Flow Velocities

Several techniques have been used to estimate paleoflow velocities. One technique consists of identifying the kind of bedform that produced a deposit and then researching the flow conditions that produce such bedforms. Empirical data relating bedform morphology and behavior to flow conditions are available for wide ranges of conditions and bedforms (Guy et al., 1966; Southard, 1971; Middleton and Southard, 1984) and for specific kinds of bedforms such as current ripples (Harms, 1969; Banks and Collinson, 1975; Allen, 1977; Ashley et al., 1982; Middleton and Southard, 1984), wave ripples (Bagnold, 1946; Inman, 1957; Komar, 1973, 1974; Dingler, 1974; Clifton, 1976; Allen, 1979), wind ripples (Bagnold, 1941; Sharp, 1963; Walker, 1981), subaqueous dunes and sand waves (Stein, 1965; Dalrymple et al., 1978; Rubin and McCulloch, 1980; Costello and Southard, 1981; Middleton and Southard, 1984), and antidunes (Gilbert, 1914; Kennedy, 1969; Hand, 1974). Dimensional analysis has enabled empirical bed-phase relations to be extended to flows with unusual sediments, unusual fluids, or unusual temperatures (Southard, 1971), but other bed phases (such as marine and estuarine mud waves, furrows, adhesion ripples, and eolian dunes) have been less well quantified.

In rare cases paleoflow velocities can also be estimated by using bedform heights and migration speeds to determine paleotransport rates using equation (2). Transport rates can then be converted to flow velocities using empirical or theoretical transport-rate relations. This technique can only be applied to deposits where the bedform migration speeds can be determined; application of the technique also requires knowing the bedform height and the bedform trend relative to the transport direction. In the few cases where this technique has been applied, bedforms have been presumed to be transverse, and migration speeds have been determined from the distance of bedform migration caused by currents of known duration such as tidal currents (Allen, 1981; Allen and Homewood, 1984) or annual wind cycles (Hunter and Rubin, 1983).