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Investigation and Model Correlations of V_p/v_s and Porosity of Carbonates

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Many articles deal with the topic of compressional and shear wave velocity of carbonate rocks and their correlation.

This paper will show the first results of compressional and shear wave velocity measurements and the calculations using the model of Kuster & Toksoez and Hashin-Shtrikmann bounds to describe the upper and lower limits.

Three different carbonate types from Austria were selected for measurements. Both dry and saturated samples were used for the measurements. Helium pycnometer and principle of Archimedes were used to determine the effective porosity of samples.

Ultrasonic device was used to measure the compressional and shear wave velocity of dry and brine-saturated carbonates. Using the measured v_p , v_s and the effective porosity the inclusion model that developed by Kuster and Toksoez was accomplished to describe the data of the dry samples. Equations for penny shaped cracks with different aspect ratio (0.005-0.5) were used. The spherical and spheroidal inclusions of "Dachstein"-limestone are characterized by 0.1 and 0.005 aspect ratios. The "Wetterstein"-dolomite can be represented with an aspect ratio of 0.01. Data for the "Haupt"-dolomite scatter.

Hashin-Shtrikmann bounds (upper and lower bounds) of elastic parameters of dry and saturated samples were calculated. Observable is that the shear modulus for the saturated samples changed. This shear weakening can be occurs as a result of present of a lot of microporosity within the samples.

In conclusion, the different model calculations provide useful interpretation tool for our data set.