HIGH RESOLUTION SEISMIC PROFILING APPLIED TO A HETEROGENEOUS AREA IMAGING AND TO CAVITY DETECTION IN SWITZERLAND

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Since the beginning of the nineties, the simplification of the acquisition and processing techniques in reflection seismic profiling has led to its use for civil engineering and environmental purposes. Moreover, the methodology is capable of generating high resolution images (several metres or tens of metres) of the shallow subsurface (generally 20 to 100 m deep).

This work describes the use of this technique to obtain images of a complex geological structure between the Jura and the Molasse Plateau, in Canton Vaud (Switzerland). Comparison with other methods (old seismic profiling, gravity, resistivity) and the integration of the geological structure provided a consistent interpretation.

The significance of data processing was emphasised. The importance of deconvolution was specially shown for the enhancement of the "signal/coherent noise" ratio. Detailed checking of the origin of the stacked events on shots or on common depth points (CDP) enhances the confidence in the final profiles.

The first part of the research provided then the necessary experience to use high resolution profiling for small cavity detection. Three different tunnels and a cave were studied in various geological environments in Switzerland and the method was tested before and after a gallery drilling. The cavities were approximately 5 to 10 m large and 20 m deep.

Although positive detection was made at three of the four tested sites, the data gave rise to a discussion of the limitations of the method. The resolving power of the seismic profiles, the depth and dimensions of the cavity, the a priori knowledge of the target and the heterogeneity of the site are factors which must be taken into account.

Other cavity detection methods (mainly, microgravity and resistivity) were tested at two of the sites. It confirmed that microgravity is an excellent void prospecting method, but that seismic profiling could complete its information by generating images of the anomalous area.