

Introduction

Surveys of rock quarries are extensively performed by means of Ground Penetrating Radar. With the proper antenna and a bit of planning, it is possible to detect bedding planes, fractures and variations in the material.

In this case study, we will show a marble quarry in Italy surveyed using our TUBEWAVE-100 borehole antenna. The small cross section diameter allows for going deep in the material using reduced dimension boreholes.

The borehole was around 20 meters deep with one third water filled, as will be clearly shown in the radargram. The survey starts from the bottom of the borehole and up.

Survey planning

A time range of 200 ns was chosen as a starting value due to the fact that marble allows good penetration. The markers were separated by 5 m in order to allow a proper mapping of the site without cluttering the data.

To collect the maximum amount of information, a wide bandwidth was selected. We used a filter setting that was completely open over the whole operating range of the antenna. As a low pass filter we chose a value of 1 GHz, as a high pass filter we chose a value of 100 MHz.

The gain was set up incrementally to compensate for eventual weak reflections from the bottom of the range.

We chose four points with the follow values: 10 dB, 46 dB, 47 dB and 56 dB.

Interpretation

All the collected data was post-processed using Radarteam Sweden AB's C.O.B.R.A™ software.

A waterfilled fracture is clearly seen crossing the borehole between marker 3 – 4 at 300 scans (2 and 3 in fig.2).

Note structures in marble and that the frequency and penetration/resolution changes rapidly when TW-100 Antenna goes from water saturated to dry marble. Dry marble from 300 – 750 scans.

The approximate size of the fracture can be estimated by intensity and thickness of the line in the radargram. The wider part of the fracture shown in (2) and the thinner in (3 in fig. 2). A bedding plane is shown in (4 in fig.2).

Note that the sharp frequency and penetration/resolution changes when the TW-100 Antenna goes from saturated water between 0 to 300 scans to dry marble. Dry marble is seen from 300 to 750 scans (5 in fig.2).

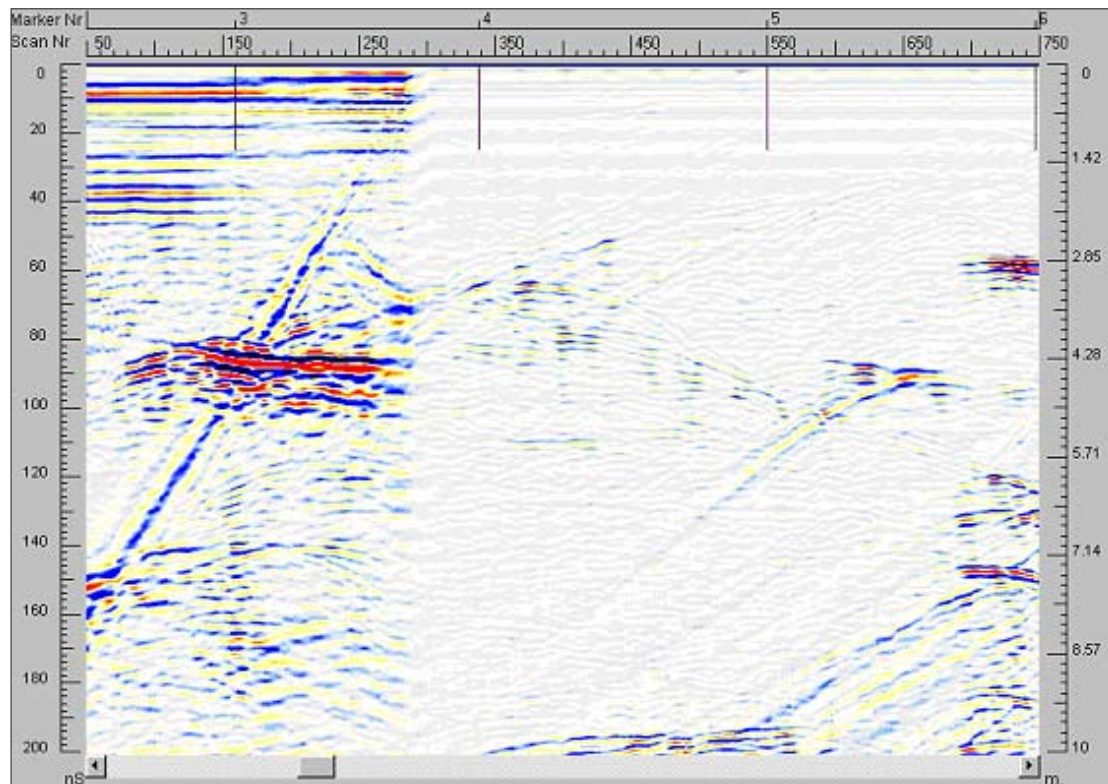


fig. 1
Raw radardata as collected from a Marble quarry in Italy

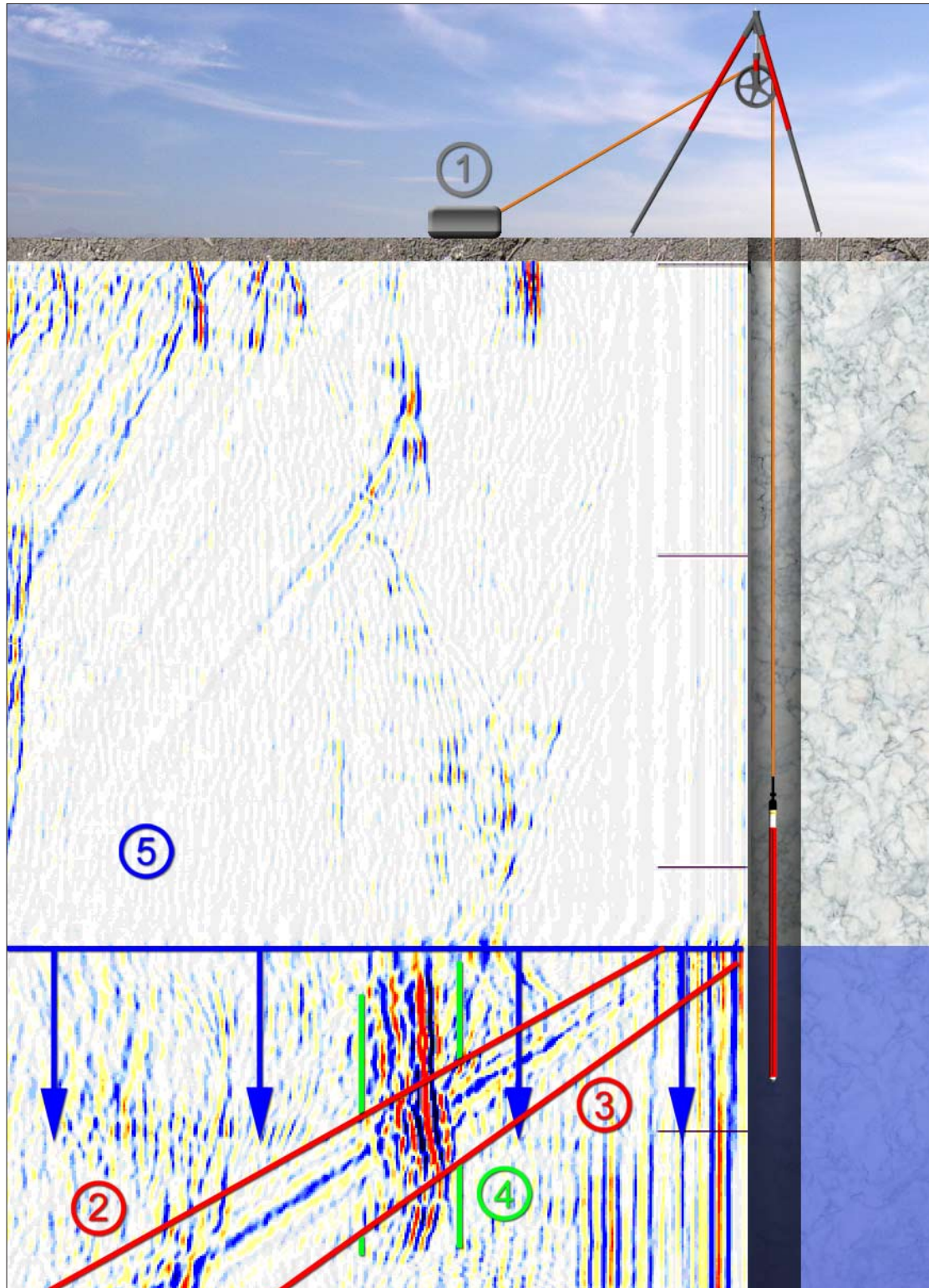


fig. 2
Schematic representation of the radar data.

Data compliments of Geostudi Astier, Italy.



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RADARTEAM SWEDEN AB
Gränsvägen 51
S-961 37 Boden
SWEDEN

Brazil - Tel.: 21 2556-1295

Web: www.alphageofisica.com.br
E-mail: info@alphageofisica.com.br

