Faroes Rock to new seismic source

Veritas DGC's marine seismic survey vessel M/V New Venture.

Professor Anton Ziolkowsdki

From Veritas DGC

Have you ever been disturbed by loud music from noisy neighbours or errant teenagers? If so, did you notice that the music sounded »duller« than it would if you had been in the same room as where it was being played? In fact, the reason the music sounded dull is not just because your tastes are likely very different from that of the culprits, but because sound is affected by the way it travels between a musical source and your ears. Specifically, deep notes from drums and other bass instruments that normally carry the beat (so-called »low frequencies«), are able to pass through walls more easily than the higher pitched notes (»high frequencies«) that usually carry the tune. As a result, the high notes are relatively weak, and music coming from another house or room typically sounds like a deep, »thud, thud«.

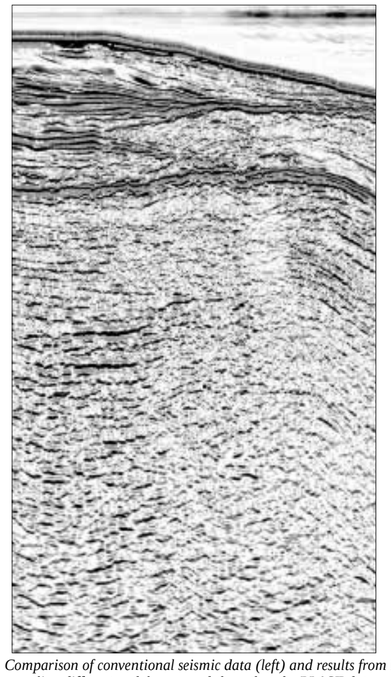
Although the context is somewhat different, Professor Anton Ziolkowski of Edinburgh University in Scotland has recently suggested that the fact that low frequency sound can penetrate barriers more easily than high frequencies could have a profound impact for oil exploration in areas such as the Faroes. This is because modern exploration is heavily reliant on seismic information, which in turn is obtained by measuring echoes from artificial sound sources generated at the surface. Unfortunately, most of the prospective areas in the Faroes are covered in basalt, and this acts as a barrier that prevents sounds from penetrating to the deeper formations that hopefully contain valuable oil fields. As a result, seismic studies have had limited success, and this has discouraged oil companies from exploring the area more fully. However, Professor Ziolkowski has pointed out that, although basalt is relatively »opaque« to conventional seismic sources, it should be more »transparent« at low frequencies. Hence it may be possible to obtain reflections from beneath the basalt by using special sources that produce more of this type of energy.

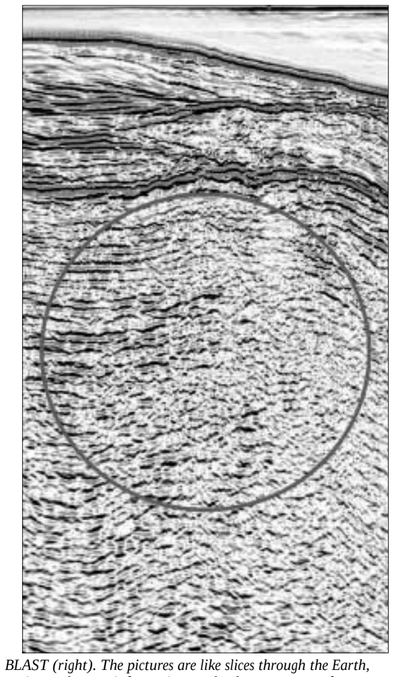
Unfortunately, implementing Professor Ziolkowski's idea is far from easy — especially in the marine environment. Marine seismic surveys use so-called »airguns« which generate sound by releasing high-pressure air into the surrounding seawater, and thereby producing a "bang" (the effect is similar to that of popping a balloon). As with musical instruments, airguns can be tuned to different frequencies, and this done by varying the amount of air they release and changing the depth at which they are deployed in the water. However, Professor Ziolkowski's calculations suggest that the source needs to have frequencies below 10 Hz (i.e. ten vibrations a second), and this in turn means that the airguns have to be both deeper in the water, and four or five times the normal size used for exploration. As a result, the equipment required for this type of survey is far from standard, and, from a practical point of view, much more difficult to handle.

Notwithstanding the challenges inherent in configuring a set of airguns to produce ultra-low frequencies, seismic contractor Veritas DGC recently acquired a set of test data over prospective areas in Faroese waters with a view to testing Professor Ziolkowski's idea. The survey was nicknamed "BLAST" (Basalt Large Airgun Seismic Test), and was carried out in conjunction with the members of Faroes Licence Groups 6 (Statoil, Anadarko, Enterprise, Phillips Petroleum and Veba Oil) using Veritas' seismic vessel, M/V New Venture. In addition, the survey deployed a new type of recording cable, or »streamer«, made of solid material, that is able to detect weaker sounds than conventional streamers which are made of hollow tubes filled with liquid. Veritas is also a pioneer in using ultra-long streamers to help provide additional information on deep geology, and the streamer towed in the experiment was 12 km long - twice the length normally used for exploration.

Detailed analysis of the BLAST data is still in progress at Veritas' office in Crawley, England. However, the initial results are encouraging, and comparisons with data obtained from older surveys show strong evidence that the new source configuration can produce reflections beneath the basalt that are not obtained in conventional surveys (see comparison below). Veritas' Manager of Geological Services, Richard Morgan says, »The BLAST results are extremely exciting, and could lead to important advances in our geological understanding of basalt environments. I am sure this technology will have an important role in future exploration in the Faroes.«

Meanwhile, Professor Ziolkowski is continuing to refine his ideas, and Veritas is trying to make an even better low-frequency source using novel airgun designs. If everything proceeds according to plan, the new source will be available for further surveys by the middle of next year. So, the next time you are disturbed by loud music from noisy neighbours, you might like to think of BLAST, and how understanding why the music sounds the way it does is helping discover new oil fields. It is just another form of rock music!





Comparison of conventional seismic data (left) and results from BLAST (right). The pictures are like slices through the Earth, revealing different rock layers, and show that the BLAST data contain much more information on the deep structures, for example in the area highlighted by the circle. (Data courtesy of the BLAST group: Statoil, Anadarko, Enterprise, Phillips Petroleum, Veba Oil and Veritas DGC).