parallel, more or less equidistant ridges, trending in straight or gently curved lines at right angles to the current. With a continued increase in velocity the rippling disappears and a smooth bed is formed over which sand is swept.

If sand is being moved in a non-sandy bottom e.g. like a firm mud surface and supply of sand is insufficient to form a continuous layer, the sand will accumulate in isolated ripple ridges and appear in cross section as Plano-convex lenses of sand embedded mudstone. The term lenticular bedding is applied to this structure.

FLASER BEDDING AND LENTICULAR BEDDING

When mud is present, the form of the ripple-bedded unit becomes more evident. Intercalated mud may be in the form of lenticles or flasers as a result of isolated accumulations of mud in ripple troughs; this is flaser bedding. If the mud lenticles coalesce, the result is wavy bedding. If the mud dominates, the ripple-bedded units are isolated and enclosed in a mud matrix; this is lenticular bedding or starved ripples.

GRADED BEDDING

Graded beds are sedimentation units marked by gradation in grain size form coarse to fine, upward from base to the top of unit. Graded beds are deposited from waning current and may range in thickness from a centimetre or one or more meters. Graded materials maybe silt, sand or in rare cases gravels. Usually most graded beds are sandstones and range from a few centimeters to a meter in thickness. In general, the thicker the graded unit, the coarser the materials at the base of the bed.

BOUMA SEQUENCE

Grading is of several types. Some graded beds are composites apparently formed by a second surge which arrived before the first current had completed its deposition or alternately formed by truncation of an earlier deposit before deposition of a new graded unit.

Despite the variation in styles of grading shown in the field, it is clear that that there is an ideal or normal sequence of structures found in the most completely graded unit. This ideal cycle has come to be called the Bouma Cycle. The ideal sequence consists of five sub-divisions or "intervals". The lowest graded interval A, displays the marked grading and is normally the thickest part of the bed. In some cases the grading is indistinct or even absent if the sand available was exceptionally well sorted. The graded interval is followed in some cases by an interval of laminated sand. (B), which is commonly followed by an interval displaying ripple cross-lamination (C). According to Bouma this in turn is followed by an upper interval of indistinctly laminated sandy or silty pelitic material (D) an interval generally poorly displayed and not often observable. The top interval (E) is the pelitic interval (shale or slate) which terminates the Bouma sequence.

As noted by Bouma, beds displaying the entire sequence are not common. Many display top truncation that is incomplete cycles starting with the graded interval but lacking one or more of overlying members. More common is the bottom truncation that is beds beginning with higher interval. But as noted by Bouma where truncation has occurred, the remaining intervals present are in their proper sequence. Incomplete sequences may be attributable to the weakening of formative current as it deploys over the floor of the basin.

Graded bedding and cross-bedding are earmarks of two contrasting facies of sand deposition they are therefore mutually exclusive features and do not occur in the same sedimentary sequence.

Graded bedding is a feature primarily of sandstone, principally graywackes in the Palaeozoic and older sequences. Each graded bed records a single short lived episode and is a product of deep water sedimentation beyond reach of normal bottom currents and waves. The accumulated evidence now almost certainly indicates deposition from a dense turbidity flow, which may be a product of submarine slump, triggered perhaps by earthquakes. Although some isolated or sporadic graded beds can be produced by volcanic eruptions, heavy floods or hurricane like storms, most repetitive marine graded beds are certainly product of turbidity flows.