Geophysical Research Abstracts, Vol. 9, 01473, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01473

Phonon thermal conductivity of carbonate geomaterials: A relationship to adiabatic incompressibility

S. Maj / IGPh-PAS

Institute of Geophysics, Pol. Acad. Sci., ul. Ks.Janusza 64, 01-452 Warsaw, Poland
(maj@igf.edu.pl / (48)(22)69-15-915)

Two variants of a general relationship between the phonon thermal conductivity at room temperature (about 298 K), ko, and adiabatic incompressibility (adiabatic bulk modulus), Ks, for carbonate minerals (calcite, aragonite, and also dolomite groups) are suggested. Considerations are based on the Debye's theory of crystalline lattice vibrations (with only the acoustic modes taken into account). The mean velocity of phonons is approximated by a hydrodinamical speed of sound. In particular case, the seismic equation of state was also used. All thermal and elastic laboratory data used in our calculations are for the polycrystalline aggregates of carbonate phases. The first variant is of the form: log ko = (5/6)log F - 0.7173, where seismic parameter F = Ks/d (symbol d denotes the density); it is assumed that the average free path of acoustic phonons is about 0.7 nm (mean dimension of unite cells of carbonate structures). The second variant is of the form: ko = (16.7/3)(Ks/<A>)<to>, where <to> is the mean lifetime of phonons in picoseconds, and <A> is the mean atomic weight (in g/mol). Other parameters, as ko, F, Ks, d, are expressed in W/m K, (km/s)ˆ2, GPa, and g/cc, respectively.