

### ¡ CHEERS!

We would like to take some of your time to deliver you the latest issue of our periodic newsletter. This time, we will depart from the traditional mining exploration topics to offer you information in another of our exploration fields: engineering geophysics. There are a vast number of geophysical applications in this particular exploration field, including large-scale projects like hydroelectric power plants, factories, foundations, tunnels, water and tailings dams, among others. We started application of engineering geophysics in 1967, with the arrival of our first seismograph, an analog 12-channel Geospace, no longer in use, despite the fact it is still fully operational.

In this bulletin, we'll discuss the seismic refraction method, which when properly applied provides a large amount of information in a relatively short time span. This is the main engineering geophysics method, and we feel that dedicating it one of our bulletins is just and appropriate.

José R. Arce

### INSTRUMENTATION

Surface and drillhole Refraction Seismology, is performed with a digital seismograph and sensors, known as geophones when they are surface units and hydrophones when sealed within a cable for underwater work. Our company presently owns and operates two digital seismographs, a 12-channel ES-1200, and a 24-channel Strataview R24, both manufactured in Silicon Valley by Geometrics Inc. The larger amount of channels increases surface fieldwork efficiency but is not as significant for down-hole work.

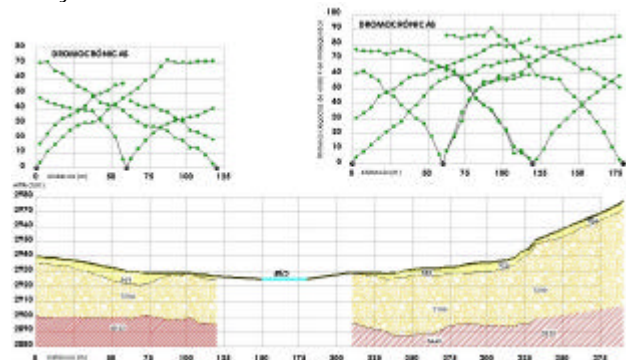
### TODAY'S SEISMICS

Seismic methods essentially measure compacity variations between and within materials. This is what makes this method quite useful in defining sediment-basement transitions. Method results are in the form of P-wave (compression) or S-wave (shear) velocities and lateral and vertical resolutions have greater definition than traditional electric and electromagnetic methods, depending mainly on geophone separation.

In order to design a high-quality seismic study, one must first define the desired penetration, taking into account that refraction signals are rarely measured beyond a depth of 200 meters. Depth reach depends on geophone cable length and may be quickly estimated as 1/3 to 1/4 of the total spread length. Thus, for a 24-channel seismograph such as our 24-channel Strataview, total cable length of 120 meters and 5-meter geophone spacing, depth penetration will range from 30 to 40 meters. In general, to penetrate some 35 meters, explosives are not required and a 20 lb sledgehammer suffices. For larger penetrations, explosives or a shotgun-type generator such as our Betsy gun, are required.

The example shown below is an inverted seismic refraction section obtained at both margins of the Marañon

River. You can clearly note the layer definition, consisting of a yellow-painted low velocity (<1000 m/s) overburden, an orange medium-compacity alluvium (1000 m/s < Vp < 2000 m/s), and a high velocity basement rock (Vp > 2500 m/s), colored with red. Note the difference in basement velocity between both margins; we interpret this change in rock compacity as caused by a fault running through the valley.



### ALREADY IN PERÚ....

Taking a short break from seismics, we inform you that we received in July the most advanced IP/Resistivity instruments in Peru. Aside from our previously known instrumentation, recognized for their successful runs in South America, we now have an Iris VIP 4000 transmitter and an Iris ELREC PRO receiver.

The VIP has several great features, ranging from full self-regulation control managed by internal microprocessor circuitry to its ability to use basically any off-the-shelf 220V 50/60Hz motor generator. The internal computer does not allow the VIP attempt injection of larger amounts of currents and voltages than the terrain conditions permit, by constantly self-regulating its output to measured contact resistance. This electronic regulation does not allow the operator to exceed cable and terrain properties, so the transmitting electrical field is well-formed and very stable, allowing much better signal input in the receiver. This was a problem with older transmitters, where the operator just kept increasing the output current or voltage to attempt higher input signal, not realizing that the transmitting field was erratic.

Our ELREC Pro, serial number 102, is the first commercial unit made of this model. The first two (#100 and 101) are prototypes!. This instrument, with its 10 input channels, is a much more advanced and modern version of the ELREC 10. Its 100 Mohms of input impedance allow quality operation in highly resistive terrain, so common in Peru. Another new feature is the use of flash RAM memory for its 21000 reading capacity, which does not require safety battery backup. IP decay curves may be analyzed for each input channel in graphic or numerical formats.

These state-of-the-art instruments have been working in the field since the end of June, when we received them.

Until next time...

