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Study of the dielectric properties of weathered granite, basalt and quartzite by means of broadband dielectric spectroscopy over a wide range of frequency and temperature.

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Broadband Dielectric Spectroscopy (BDS) allows the measurement of the complex impedance of various materials over a wide range of frequency (0.1 Hz to 2 MHz) and temperature (-150 to 400°C). Other properties can be assessed from this measurement such as permittivity and conductivity. In this study, the BDS is presented to figure out the complex behaviour of several rock parameters as a function of the temperature and frequency. Indeed, multiple processes might occur such as interfacial polarization, AC and DC conductivity. The measurements of a weathered granite, basalt and quartzite were performed. The activation energy associated to each process involved during the measurement can be calculated by following the relaxation time as a function of the temperature, taking into account the Havriliak-Négami model. The principle of the technique and the whole study is presented here and several hypothesis are advanced to explain the dielectric behaviour of rocks. Finally, as the range of frequency and temperature of the BDS method is common to several electromagnetic and electrical techniques applied in subsurface geophysics, some perspectives are proposed to better understand geophysical measurements in hydrothermal systems.