WEIGHTED CONTACT PACKING - IMPROVED FORMULA FOR GRAIN PACKING OF QUARTZ ARENITES

JOHN D. HOHOLICK,2 H. N. Fisk Laboratory of Sedimentology
THOMAS A. METARKO,3 University of Cincinnati
and PAUL E. POTTER Cincinnati, Ohio 45221

ABSTRACT: Contact types between grains — floating, point, long, concavo-convex and suture — help define the fabric of the detrital framework in a sandstone and its pore geometry. These contact types are combined in a non-linear equation based on powers of two, which is more discriminatory of fabrics in quartz arenites than the original linear equation proposed by Füchtbauer in 1967.

INTRODUCTION

Pore systems of sandstones are complex and have proved difficult to define in thin section although much work has been done. Porosity, $\phi$, is related to depth of burial and thermal gradient and depends on the following rock properties, all of which are measurable in thin section:

$$\phi = f \text{(framework packing, type of framework grains, size and sorting of framework grains, percent clay matrix, and percent chemical cement).}$$

The above dependency suggests that a regression equation, one that might even incorporate estimates of maximum burial depth and paleotemperature, is a future research goal, especially if based on samples from a single basin with a well known geologic history. Our goal is far less ambitious — we simply propose a modification of Füchtbauer’s (1967, p. 365) original formula for grain packing.

GRAIN PACKING FORMULAE

Füchtbauer’s formula utilized the five grain contacts of Taylor (1950, p. 701) who recognized floating, point, long, concavo-convex and sutured framework grains (Fig. 1). Füchtbauer combined these types in an equation yielding a single number which can be plotted against depth and/or with correlated porosity.

$$\frac{1a + 2b + 4c + 8d + 16e}{a + b + c + d + e}$$

where $a =$ number of point contacts
$b =$ number of long contacts
c $=$ number of concavo-convex contacts
d $=$ number of sutured contacts

e $=$ number of floating grains

Because types of grain contacts depend not only on paleotemperature, chemistry of the fluids and overburden, but also on the kind of framework grain — soft argillaceous rock fragments are far more ductile than quartz, and carbonate grains are much more soluble — all such formulae should either incorporate grain type or comparisons should be restricted to comparable petrographic types. We suggest the latter and primarily recommend application to quartz arenites, the purer sandstones. The formula we recommend below is applicable to cathode luminescence studies (Sippel, 1968) of thin sections.

Weighted contact packing is calculated as follows:

$$\frac{1a + 2b + 4c + 8d + 16e}{a + b + c + d + e}$$

where $a =$ number of floating grains
$b =$ number of point contacts
c $=$ number of long contacts
d $=$ number of concavo-convex contacts
e $=$ number of suture contacts

1Manuscript received August 19, 1981, accepted January 15, 1982.
2Present Address: Exxon Co., USA, P.O. Box 3116, Midland, TX 79702
3Present Address Superior Oil Co., Western Division, Production Department, Englewood, CO 80111

The Mountain Geologist
V. 19, No. 3 (July 1982), p. 79-82.