

Detection of Neolithic Cultural Layers by GPR in a Lacustrine Area: the Case of Chalain (Jura, France)

More than 29 archaeological sites are found in the area of the lake of Chalain (Jura) in France. The stratigraphy from these sites span from the 32nd to the 24th century B.C. Two settlements have grown during Neolithic times between the west and the east shore of the lake. The first one has shown a stratigraphy between the Horgen culture (32nd century B.C.) and the Chalain culture (24th century B.C.). To the east, the second one, was investigated mainly by augering. The geophysical survey took place on this side with a Pulse Ekko 1,000 radar.

The stratigraphy of the sites is made principally of dark organic matter deposits within a white lacustrine chalk. In order to study these deposits, the archaeologist can either make ordinary digging, necessarily limited to a small area, or use auger-borings but with a dense sampling strategy. In the latter case, he will have to face the problem of interpolation between the borings.

Despite the fact that GPR was used for other archaeological sites, the case of Chalain is specific: i) the vertical extent of some of the deposits is very thin (a few centimetres at a depth of two meters or more) and makes this kind of target a challenge for a geophysicist; ii) due to water level changes during historical time, some of the deposits are partly under the present level of the lake or in the transition zone.

Three GPR profiles were done along the shore and six perpendicularly to the shore. Information is available down to a depth of

3.4 m. Reflectors show clear patterns such as on-lap and off-lines figures. Several strong reflectors with a North-East dip are also visible and one specially at a depth of 3.2 m. Horizontal reflectors are due to ringing. Six auger-borings were performed along one profile and have shown the presence of reduction material (charcoal) and also organic matter. In particular, three levels named as H, K and O can be correlated from one drilling to the other. They can be associated with settlements from the late Neolithic.

The superposition between the stratigraphic log obtained from drillings and the radar reflectors has enabled a good correlation between them. In particular, the oldest level named O (Horgen culture) corresponds to the strongest and the deepest radar reflector. This demonstrates that it is possible to detect and map the O strata and the more recent levels without destruction. Moreover, a trial radargram was done above the lake level and proved the feasibility of a non-destructive detection of archaeological layers under 6 meters.

In summary, this case study shows that, with a sufficient low frequency antenna, it is possible to detect anthropic levels within chalk deposits in a lake and to precise their depth and lateral extension. It would be then possible by making a high resolution GPR survey with a dense sampling scheme, to map the extension in three dimension of the archaeological deposits since 6,000 years without destruction.

