DISCRIMINATION OF SEDIMENTARY ENVIRONMENTS BASED ON PARTICLE SIZE STATISTICS

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1. INTRODUCTION

1.1 Purpose and Scope of Investigation

Particle size distribution is a very significant textural property of clastic sediments because it may shed light on the genesis of sediments.

Though it is widely known that the particle size distribution of a substance obtained from mechanical disintegration follows either the lognormal law or the Rosin's law, sedimentary processes, transporting modes, and multiple sources cause the particle size of sediments to deviate from any known probability distribution.

This report essentially summarizes several published articles dealing with the use of particle size statistics for discrimination among sedimentary environments. Theoretical consideration of particle size distributions is followed by the discussion of problems concerning their application to sediments. A comparison of the graphic and moment methods for the estimation of the population moments of the particle size distribution is also presented. The description of particle size statistics in discriminating sedimentary environments is emphasized. Finally, the multivariate method of linear discriminant analysis is introduced and used to differentiate sedimentary environments for a set of real observed data. A discussion on tests of hypotheses of means and covariance matrices between two multivariate normal populations is also included. Discriminatory power and probability of

misclassification are briefly described as well.

1.2 Definition of Individual Particle and Working Units

The American Society for Testing Materials (ASTM), defines "individual particle" as " a minute unit of matter whose size and shape depends on the forces of cohesion". It is normally only a single crystal or a particle of regular shape with a specific gravity approximating that of a single crystal. "Working units" and "ultimate particles" are terms for the actual discrete units which may be individual particles or aggregates; they do not change their state of dispersion with time nor by the addition of peptizing agents throughout the determination procedure.

1.3 Principles of Particle Size Classification

The principles for the classification of particle sizes and the corresponding methods (Herdan, 1953, p. 35) are:

Principles	Methods
Geometrical Similarity	Sieving, Microscopic Examination
Similarity in Hydrodynamic Behavior	Sedimentation, Elutriation
Similarity in Optical Density	Light Extinction
Similarity in Surface Properties of Particle Aggregates	Permeability, Adsorption Methods

According to the principle of geometrical similarity, particles whose two dimensional images or whose three dimensional forms have