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Stručni članak

DETECTION OF AN AIRPLANE BOMB BY GEOMAGNETIC TESTING OF THE »REDVIT« BUILDING IN SLAVONSKI BROD

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An old abandoned building was examined in order to perform a restoration project. Due to the presence of a round opening in the roof and the fact that Slavonski Brod was heavely bombed in the last war, it was assumed that there might be a bomb left. Geomagnetic measurements using a proton magnetometer were performed. A magnetic anomaly was obtained indicatint an iron object of more than 100 kilogramms weight. Position and depth was determined. The excavation is now expected to get the final solution is the object a bomb or not.

Ključne riječi: Geomagnetika, Protonski magnetometri, Bombe zrakoplovne

Da bi se mogao provesti projekt restauracije stare napuštene zgrade bilo je potrebno provesti ispitivanja. Tijekom prošlog rata Slavonski Brod je bio teško bombardiran. Na krovu zgrade bio je kružni otvor ispod kojega je bila hrpa zemlje, pa se pretpostavljalo da je tu možda zaostala bomba. Zbog toga su bila izvedena geomagnetska mjerena s protonskim magnetometrom, koja su ukazala na željezni objekt težine veće od 100 kg. Određena je njegova pozicija i dubina. Nakon provedenih mjerenja trebalo bi pristupiti otkopavanju koje će pokazati je li taj objekt bomba ili nije.

Introduction

Unexploded airplane bombs from the second world war are still found in some localities. When some objects have to be built or renewd in such places, the bomb must be found and removed. The mombs may be found very quickly by the use of geophysical methods. These methods make use of the difference in physical properties between the material of the bomb (steel) and the surrounding material (earth, clay, sand, brick etc.). In principle the prospecting could be performed by geoelektrical, geomagnetic, gravimetric and seismic methods, but in practice only the first two are used in prospecting for bombs. Of the electrical methods the electromagnetic ones have been utilised. However, often special adaptation of the instruments has to be done, since the so colled »treasure finders« or instruments for the search of metallic mines have very limited depth penetration. On the other hand, some electromagnetic instruments used for ore prospecting, are not so well suited for small objects like the airplane bombs. The electromagnetic instruments are also sensitive to other conducting materials, like clay, salty water etc. Some investigators also expressed the fear that strong electromagnetic field sent to the earth could cause a spontaneous explosion of the bomb.

Geomagnetic measurements

Magnetic measurements do not send any energy to the ground. They are very sensitive and they enable determination of the position and depth of the bomb with satisfying accuracy. The instrument reacts also to other magnetic objects, but usually one can estimate if the object's size corresponds to the bomb or not. The measurements are made usually by a proton precession magnetometer. We used the instrument produced by Barringer Co from Canada. It measures the total value of the magnetic flux density. This value is practically constant on a nonmagnetic rock, over magnetic objects the valus is changed, so called anomalies are present. The amount form of the anomaly gives some possibilities to determine the position, form, depth and size of the magnetic object.

The interpretation of magnetic measurements is complicated by the fact that the direction of the earts's magnetic field varies with geographic position. In the Middle Europe it is pointing towards the North under 30 degrees from the vertical. On the magnetic Nordpole it is vertical. The result is that in Northern countries the magnetic object is exactly vertically under the maximum of the anomaly. In other areas it is not so simple to determine the position, but as will be seen we succeeded to reduce the problem to the similar case.

Prospecting at Slavonski Brod

Figure 1. presents the map of the total magnetic flux density in the units nanotesla, on a relative niveau. The measurements were made in an old abandoned building, former Austro-Hungarian powder magazine »Redvit« in Slavonski Brod. There was a round opening in the roof, and since Slavonski Brod was bombed a lot in the second World War, it was assumed that there might be a bomb left. The detecting head of the magnetometer was positioned 1.60 meters above the ground. There are some disturbances due to the iron objects in the walls, but the anomaly caused by the bomb (as we think) is clearly indicated. The mass

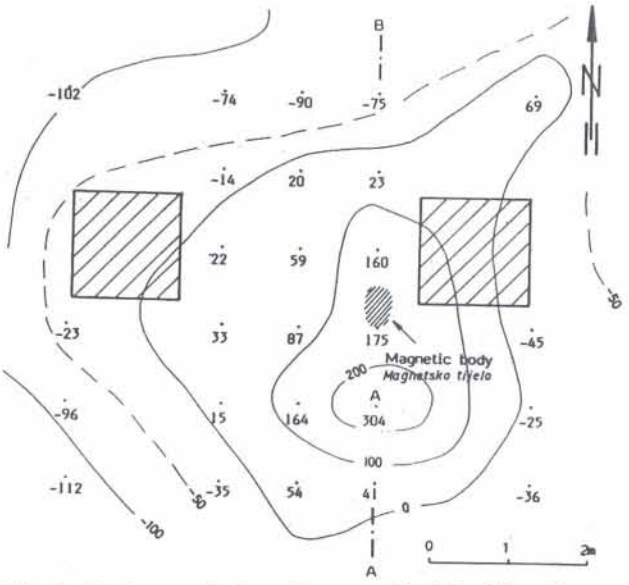

Fig. 1. Total magnetic intensity map, »Redvit« Magazine

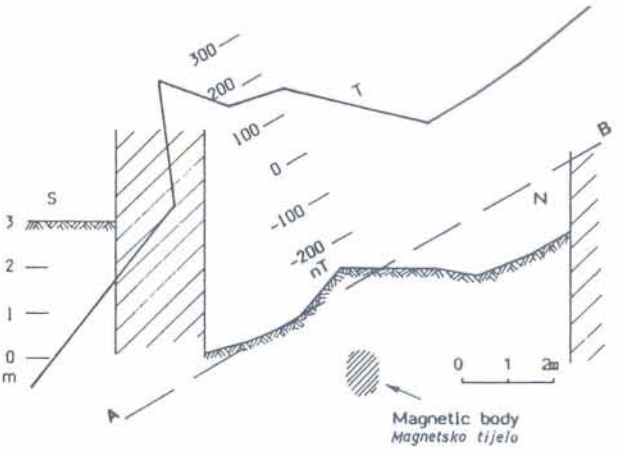

Fig. 2. Total magnetic intensity profile A-B

of iron causing it, according to the formula given by Breiner (1973) is over 100 kilograms, so it cannot be caused by any small iron objects.

Figure 2. presents a N-S profile over the maximum of the anomaly. The ground is here not horizontal, but rises towards the North under approximately 30 degrees. So when we plot the radings perpendicularly to the straight line approximating the ground (fig. 2.), we have the same case as when the magnetic field is vertical and the ground horizontal. The object causing the anomaly is situated in the direction of the magnetic field from the point of the maximal anomaly of the flux density. Its depth is determined approximately from the form of the anomaly. We are expecting now the excavation of the object and the final solution is it the bomb or not.

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