

6.1 INTRODUCTION

Seismic reflection surveying is the most widely used geophysical technique, and has been since the 1930s. Its predominant applications are hydrocarbon exploration and research into crustal structure, with depths of penetration of many kilometres now being achieved routinely. Since around 1980, the method has been applied increasingly to engineering and environmental investigations where depths of penetration are typically less than 200 m. Applications of shallow high-resolution seismic reflection surveying include mapping Quaternary deposits, buried rock valleys and shallow faults; hydrogeological studies of aquifers; shallow coal exploration; and pre-construction ground investigations for pipe, cable and sewerage tunnel schemes.

One of the principal reasons for the increased use of shallow seismic reflection surveying has been the improvement in equipment capabilities and the availability of microcomputers and portable digital engineering enhancement seismographs. Computing power is such that preliminary data processing can be accomplished while still in the field in some cases. This has facilitated real-time processing on board ships for quality assurance and control, the availability of portable data processing centres which can be housed within a container and flown into remote areas by helicopter, through to self-contained highly sophisticated seismographs which can be carried by one person. Perhaps more importantly, the growth of computer power has also provided the means whereby three-dimensional data acquisition can be undertaken much more cost-effectively. Data manipulation and management can be accomplished much faster than was possible 15 years ago. In the late 1970s, the costs of three-dimensional seismic surveying were at least double that of conventional two-dimensional acquisition, and it was only undertaken as a last resort. Now, 3-D seismics have become much more cost-effective and currently constitute in excess of 60% of the market share in the seismic industry.

As seismic reflection surveying is such an established technique, and as a very large amount of research and development has been undertaken within the hydrocarbon industry, there is a vast technical literature available. Members of the International Association of Geophysical Contractors, for example, are usually keen to respond to requests for the very latest details of proprietary techniques, new equipment for data acquisition and processing methods.

The literature in relation to shallow applications is, however, surprisingly sparse, with little attention having been paid to this growing area of work. This chapter deals particularly with shallow seismic reflection surveying but also provides an overview of the wider issues of the methods where appropriate.

