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Quantification of uncertainty in geoscience interpretation: a statistical analysis of the factors that affect interpretational ability

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Models of sub-surface geology are created from datasets that sample a limited volume of the subsurface and at a limited resolution; therefore, even with modern data collection techniques, the final model is highly dependent on the interpreter's conceptual framework. Interpreters from diverse educational backgrounds, or with experience in a range of geological settings, can come up with very different interpretations for the same data [1]. Specifically, Bond et al. (2007) showed that only 21% of the 412 interpreters sampled identified the original tectonic setting of a synthetic seismic image. To understand why interpreters see particular aspects of a dataset as being important to an interpretation is essential. This presentation will give results from 'the Freyja project'; a research project designed to quantify the uncertainty in geoscience interpretation via the statistical analysis of 685 structural interpretations of a 2D seismic image.

During the sampling process, respondents were asked to interpret an unknown seismic image and complete a questionnaire that captured their education and geoscience experience. The sampling took place at international geoscience conferences and universities, where interpreters with varying levels of experience were targeted. Respondents to the survey included academics and industry professionals, as well as postgraduate students and senior undergraduates. In this analysis, respondents' interpretations were compared against a reference expert's interpretation. The similarities between the interpretations were then statistically modelled against respondents' education and experience using logistic regression. The 'effect' of individual factors (e.g. level of education, professional background) was quantified to determine the most and least influential factors. Key findings included that the most significant variable was found to be 'how often you interpret seismic data', closely followed by 'whether or not you have a PhD'. These and other results will be discussed during the presentation.

1 – Bond et al., 2007, What do you think this is? "Conceptual uncertainty" in geoscience interpretation, GSA Today, v17, 4-10. doi: 10.1130/GSAT01710A.1