

Discovering the Black Stone was Placed for Holy Mosque of Kufa Using GPR

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Abstract: GPR Device was used for discovering the landmarks and ruins under surface layers with 5m depth in the holy mosque of kufa. (250MHz) antenna was used in this task. This study was carried out through 38 profiles in different sites in the holy mosque. This research focused on surveying 15 profiles to find any remaining of the landmarks and foundation of the location that the black stone was placed. It is thought that the black stone which exists now in Mecca was moved from Mecca to Kufa as it was said by history in (897A.D – 317A.H) specifically in its holy mosque with 7m distance from the location that the prophet Muhammad's was pray which exists in the mosque with (7m,4m) dimensions. The studies proved this promising results. This study was data processing using the Rad Explorer program as well as GPS.

Keywords: GPR, black stone, holy mosque, Rad Explorator

1. Introduction

Ground penetrating radar (GPR) is now a well – accepted geophysical technique. Method is used radio waves to probe "the ground" which means any low loss dielectric material. In its earliest inception, GPR was primarily applied natural geologic materials. Now GPR is equally well applied to a host of other media such as wood, concrete and asphalt. The existence of numerous loss dielectric material environments combined with the wide range radio frequency spectrum leads to a wide range of GPR application. The same methodology can be applied to glaciology and to nondestructive testing of concrete structures; the spatial scale of application varies from kilometers to centimeters [1].

2. Theory of GPR

The ground penetrating method is based upon the transmission of pulsed electromagnetic waves in the frequency range (1MHz to 1000MHz). In this method, the travel time of the waves reflected from subsurface interfaces are recorded as they arrive at surface, and the depth (D) to an interface is derived from:

$$D = TV / 2$$

D is the depth to the reflector.

V is the velocity of the radar wave pulse through the subsurface material.

T is the two – way travel time to the reflector (taken from the GPR trace). (figure 1)

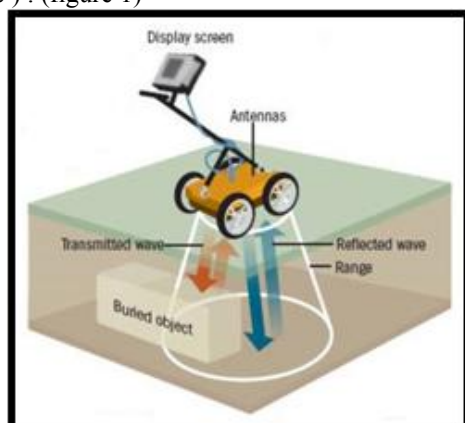


Figure 1: Basic principle of GPR

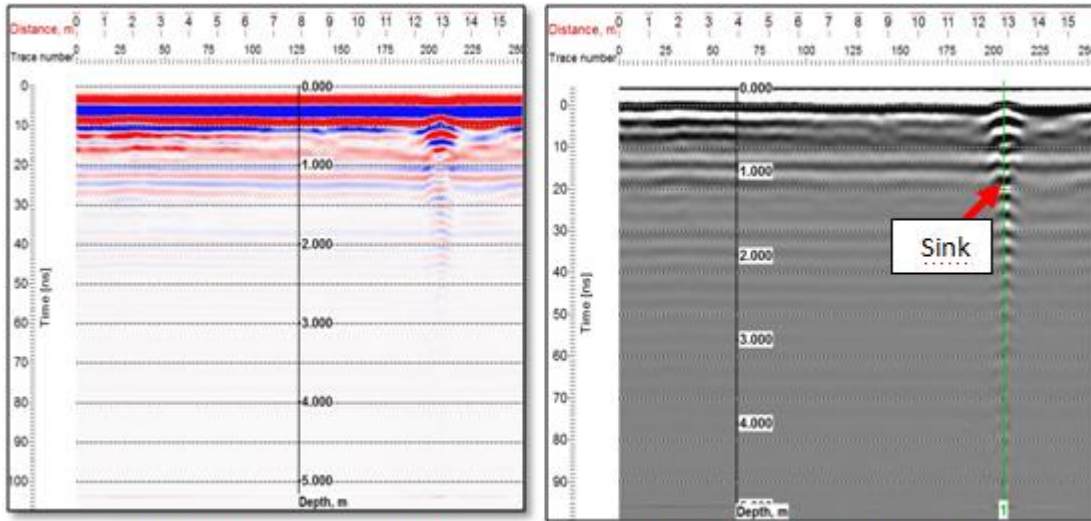
The conductivity of the ground imposes the greatest limitation on the use of radar probing, that is, the depth to which radar energy can penetrate depends upon the effective conductivity of the strata being probed. This, in turn, is governed mainly by the water content and its salinity. Furthermore, the value of effective conductivity is also a function of temperature and density, as well as the frequency of the electromagnetic waves being propagated. [2]

3. Study Area

The Holy Mosque of Kufa is one of the four important mosques. It lies in Kufa at the west bank of Euphrates River about 156km to the south of Baghdad and 10km to the east of Najaf town. The Coordinates of the area are (443396S, 3543810N) which thought it was the location of the black stone. It is known the Kufa area is Sedimentary which was formed by the Euphrates River. Its Climate of Iraq. It is rainy in winter and hot, dry in Summer.

4. Data Processing

Rad Explorer Device was used for many filters like (Time-Zero, Background Removal, Amplitude Correction) to remove the unwanted signals in the noisy tracks. The studied area included the paving of layer which has the original characteristics. The (Time-Zero) program was applied to all the tracks as it represents the line of the actual zero point when the wave leaves the antenna actually. Deform was noticed in the 297 track before execution any filtration upon the 13m distance of the track start, where is water drainage cesspit. The penetration depth is 5.3m. When Background Removal filter was used on the track No.297 as it is shown in the Fig(2c) we see a deform with 3.23m depth upend 2.5m distance from the track start and hyperbola appeared with (12.3cm/ns) velocity and (5.9) isolation constant. This area is the same area of black stone in the ancient times.



Before apply the Time-Zero (a) After apply the Time-Zero (b)
Figure 2: Profile No. 297

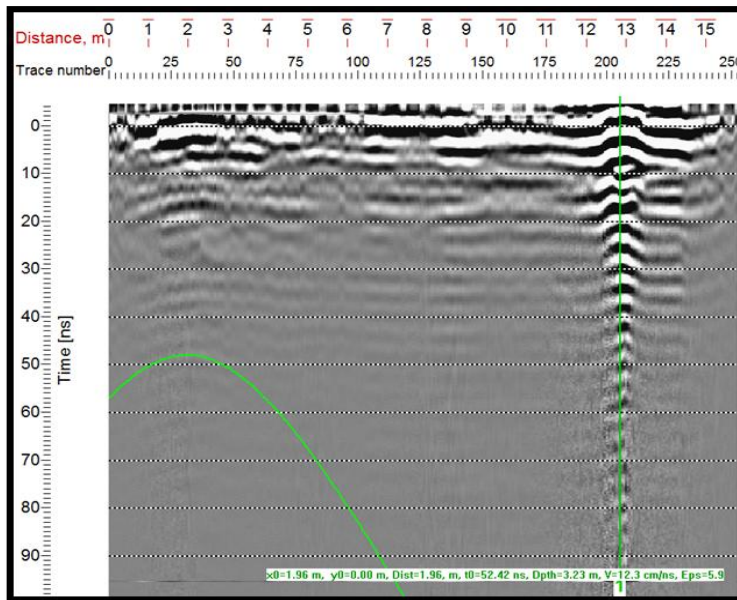


Figure 2: Profile No. 297 After the apply Background Removal(c)

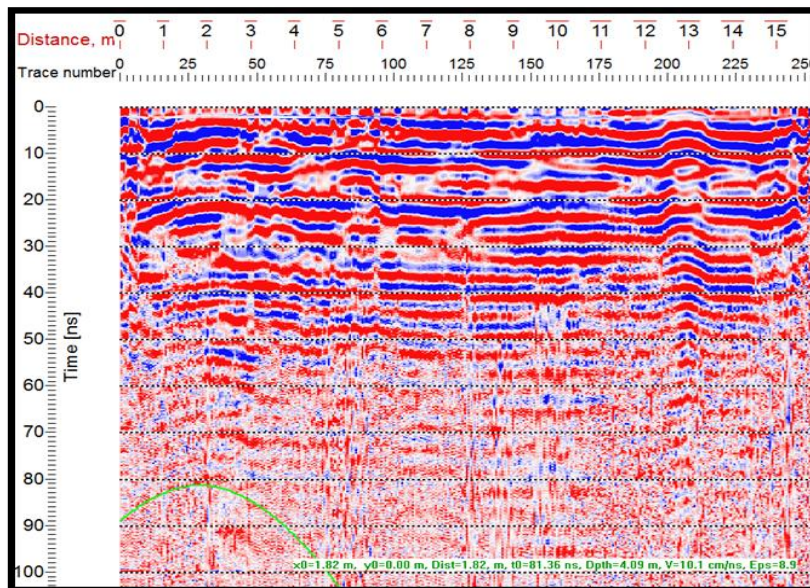


Figure 2: Profile No. 297 After the apply Amplitude Correction (d)

Mean while filtration the track 298 by the Amplitude Correction as it is shown in Fig (3c) we see a deform upon the 3.5m distance of track start with 4.5m depth. A hyperbola can be seen with (10.4cm/ns) velocity and 8.4 isolation constant .

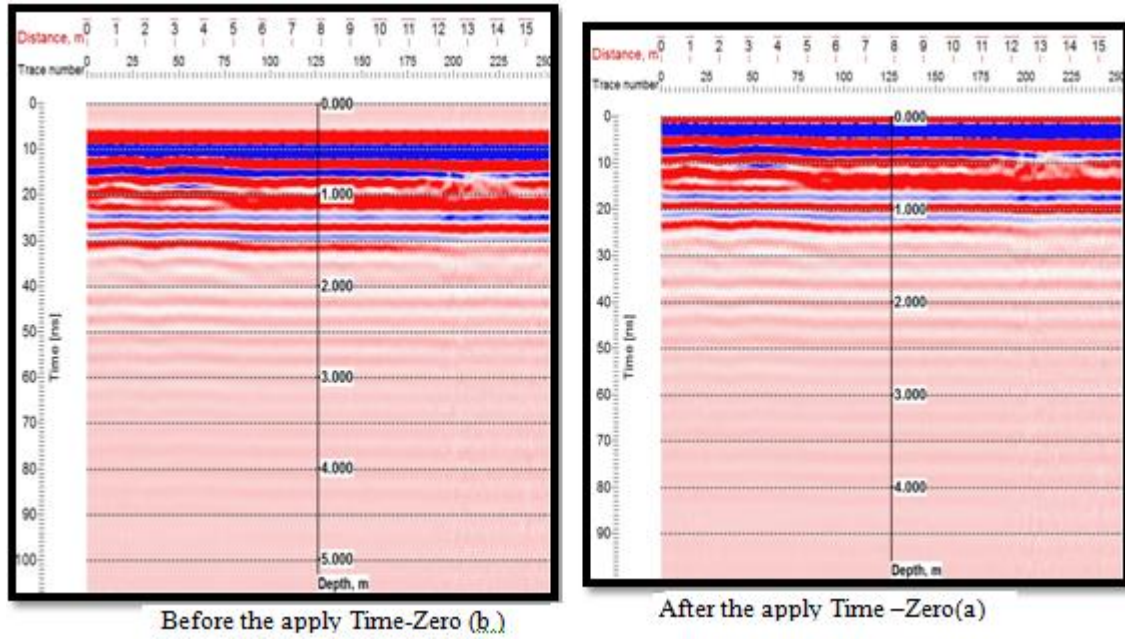


Figure 3: Profile No. 298

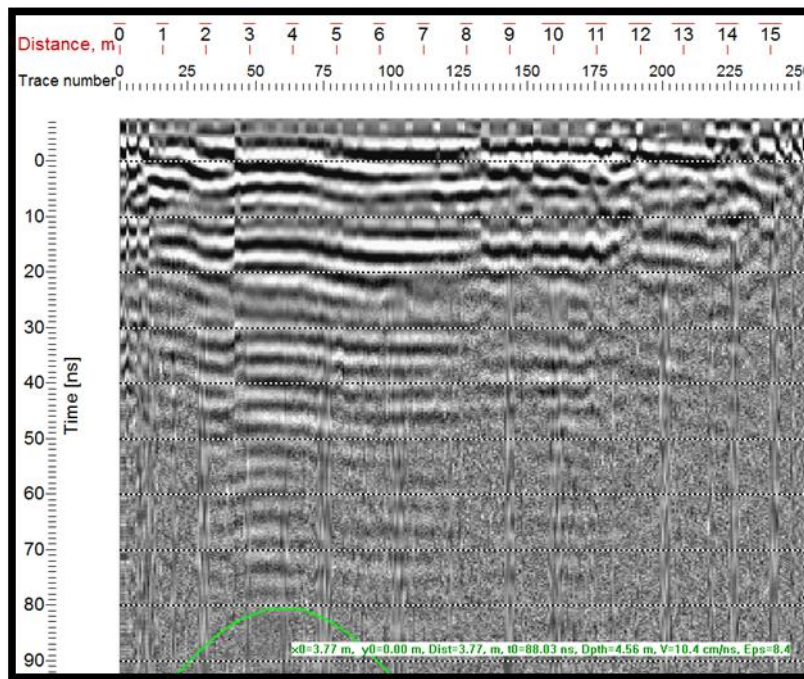


Figure 3: Profile No. 298
 Before applying the Amplitude Correction(c)

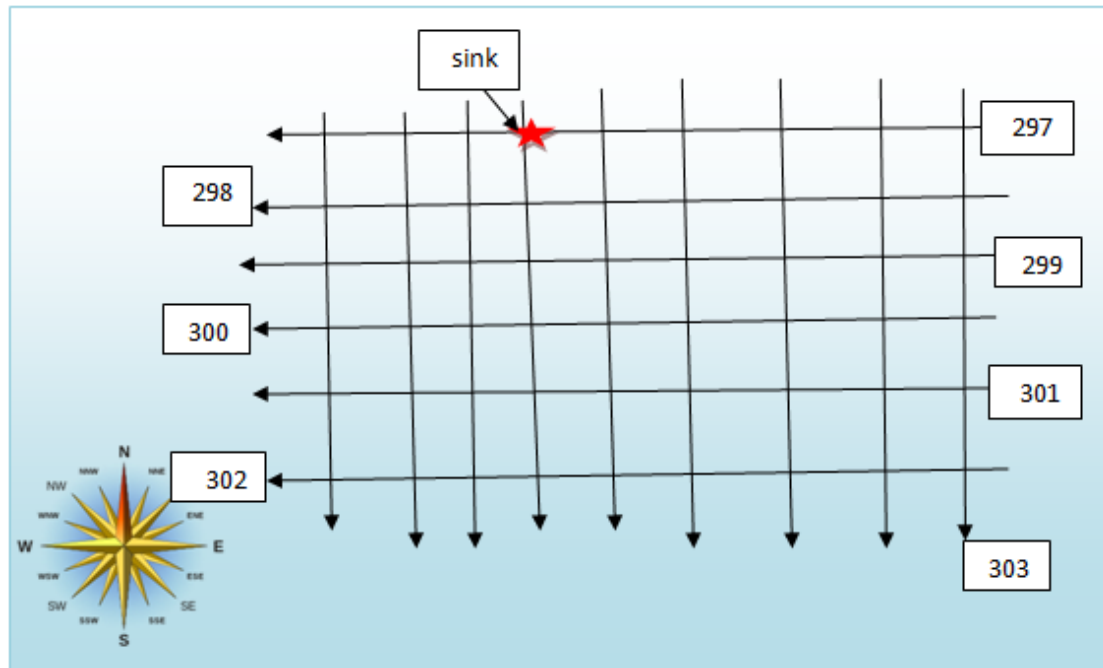


Figure 4: Field using 250MHz antenna paths

Meanwhile filtration of the rest tracks with 4m depth, the same deforms appeared with (7m, 4m) dimensions which is the same location of black stun in the ancient times .

5. Conclusions Remarks

- 1) Using 250MHz antenna in start of the antenna high frequency to check and study of the under face layers with 5m width inside the study.
- 2) Through filtration of track No.15 with 4m depth , we find a deform with (7m,4m) dimensions which is the location of the black stun in ancient times .

References

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