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Discovery of a first Neolithic settlement in the Meseta of Central Spain near Ambrona (Soria) by caesium magnetometry in 1996

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The archaeological excavation of the Early Bronze Age barrow La Pena de la Abuela near Ambrona (Soria) by Manuel Rojo, University of Valladolid, brought some Early Neolithic pottery fragments from the deeper strata to light, which gave the idea searching for an Neolithic settlement somewhere in the vicinity. An extensive program for fieldwalking by a team of the University of Valladolid surveyed about 12 localities with Neolithic and later ceramics in the wider surroundings of Ambrona, which were completely unknown before.

In September 1996 a magnetic prospection by caesium magnetometry was undertaken in the sites Ambrona-La Lampara containing also the Pena de la Abuela, and Ambrona-La Revilla del Campo trying to get more information about these supposed Neolithic settlements. In August 1997 first test excavations in both sites started on the base of this magnetic prospection. In 1997 the Neolithic settlement of La Cumbre and another barrow Ambrona-Atalayuela, followed 1998 by Ambrona-Dolmen de la Sima and Ambrona-El Pozuelo, were also prospected by magnetometry and resistivity.

For magnetic prospecting a Scintrex SMARTMAG SM4G-Special was used with the duo-sensor configuration for saving time (for details of the instrument and data processing see Becker, 1999, 2000). This instrument and the special duo-sensor technique was tested first only in spring 1996 for the prospection of the Copper Age site of Monte da Ponte in Portugal. The magnetometry at the site La Lampara was applied with 0.5 m distance between the sensors and with 0.2 second cycle (5 measurements per second), which corresponds to 0.2 m spacial resolution. Only the open area of the barrow Pena de la Abuela, which still was under excavation, was measured with 0.25 m and 0.1 sec cycle

Fig. 1a. Ambrona-La Lampara 1996. Caesium magnetometry using Scintrex SMARTMAG SM4G-Special with duo-sensor configuration

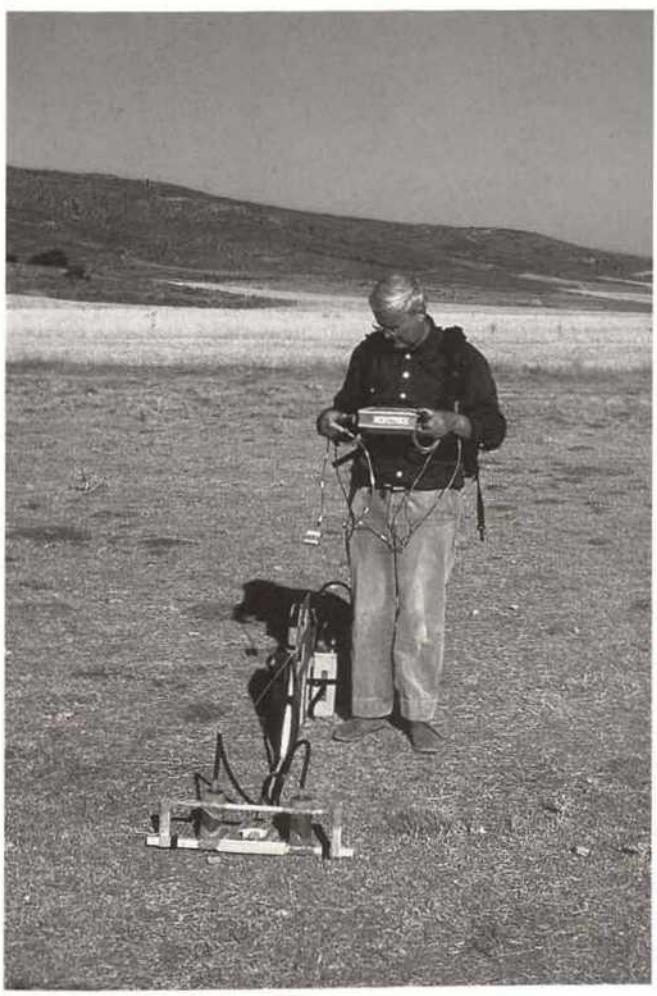

Fig. 1b. Ambrona-Dolmen de la Sima 1998. Resistivity survey using Geoscan RM15-Advanced Resistance meter with twin electrode

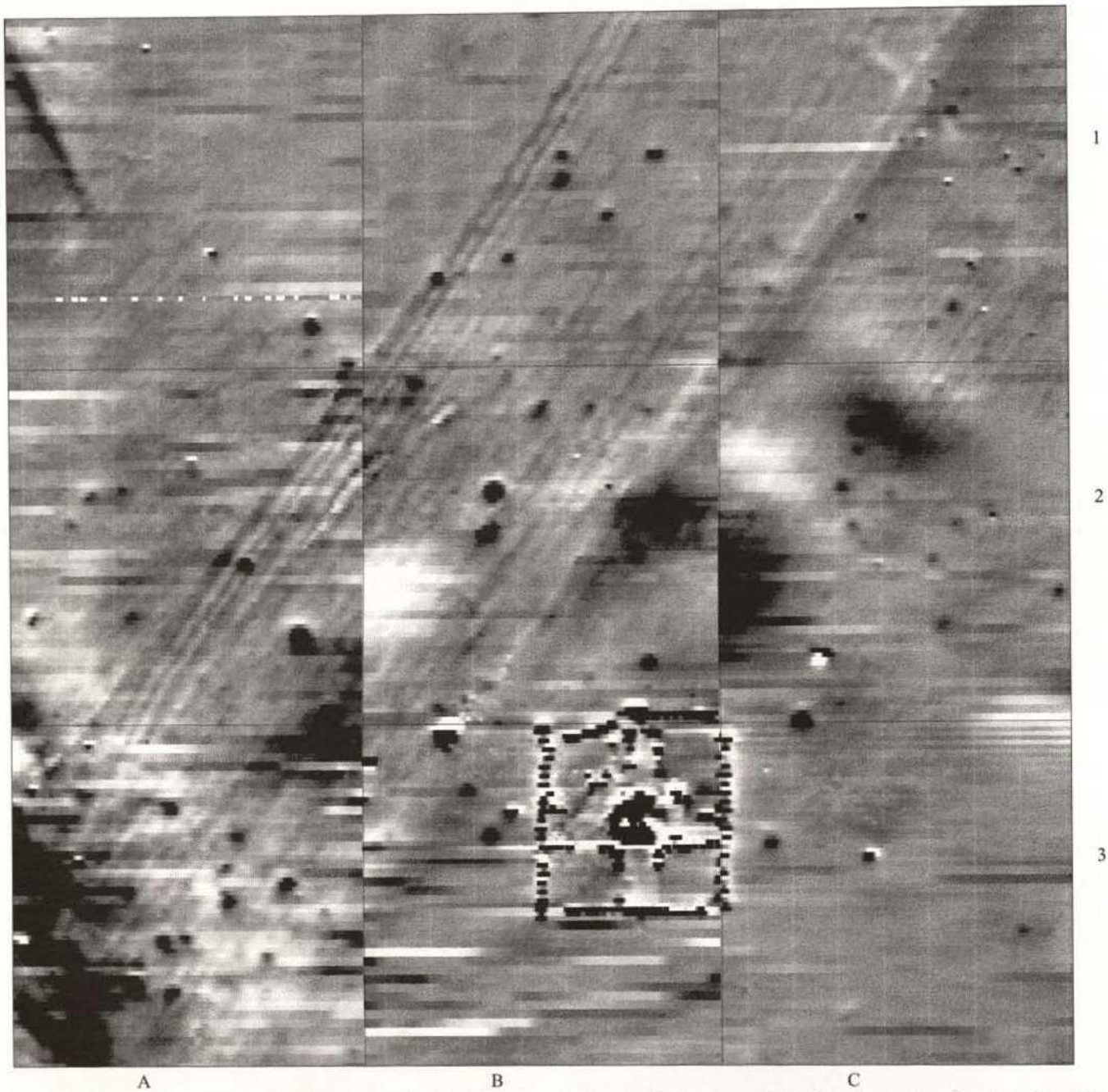

Fig. 2. Ambrona-La Lampara 1996. Magnetogram after digital image processing. The distinct anomaly in B2 marks the pit with an Early Neolithic burial. Caesium magnetometry Scintrex SMARTMAG SM4G-Special with duo-sensor configuration, sensitivity 10 pT, raster 0.5/0.25 m, dynamics -3.2/+3.2 nT in 256 grayscales, 40 m grid, North upwards

resulting in a raster 0.25/0.125 m after resampling. Bandpass filters were switched to 1 Hz for canceling the high frequency time geomagnetic variations. The slower diurnal variation was reduced by the mean of all line values, which follows ideally the daily variation. The reduction to the square mean value was also calculated, to be shure for not cancelling anomalies in the direction of the line. The duo-sensor configuration was carried by the operator and the distance control was switched manually every 5.0 m. After dumping the data to a notebook computer complete data processing was undertaken during the night controlling the quality of the data and the archaeological relevance of the measurement. GEOPLOT V2.2 software (Geoscan, Bradford) was used for first visualization as grey shading plot. These plots showed that unsufficient control of sensor hight above ground resulted in some stripes, which could not be corrected any more. But these are easy to differentiate from archaeologically relevant anomalies.

Due to the topographical conditions around the barrow Pena de la Abuela in the field La Lampara one would suppose the extension of a possible settlement only in northwestern direction. An area of 120 to 120 m consisting of nine 40 m grids were measured (about 300,000 measurements) in two days. In the

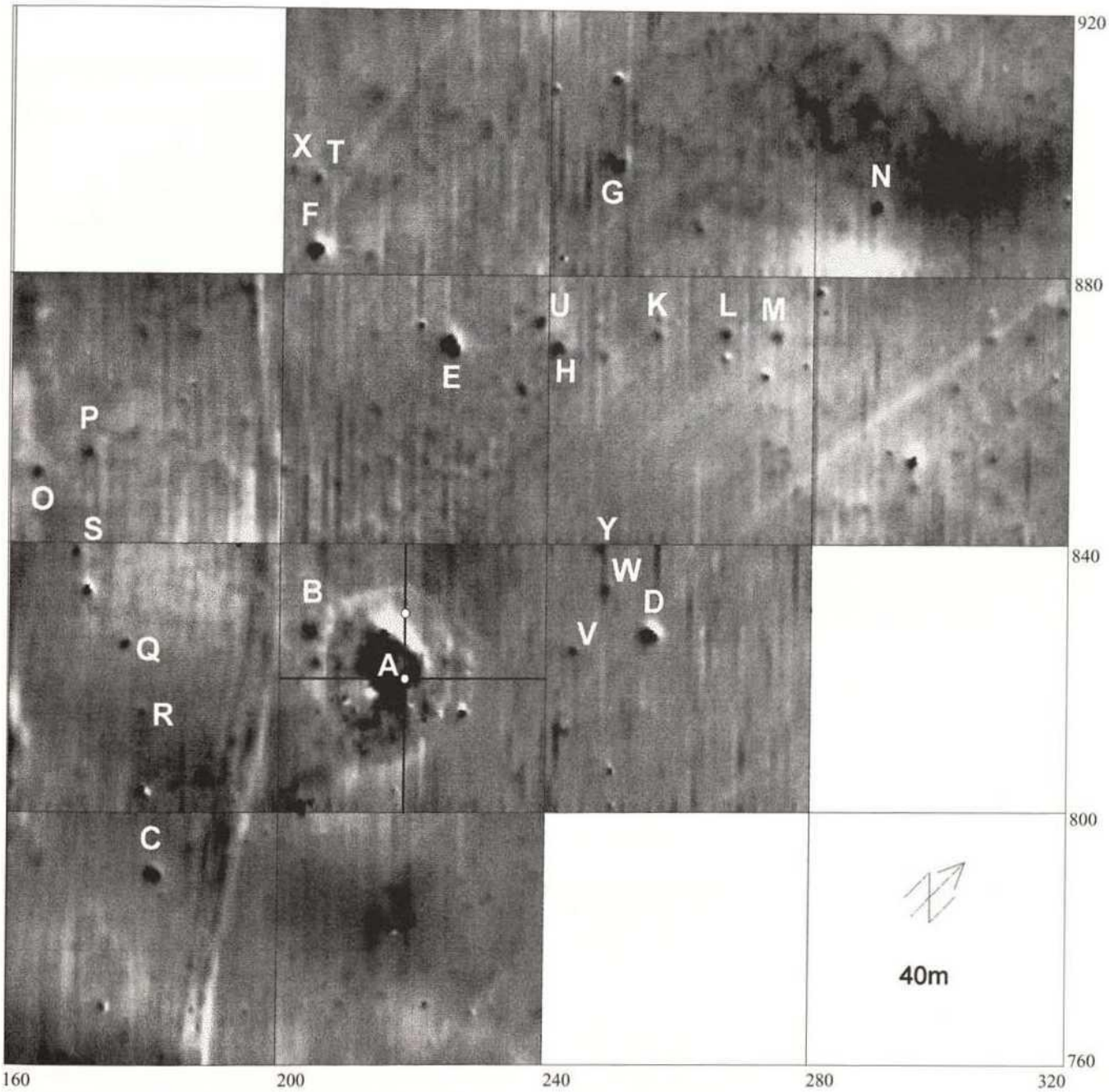

Fig. 3. Ambrona-Dolmen de la Sima 1998. Magnetogram of the round barrow (A) and its surroundings. Caesium magnetometry Scintrex SMARTMAG SM4G-Special with duo-sensor configuration, sensitivity 10 pT, raster 0.5/0.25 m, dynamics -4.0/+4.0 nT in 256 grayscales, 40 m grid

magnetogram about 30 pits (settlement or burials) with various sizes in a wide distribution were identified clearly (Fig. 2). The distribution of all these pits was covered completely by the magnetic survey, therefore one would suppose, that the settlement had an extension of 110 to 80 m. Most of these settlement traces lie in the socalled canada, an old track for driving herds of sheeps over long distances. The trace of this canada also is clearly visible in the magnetogram possibly due to the compression of the ground in several trails over centuries. This area of the canada has never been ploughed, and the archaeological structures in the ground should be well preserved even near to the surface. But there were no traces of poste holes, which would mark prehistoric houses. Some of these magnetic anomalies are in such a manner strong and wide (e.g. A2 in Fig. 2, diameter about 2.6 m), that one would suppose rather an burnt place than a settlement pit.

For the barrow under excavation only little details are visible in the magnetogram (B3 in Fig. 2) because of the extremly strong disturbances due to a great many iron nails used in the excavation for taking the measurements. Nevertheless some archaeological features are still visible in the magnetogram like the burnt chamber, which causes quite a strong magnetic anom-

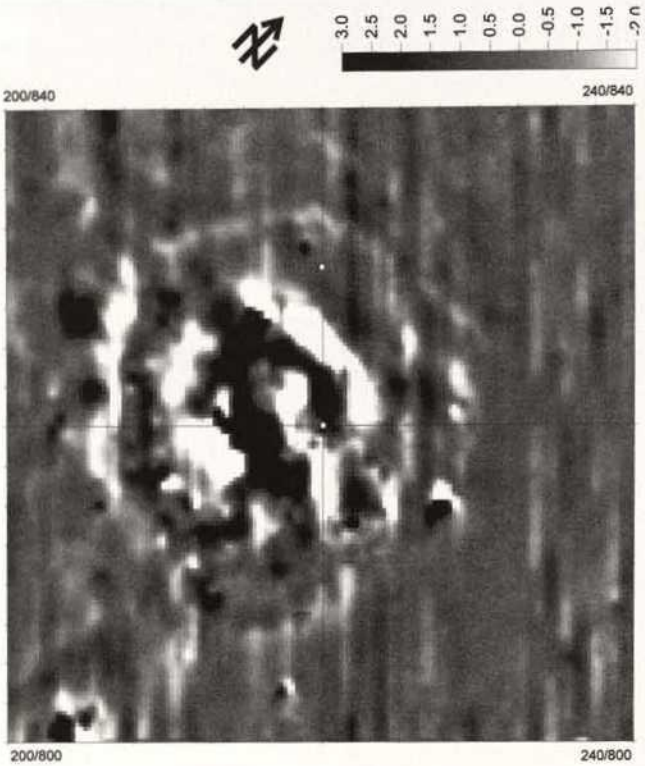

Fig. 4a. Ambrona-Dolmen de la Sima 1998. Magnetogram (detail) of the round barrow with a rectangular chamber. Caesium magnetometry Scintrex SMARTMAG SM4G-Special with duo-sensor configuration, sensitivity 10 pT, raster 0.5/0.25 m, highpass filtering 10 x 10 pixel, dynamics -2.0/+2.0 nT in 256 grayscales, 20 m grid

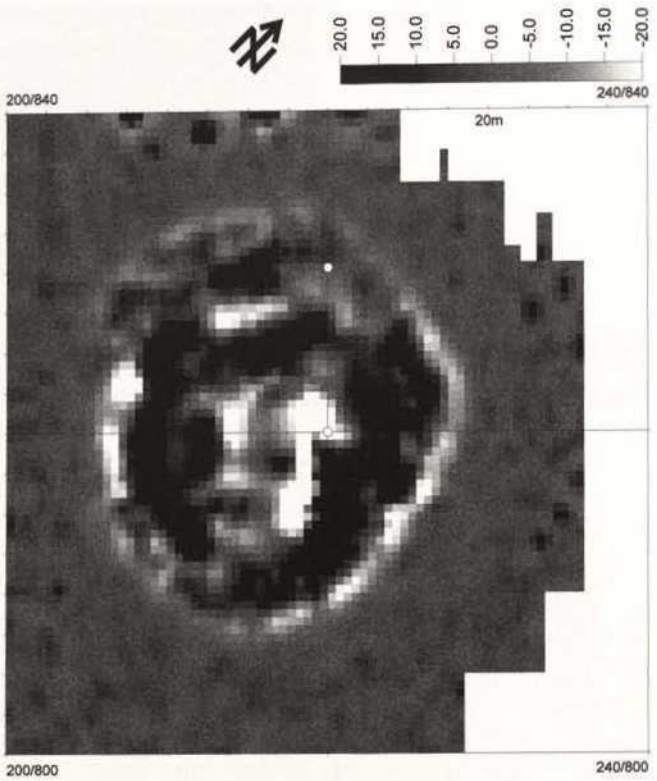

Fig. 4b. Ambrona-Dolmen de la Sima 1998. Resistivity diagram of the round barrow. Geoscan RM15-Advanced resistance meter with twin electrode, raster 0.5/0.5 m, dynamics -20.0/+20.0 units (original data 40.0/240.0 Ohm m), 20 m grid

aly. The trace of a circle of some burnt postes, which may have marked the border of the mound, may be seen in the western half of the barrow.

Also in 1996 the neolithic site La Revilla was prospected over an area of 120 to 160 m. The magnetic anomalies were quite different to La Lampara, therefore one would suppose rather an settlement than an burial site, but the structures were not clearly to be seen and difficult to interpret. Another possibly fortified neolithic settlement (La Cumbre) situated at an rocky plateau some kilometers apart was test measured in 1997. The magnetogram shows a wide range of magnetic anomalies of various amplitudes and widths, which would be typical for a settlement. Some of the minor anomalies might be post holes cut into the rock (lime stone). The pits of the settlement are mainly distributed on the upper plateau only. The northern border of the settlement was possibly a burnt rampart or a burnt wall, which still forms a steap edge.

In 1997 another tumulus was detected by Manuel Rojo, who saw the site from the nearby road. His name Dolmen de la Sima means that this is an megalithic monument, which should contain a burial chamber made from huge stones. Like in La Lampara the magnetic prospection covered also a wide surrounding area. The magnetogram was found to be also rather similar to La Lampara with many pit anomalies of various types in the surroundings (Fig. 3). Possibly another burial site was detected in the vicinity of the round barrow. The Dolmen de la Sima shows a very distinct rectangular positive anomaly over the centre of the mound, which may be the burial chamber. There is some evidence, that the chamber is made from wood, but outside packed with stones, because of its geometric shape with absolutely straight edges, which might be constructed by wooden beams (Fig. 4a). The higher magnetization of the chamber may be explained either by a burnt chamber or by a biogenic magnetization process due to magnetic bacteria, but there are no investigations about this process until now.

It was tried to learn more about the interior structure of Dolmen de la Sima by a resistivity survey in August 1998. But this was rather problematical because of a extremly dry soil which gave no electrical contact to the gound at all. After putting some 10,000 liter of water over the site the resistivity measurement could be started. Also in resistance the chamber is marked by a wide anomaly in the centre of the mound with good conductivity. The stone package around the chamber is well visible in the electrical diagram too (Fig. 4b). But there are also some anomalies of high resistance upon the chamber shown in the magnetic prospection, which gives some evidence to the earlier idea about a stone chamber in the Dolmen de la Sima. We will know more about this complex site by the end of the sommer, because an excavation will start in August this year. Both archaeologists and geophysicists have to learn more about the possibilities interpretating geophysical prospection with archaeological evidence.

References

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