## BGP-T5: **Borehole Geoscience in Sedimentary Basins: from qualitative correlation to quantitative characterization.**

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Geophysical measurements in boreholes started in the 1920s and were initially intended as a tool for geological correlation between boreholes. "Electrical coring" was intended to provide the geologist with the ability to correlate between boreholes, and to build simple 2-D and 3-D geological models. Since then there have been many developments, not least in downhole logging tool development, enabled through the discovery or synthesis of novel materials, miniaturized yet powerful electronics, advanced sources and sensors, huge computer-processing capabilities, and real-time acquisition and analysis on a remote, mobile computing platform. Consequently, today we make a vast range of geophysical measurements in the borehole and we attempt to relate these to specific static and dynamic physical and chemical rock properties. We assume the rock is composed of a mixture of solids and fluids, and in turn these properties may be interpreted in terms of past and present-day geological processes.

These borehole geophysics measurements provide the geoscientist with a wealth of data, but at times also an excess of information, and identifying the important or critical measurements, especially for unconventional studies, can be increasingly difficult. While advanced processing techniques can quantify resistivity anisotropy, or yield the proportions of different pore sizes from NMR measurements, simple pattern recognition or graphical techniques can also aid the geoscientist's interpretation. More advanced nuclear-based geochemical measurements have developed to help characterize mudstone (or shale) complexity, while quantification of heterogeneity through a variety of statistical techniques can inform the scale dependency of any geological variability. The link between high-resolution downhole geophysics and surface geophysics can be investigated through petro-acoustic models, linking downhole acoustic measurements with surface seismic, and allowing the influence of different fluids to be investigated.

Examples from recent research in sedimentary basins are used to highlight the power of downhole geophysics in aiding the geoscientist, and in providing a critical link between different scales, from high resolution but localized observations on core to low resolution regional seismic observations. The extension of well-established techniques to new environments is also explored, demonstrating how the natural complexity of subsurface formations presents an ever changing and expanding intellectual challenge for geoscientists.