AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

Guido Bracco Gartner[1], Gregor P. Eberli[1], Gregor Baechle[1], Michael L. Incze[2], Flavio S. Anselmetti[3] (1) University of Miami, Miami, FL (2) Naval Undersea Warefare Center, Newport, RI (3) Swiss Federal Institute of Technology (ETH), Zurich, Switzerland

Effects of Pore Types and Cementation on Velocity and Permeability in Carbonates

Laboratory experiments show that velocity and permeability in carbonates are strongly controlled by the combination of porosity and pore type. Consequently, rocks of similar porosity but with different pore types display different velocities and permeabilities. Understanding the influence of various pore types on the elastic properties in carbonates has the potential to relate sonic and porosity logs to permeability. Pore types in carbonates are the result of cementation/dissolution processes. Cementation transforms the sediment into a rock but the type of cementation is very important to determine the resulting elastic properties. For example, little amounts of meniscus cements are needed to produce a high velocity rock, while larger amounts of fibrous aragonite cement are required to generate a rock with similar velocity. In addition, variable pore types are responsible for deviations from the inverse relationship between total porosity and velocity and the positive relationship between porosity and permeability. In general, isolated pore types, such as moldic and intragranular, result in high velocities and positive deviations from Wyllie's equation while connected pore types as intergranular or intercrystalline produce low velocities and negative deviations. Because permeability is also highly dependent on pore types, a good correlation exists between velocity deviations and permeability. Assessing and quantifying pore types is difficult from rock properties measurements. Digital image analysis can quantify pore types and relate them to permeability and velocity. Understanding these relationships is a first step for prediction of permeability from sonic and velocity logs and seismic data sets.