Estimation from elastic velocity to density - relation between velocity, porosity and density -

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We develop a theoretical formula relating seismic wave velocity of rocks to their porosity and density based on an effective medium model. Rocks are modeled as aggregates of elastic spheres whose sizes are the same, and the frame of spheres are assumed to be uniquely determined by porosity. We then expressed both the elastic properties and density of rocks in terms of porosity and effective pressure. We confirmed that the formula gives rock density consistent with those of ODP core samples and empirical data of Nafe and Drake (1957). The theoretical formula obtained here can be applied to the analysis of gravity anomalies, by estimating density structures from seismic velocity structures.