

## Teaching teachers: The permeability-porosity relationship

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How a fluid flows and gets trapped to form a reservoir in the Earth's crust depends on the characteristics of the rocks making the crust. In Earth sciences, we often relate the ability of a fluid to flow through a medium, or permeability, to the pore space volume of that medium, or porosity. The drive for more accurate permeability-porosity relationship determination forces geoscientists to use relatively expensive apparatus. However, quick estimations of both parameters can be drawn with simple and cheap equipment. At the University of Liverpool, the CPD (Continuing Professional Development) course allows high school teachers across Great Britain to learn about cutting edge research, new scientific advances and techniques for communicating these to their students. In this regard, we developed a low-cost practical to determine the permeability-porosity relationship for a range of rocks. The 16 teachers were all provided with a selected suite of rocks with varying porosity and permeability, both of which were previously determined using conventional laboratory methods. Here we will compare the results, examining the repeatability and variability of the measurements, and how statistical analyses can be applied to these results. We are now expanding this practical to provide sample suites to schools teaching A-level geology, and have distributed 12 sets to date. In the practical, students are provided with a series of exercises in which 1) the porosity is estimated by saturating samples with water while keeping track of the weight gain through the experiment. 2) The permeability is then calculated using the constant head method. In this experiment, a 2.5-cm long sample is placed at the bottom end of a 10-cm long jacket filled with water. In this setup, the pressure gradient is set by the constant weight of water above the sample, while the flow rate can be monitored with high precision lab glassware or a set of scales. These parameters, then entered in an excel spreadsheet provided with the practical, are used to calculate the permeability, before the groups of students can meet to compare results. Throughout the exercise, students are asked to reflect on units and errors associated with these determinations.