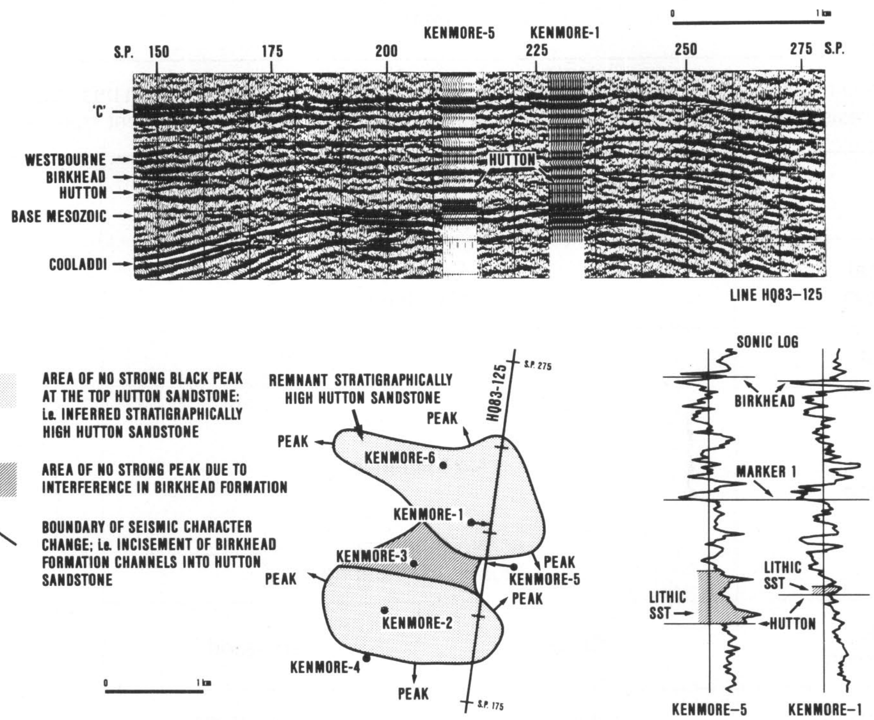

FIGURE 6
Kenmore Field, showing stratigraphic model based on seismic character.

(iii) **Stratigraphic Prediction**

The two main producing reservoirs in the Block unfortunately have in common a low acoustic impedance contrast with the overlying section. In the Kenmore Field, the reflection observed nearest to the top Hutton Sandstone is dominated by the overlying sequence in the lower Birkhead Formation. Where lithic channel sandstones are thickly developed in the Birkhead and associated with thin carbonate bands, a strong negative acoustic impedance contrast gives a black peak on the section. Alternatively, where the lithic channel sand is thin, the dominant reflection originates from a positive acoustic impedance contrast resulting in a weak trough.

The absence of a black peak indicates possible uneroded Hutton highs, and may guide future well locations (Fig. 6).

Seismic inversion work at Kenmore has yielded little at the top Hutton because of fundamentally low acoustic impedance contrasts, but results are encouraging at the Cadna-Owie and Westbourne Formations.

Future Directions

Recent studies in ATP 269P(1) have shown that our 12-fold dynamite data, carefully acquired and processed has brought us to the threshold of usefully predicting local velocity gradients, and also stratigraphic variations at the reservoir level.

To realise the potential we need to significantly improve the signal to noise ratio of the data. Some 20-fold dynamite recording results encourage us to experiment with high-fold dynamite, airgun and vibroseis techniques.

ELECTRICAL POWER IN THE FIELD

J. Beamish

Introduction

The provision of power for field use is not often given a high priority. Consequently, frustrating delays and failures occur often, necessitating costly detours and backtracking and sometimes even rendering much of the work undertaken valueless. The prime method of storing electrical energy is, of course, the battery. That much maligned, and often misunderstood object that gives up just when you need it most or expect it least. Simple you say, just stick a couple of spare truck batteries in the back of one of the Land Cruisers and the problem is solved. Or is it? That solution can provide a useable answer for expeditions doing their work in and around vehicles, but is it the best or most cost effective answer? What about the man who has to go trudging about in difficult terrain in the heat/cold needing autonomous power? He needs a truck battery like he needs a lead hat. A similar situation exists with marine data gathering. A cheap or unsuitable battery which fails in eight weeks when it should have lasted twelve, negates savings made in its purchase by causing duplication of work. Well then, what are the answers?

Battery technology is advancing at a rapid pace, I know because I'm trying to keep up with it! The answers to some of the problems of the exploration industry were found long ago, some were solved only recently and some still have to be solved in a financially acceptable form.

The largest problem extant, and that which still has to be addressed, let alone solved, is how to disseminate information on battery technology to the exploration industry and many others. The purpose of this paper is to disseminate information on some of the technology available in the wide field of batteries.

What battery you should use depends of course upon the application for which it is needed. A brief look at the available technologies will help. The two main groups are Primary (use and dispose of) and Secondary (re-chargeable).

Primary types are many and varied, ranging from the manganese-dioxide cell, which has changed little since its invention by Georges Leclanche in 1886, to thermal batteries. Types encountered in the exploration industry are manganese-dioxide-acidic (Leclanche), manganese-dioxide-alkaline, mercuric-oxide, zinc-air, air depolarised and water-activated cells and the rapidly growing family of lithium cells. Some applications and parameters are as follows:

Leclanche. The most widely used cell in the consumer market. Used for a wide variety of applications from toys, clocks and torches to power for remote signalling devices where the expense or complication of solar or mains recharging is unjustified. The cell is unsuitable for heavy loads. Smaller sizes are prone to failure and/or poor performance at high and low temperatures and a short shelf life at high temperatures.

Manganese-dioxide-alkaline. Applications as for the Leclanche cell but offers greater reliability, longer life on the same load and improved shelf life. The cell is unsuitable for heavy loads and more expensive to manufacture than Leclanche cells. Shelf life is inversely proportional to temperature.

Mercuric-oxide. Used where a stable voltage and long shelf life are required. Often found in older instrumentation. The cell is unsuitable for heavy loads, forms fulminate of mercury in long term storage (explosive), is poisonous and very pollutant. Mercury primary cells are rapidly disappearing from the scene.

Zinc-air. Few applications for the exploration industry. Cheap to manufacture, very stable, wide temperature range and is non-pollutant but cathode design is critical for each application and load current must usually be limited to 25 ma or less.

Air-depolarised and Water-activated. These types are developed from the Leclanche but very large capacities are available, e.g. 10 000 AH. Some types can be considered very competitive for remote installations and elimination of a charging system necessary for secondary batteries. Shelf life of 2-3 years possible with very high charge retention. Used also in sealed marine bouys, etc. Require no maintenance. Old technology but still viable. Load output limited to a few amps. It would be true to say that most people in the exploration industry seem to be unaware of their existence!

Lithium cells and batteries. Without doubt the most important development in the electro-chemical (battery) industry in many years. Lithium cells, thus far, are limited in size and offer a wide range of different lithium couples giving different voltages per type. Why are these cells important? They provide many of the qualities long sought after in portable energy sources. These being a high energy density, a high energy/weight ratio, higher voltages per cell—giving the facility of using fewer cells and further reducing weight or connecting the cells in series/parallel and more than quadrupling the operating life of the equipment. They offer performance over an amazing temperature range, i.e. down to −70° to +177°C! A very low self discharge rate of less than 1 percent per year gives a shelf life of 15 years (down to 85 percent capacity) for some cells manufactured by the SAFT Company and nearly all Lithium cells offer at least a doubling of shelf life compared with conventional primary alkaline cells. Contrary to a belief which seems to be widely held in the exploration industry, Lithium cells can be, and are being transported by air, in passenger aircraft. Siomar regularly receives consignments in this way.

Secondary batteries are manufactured in three main groups and careful purchasing will ensure that you obtain value for money. Many cheap substitutes are available in two of the groups. These substitutes debase the reputation of the battery types they purport to represent and the advantage of lower price is lost in replacement costs, etc. The three groups are: (a) precious-metal; (b) noble-metal; (c) base-metal. Basically the batteries exhibit the general characteristics of the materials from which they are made.

In order to compare noble- with base-metal types a good starting point is comparison of the materials used. For example nickel-cadmium (nicad) compared to lead-acid. The materials used in the former are nickel, cadmium, steel and potassium hydroxide. The tensile and ductile strengths of these materials is great and in their manufactured form are highly resistant to corrosion, shock and vibration. The alkaline electrolyte does not significantly affect the plates. Owing to the nature of the materials very high performances and long life spans are easily attainable together with performance over a wide temperature range (−40° to +60°C). By contrast lead-acid batteries employ materials which, while being cheap, exhibit undesirable characteristics. Many materials have been, and still are being, alloyed with lead in attempts to improve durability and performance. Each gain in one direction is soon found to be offset by new disadvantages. The basic parameters are: poor ductile and tensile strength, prone to failure under conditions of shock and vibration. Both plate grids and lead paste therein are under attack by the sulphuric acid electrolyte. In addition the optimum temperature range of lead-acid batteries is small (15–25°C).

What then does one do? Pay large prices for superb nicads or put up with self destructing lead-acids? Practical alternatives to these extremes are available in many cases sometimes with alternate choices. Consider our often used car battery. These batteries are designed purely for starting purposes. All pretence of load supporting ability has been dropped and they are rated only in terms of starting current (amps) and not capacity (ampere-hours AH). The plate design of a starting battery is very different to that of a load carrying (traction) battery. When used in a cyclic application (charge followed by discharge) available capacity falls progressively, and fairly rapidly, after the first few cycles. This is not so with traction batteries designed specifically for deep discharge. Cost in dollars per cycle is about 3 to 1 in favour of traction batteries, initial cost is 3 to 1 in favour of starting batteries. Traction batteries have no problems in handling starting duties.

In terms of performance and longevity lead-acid rates abysmally against nicad. For portable applications the smaller nicads are hard to beat. It is a scientific fact that lead-acids cannot compete with nicads for performance, energy/weight ratio, longevity, etc. Many nicad types are very cost effective and we have enjoyed many successes with power packs and battery belts utilising this technology. Table 1 compares the characteristics of three types of battery used for the lighting of trains.

Finally, a few general rules. Alkaline cells are superior to acidic cells. Sealed batteries usually have a shorter life than open batteries. Try to compare like with like, e.g. avoid comparing a 10 AH acid type with a 10 AH alkaline, they are rated on different scales. The most common cause of dissatisfaction with nicad cells is lack of understanding of their principles, charge and use them as alkaline cells and not as a substitute for acid cells and you will experience few problems.

If this paper has served to increase your insight into the battery industry or has given you a key you can use to open new doors it has performed its function.

NEAR SURFACE MODELLING BY INTERACTIVE REFRACTION ANALYSIS

R. Beattie and J. Wardell

Introduction

An accurate estimate of the shallow near surface structure, and the static corrections for its compensation, has become more important as seismic exploration objectives become more difficult to attain. The static correction profile must be 'broadband' in the sense of containing good estimates of short, medium, and long wavelength components. In most modern seismic surveying, the short wavelength components (up to one spreadlength), which affect the signal-to-noise ratio of the stacked section, are usually determined by an automatic residual static analysis of the refraction data; while the long wavelengths (greater than about five spreadlengths), which affect structures and velocity estimates, are estimated from uphole survey information. This leaves the medium wavelengths, which also affect structures and velocity estimates: these cannot be reliably estimated from the reflection data, and would require an uphole survey spacing of half a spreadlength for complete resolution—an expensive proposition.

An alternative source of information on the medium wavelengths are the refraction events, or 'first breaks'. Ideally this data would be collected by a specialised refraction crew, but again this is relatively expensive, and so in recent times attention has turned more and more to the use of first breaks on the 'production' reflection records. While these first breaks may not be of optimum quality, at least with modern multi-channel high fold recording they are available in abundance. This large volume of data makes an automatic picking and interpretation system essential, but at the same time the inherent ambiguities in the data require an efficient means of manual intervention in the process: in other words, an interactive system.

The Interactive Modelling Method

The system discussed here runs on a Texas Instruments desktop computer, with colour graphics, and preferably linked to the mainframe computer. The procedure begins on the mainframe, where trace data from a time gate over the first breaks is selected and transferred to the desktop computer, along with the data collection geometry files. First breaks are picked semi-automatically, and the trace data with superimposed picks displayed on the screen for quality control and editing; the latter function being controlled by a 'mouse'. Adequate display resolution within the confines of the video screen can be aided by the application of linear moveout correction, based on an estimated refractor velocity (Fig. 1).

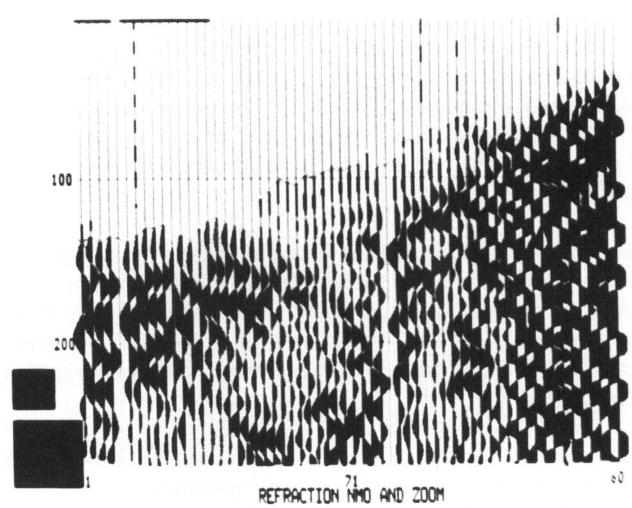

FIGURE 1
Video screen display of first break data, after linear moveout correction, showing first break picks. Original display is two colour dual variable area.

From the pick times, short wavelength residual statics are computed using a 'beamsteer' algorithm of the type described by Hileman *et al.* (1968), and bandlimited by a spatial low cut filter, normally to wavelengths less than about one to two spreadlengths. (If desired, the automatic first break picking and short wavelength static computation can be done on the mainframe, then transferred to the desktop computer for editing.) These short wavelength statics can be separated into left and right statics for a split spread.