2. In nearshore continental beds, species of microfossils are less numerous generally; many beds contain mainly one kind of palynomorph, such as resinous bodies or fusinized material. Possibly this reflects local conditions which favor minimum particle transport and mixing.

3. Bladdered pollen grains occur in varying abundance in almost every bed regardless of other palynomorph abundance. Differing hydrodynamic response of these large grains may govern their anomalous occurrence, in contrast to smaller nonbladdered forms.

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PRACTICAL COMPARISON OF METHODS OF COMPUTING GRAIN-SIZE PARAMETERS

Sieved modern coastal sands were used to compute standard grain-size parameters from all known graphic formulas and the method of moments. Progressively greater variation existed in computation of mean, sorting, skewness, and kurtosis. As a group, Folk and Ward's parameters came closest to approximating moment parameters.

The median yielded the greatest deviation from the moment mean, being too fine for coarse-skewed samples and too coarse for fine-skewed samples. Graphic means were very close to the moment mean. Formulas (Folk and Ward, McCammon) considering points near the tails of the distribution and the median produced almost the same values as the moment mean. Formulas (Otto, Inman) omitting the median yielded slightly too coarse means for coarse-skewed samples and slightly too fine for fine-skewed samples. Sampling more than four frequency curve points did not increase accuracy of means or sorting estimates.

Among graphic sorting estimates, Krumbein's QD_ϕ consistently was appreciably lower and Friedman's SO, and Griffiths' PD_ϕ consistently were appreciably higher than moment standard deviation. Cadigan's S and Otto's and Inman's σ_ϕ produced irregular values averaging higher and lower, respectively, than moment values. Folk and Ward's σI and McCammon's σ yielded consistent results slightly below moment values. Tanner's $D_{3,29}$ produced the closest approach to moment values. The non-phi-unit methods (Trask's So; Miller and Zeigler's DS; Sharp and Fan's Si) showed the same relative change in sorting between samples.

No graphic skewness estimate correlated well with moment skewness, although they usually yielded the same sign. Only Folk and Ward's Sk_I and Inman's σ_ϕ produced fairly consistent results close to the average skewness value. No graphic kurtosis estimate correlated with moment kurtosis, which was consistently higher.

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GRAIN AND GRAPTOLITE ORIENTATION IN TURBIDITE GRAYWACKE, CLORIDORME FORMATION (ORDOVICIAN), GASPÉ, QUEBEC

Sedimentary structures, textures, and fabric were studied in eight graywacke beds exposed on the wave-cut platform near Grande Vallée; these beds were traced continuously for 2 mi along the strike which is almost parallel with the average current direction indicated by sole marks.

The direction of current flow during deposition of the bed was determined from intrabed lineations and grooves, oriented graptolites, and grain fabric. Most beds show large deviations of internal flow directions from sole-mark directions, particularly in distal regions. Internal directions were increasingly divergent from the sole toward the top of the bed. Agreement between dimensional grain orientations and other internal flow-direction indicators proves that grain orientations are depositional, not tectonic fabrics, and that grains generally were oriented parallel with the flow and imbricated in an upcurrent direction. Current-normal orientation was found in a plane-laminated part of one bed. Grains tend to lack statistically significant preferred orientation in proximal parts of the beds but show preferred orientation as the beds were traced distally.

These results suggest that existing concepts of turbidity-current flow are oversimplified and neglect the possibility of large changes in flow direction, perhaps caused by secondary currents within a single turbidity current.

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MULTIVARIATE FACIES MAPS

Facies maps are constructed from paleontologic and lithologic data to depict major and subtle depositional environment differences across a region during a specified time span. Ratio maps and three-component maps exhibit a lack of discrimination because they cannot incorporate all available data. Factor analysis and cluster analysis techniques can be used to construct truly multivariate facies maps. Earlier attempts at factor or cluster analysis multivariate facies maps had one or more deficiencies: (1) inability to handle a sufficient number of variables and locations; (2) inability to handle mixed-mode data (presence-absence, coded states, integer counts, and continuously variable measurements); (3) inability to take into account redundant or highly correlated variables; and (4) inability to accommodate to missing data.

A new cluster analysis classification computer program has been written to overcome these deficiencies. The FORTRAN IV program can utilize up to 200 variables on as many as 1,000 stations. It performs a distance function principal components analysis to compute orthogonal (uncorrelated) factor measurements for a distance function cluster analysis of locations. This combination will handle mixed-mode data and will adjust to missing data.

From the resulting multivariate classification of paleontologic and lithological data, a facies map showing the distribution of the various classes was constructed and compared with previously published facies maps. An example using multivariate lithologic data from coded AmStrat sample-description logs from central Montana demonstrates the potentialities of this method.

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MINERAL RESOURCE POTENTIAL OF CONTINENTAL MARGIN OF UNITED STATES

The submerged margin of the continent adjacent to the United States is an asset of great importance to the nation. In the aggregate it is a most promising frontier for exploration and development of mineral resources.

The continental margin, considered here to extend