PPM MarkII test results

The following test results were generated by one of our first users with the above MarkII system.
The sensor is carried at around 40cm over ground.

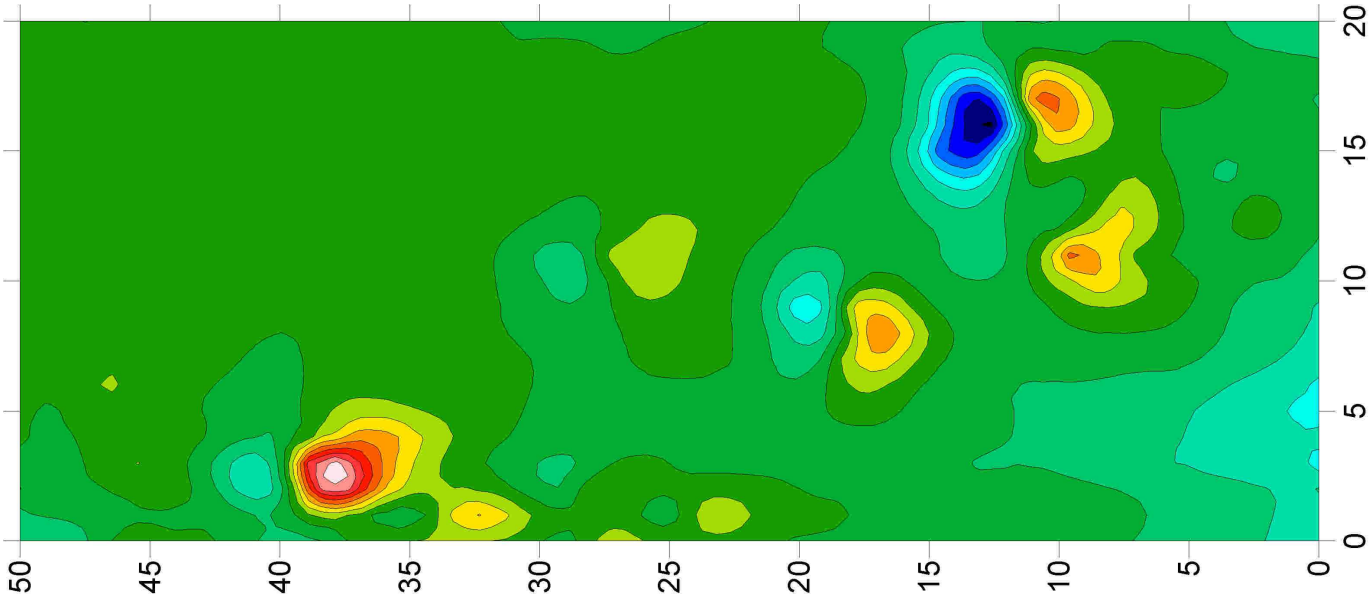
The effects of the presence of an object made of magnetic material upon the local earth magnetic field is ruled by well-known physical laws and are independent from the type of magnetometer instrument used to make the surveys. Every such objects act much like a magnet with two poles (**dipole**) where one pole re-enforces the total earth field and the other pole decreases it (e.g. a cannon made of iron). Sometimes, a dipole has its two poles so much distant from each other that the survey instrument just measures the effect of the closer pole, this is then called a **'monopole'**. This is the case if a long object is buried vertically. In that case, the instrument will only see the effects of the top end. This is also the case if the object is round (e.g. a cannon ball)

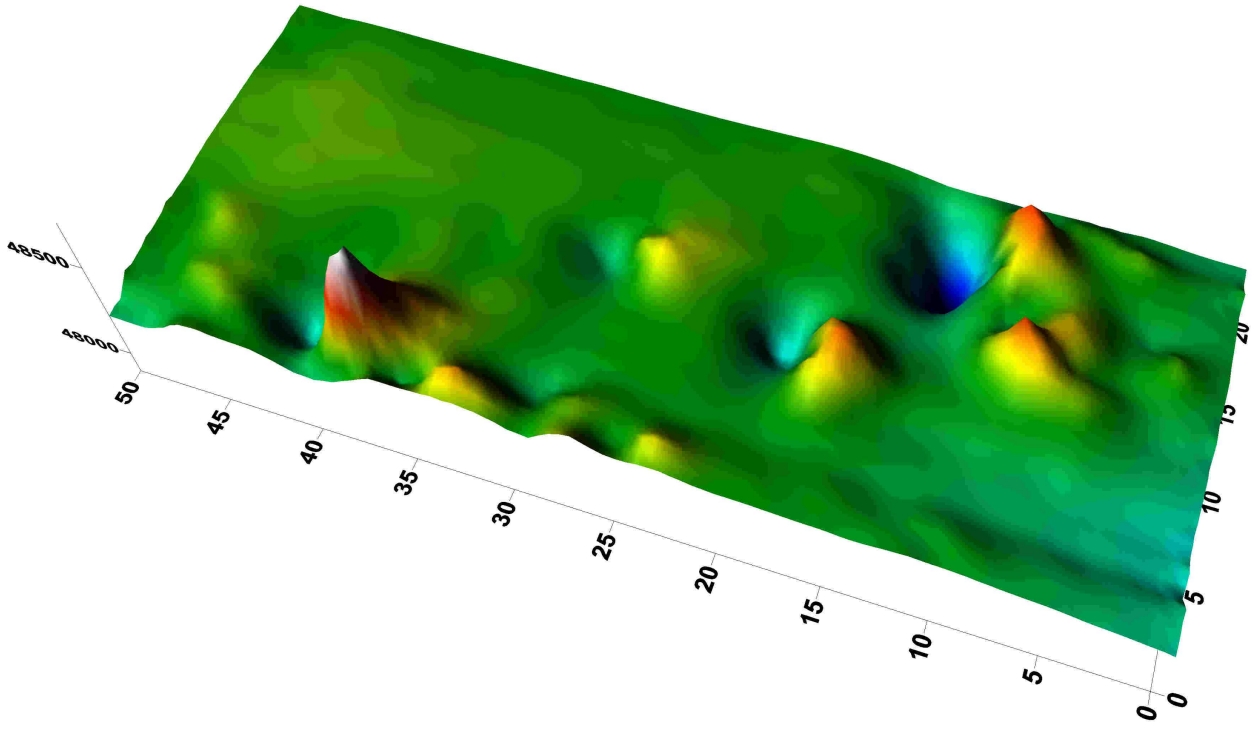
To make things simpler, there are thus two main cases to consider:
1. A **monopole signature** will show as a single point on the plot with a large positive field gradient (a mountain). In that case, the object is located right at the top of the positive peak. See test1, this is a ball-shaped object made of the accumulation of magnetic coins. It is located at around 4,3.
2. More usually, you will see **dipole signatures** where you see a positive field gradient (a mountain) close to a negative field gradient (a valley). This is the effects of re-enforcement and weakening of the total earth field at the two ends of the dipole. You draw a straight line between the two peaks and the object is located just in between with its orientation given by the straight line. This is the case for all the other tests.

The depth of an object can be evaluated by the sharpness of the peaks. Shallow objects generate sharp peaks while deep objects generate low and wide peaks.
The test 3 shows two simple objects of different weight and buried at two different depths in two different orientations. The bigger one generates a large field gradient of around 45 nT (this is the difference between the total field at the positive peak and the total field at the negative peak).
All the color changes shown along the borders of the surveys have to be ignored; they are measurement and gridding artifacts.
If the survey area had been much larger, these peaks would show like mountains in the middle of a flat desert.
In test 2, the ammo box was explicitly buried at the location shown on the 2D plot and showed a signature of a typical dipole but it seems that there was already a target of unknown nature in the survey area. An actual digging could uncover this 'mystery'!
Test 4 is the most difficult to interpret as it shows a multiple target buried rather deep (almost 3 meters). Also, the survey area was rather small, just to enclose the target surface, for a reason of survey time and effort. During this survey, we can see that there were some surrounding disturbances (the red area in the S-E corner). This can be due to unknown buried material or some diurnal variations.

If you want to fully understand the theory behind the magnetic survey interpretation rules, you should read the following document: http://perso.infonie.be/j.g.delannoy/BAT/ampm-opt.pdf in the chapter V Interpretation.

Example of a l*arge Survey area with a few dipole and monopole signatures*





The plots of the tests have to be interpreted as follows:

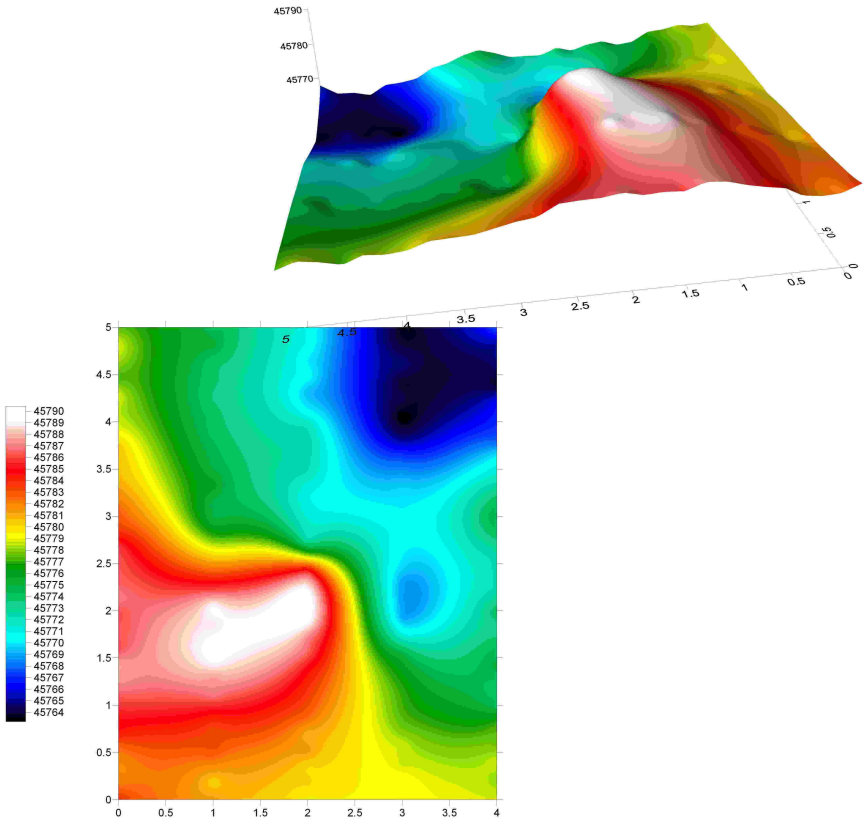
- A **dipole target** (a target appearing as a rectangle) shows itself as a positive field peak near a negative peak. The target is located in between the two peaks.
- A **monopole target** (a round target or a long target buried vertically) shows itself as a single positive field peak. The target is right in the middle of the peak. See test 2.

A shallow target generates high and sharp peaks while deeper targets generate low and crushed peaks.

All the X scales are shown in meters while the Y scales (separation between consecutive survey lines) are 0.5m.
The following plots use a color scale to represent the range of Z values. They show positive peaks as RED while negative peaks are BLUE.

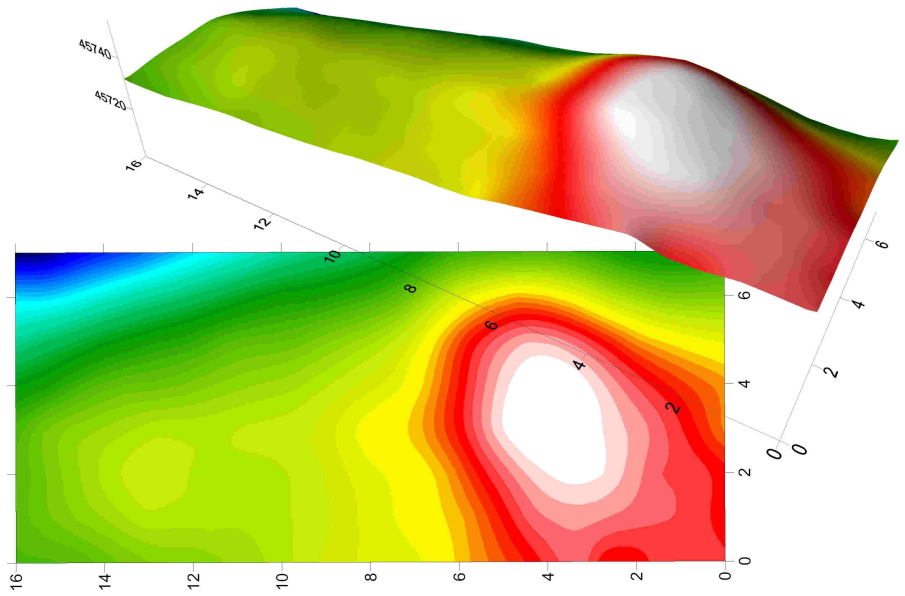
Real Target

This bomb shell has been located at more than 80cm deep



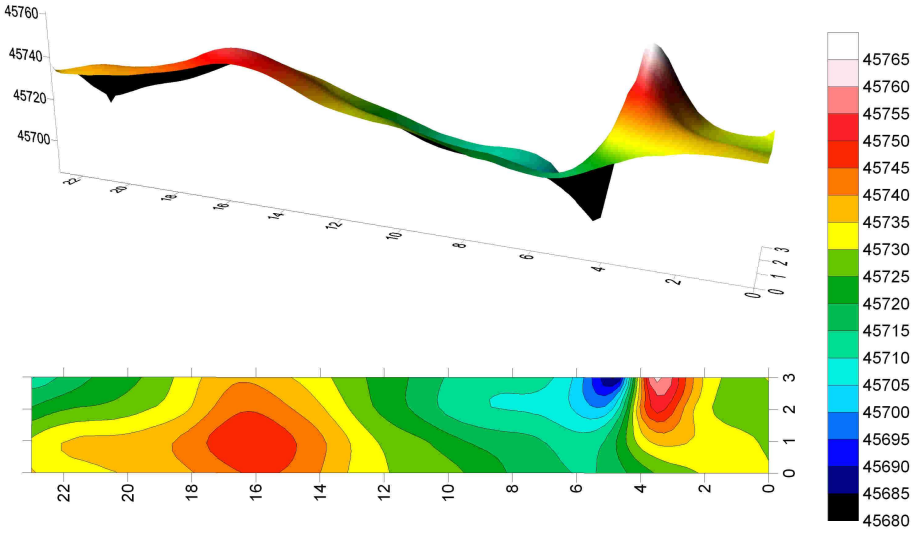
Test 1


2350 coins
eurocents (1,2,5)
7.770 Kg
1.15 meters depth (top)


457140
457120
16
14
12
10
8
6
4
2
0
0
2
4
6
16
14
12
10
8
6
4
2
0

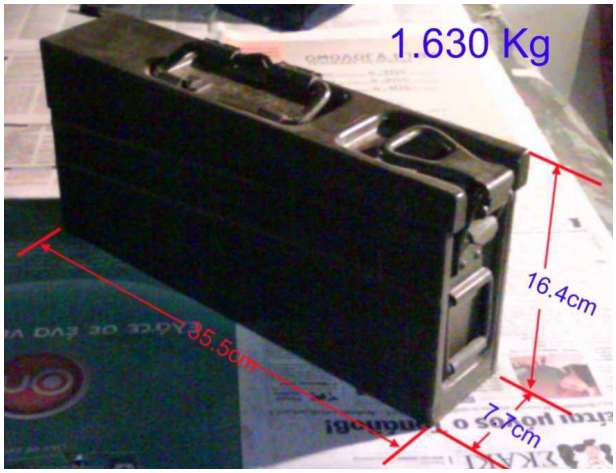
Test1a

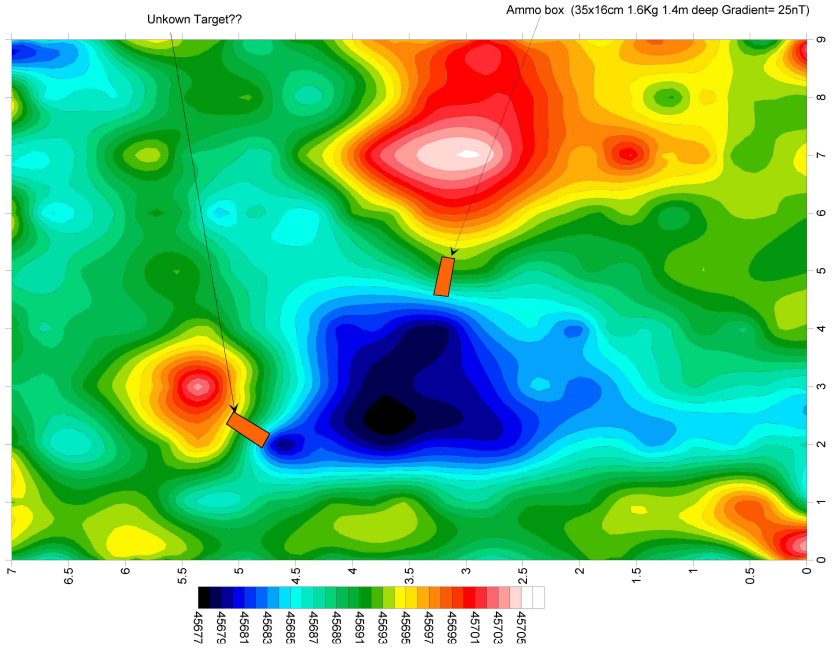
During a supplementary survey at the coins site (test 1), a high and narrow double peak (red+blue) was detected indicating an unknown dipole target. After digging 50cm deep, exactly between the two peaks, this old rusted tweezers was removed from the hole.
The wide and low single red peak is the signature of the bunch of coins.

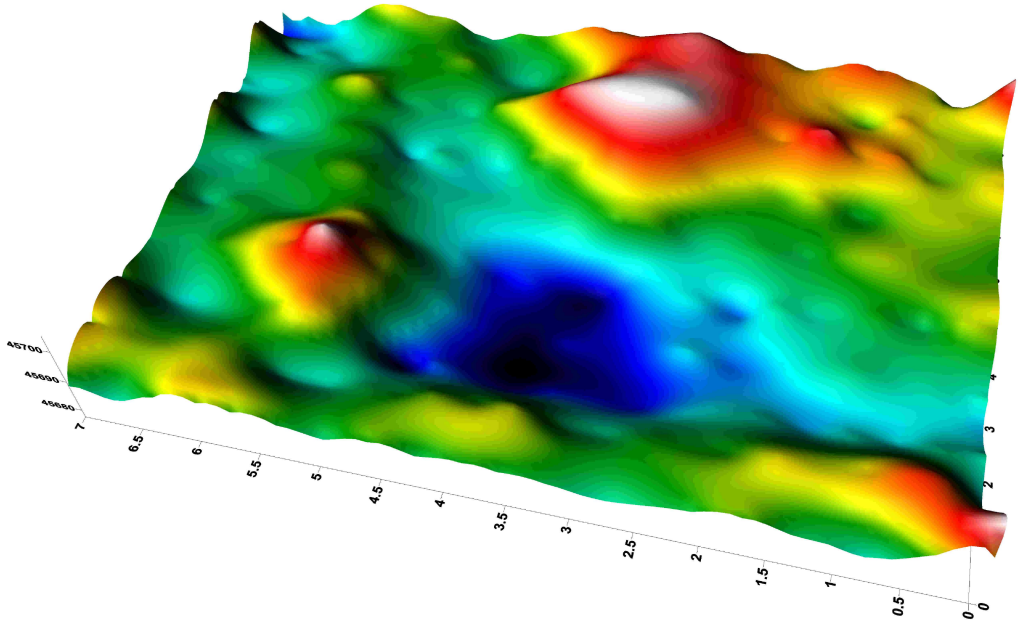


Test2

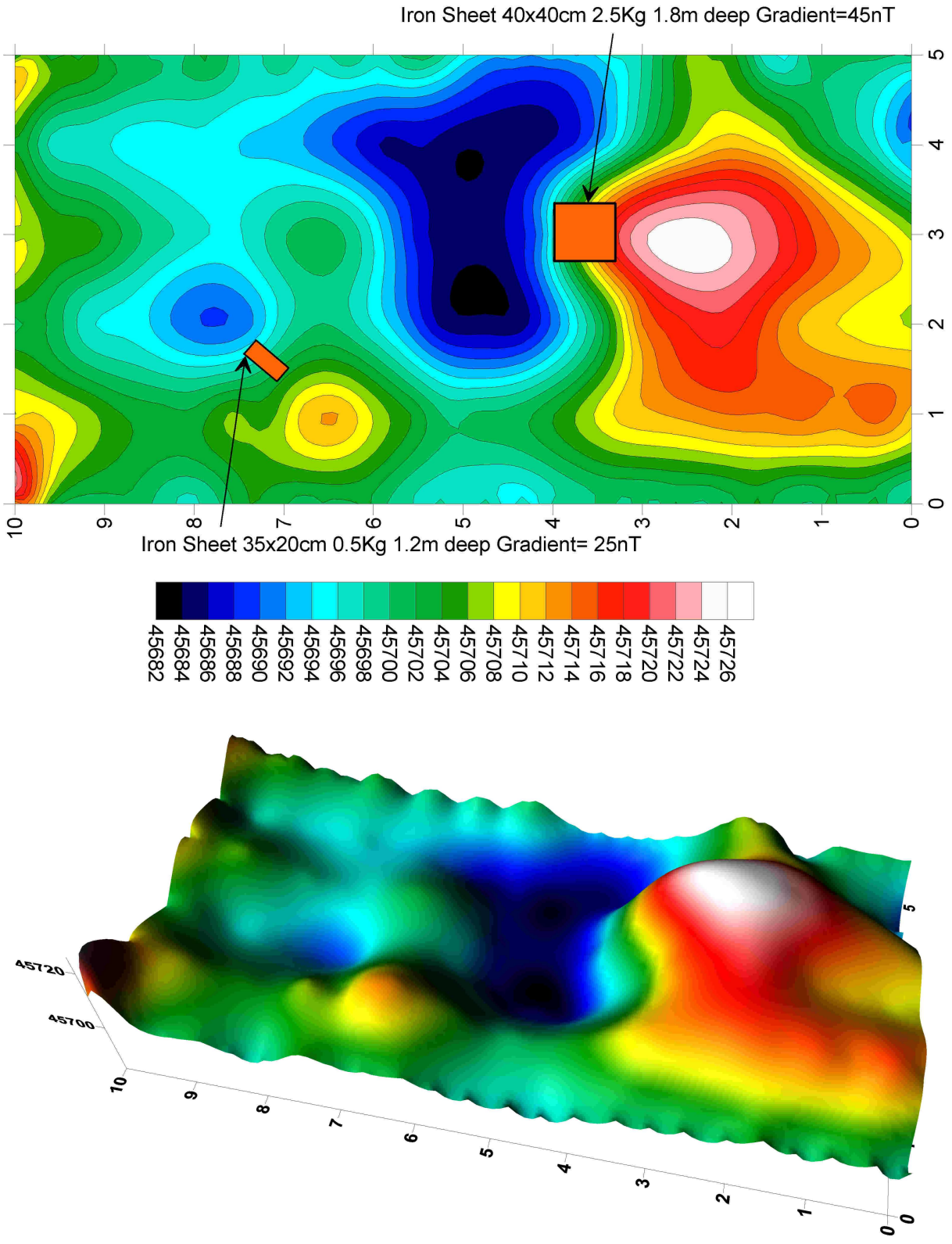
Single empty ammunition box buried 1.6 meter deep.





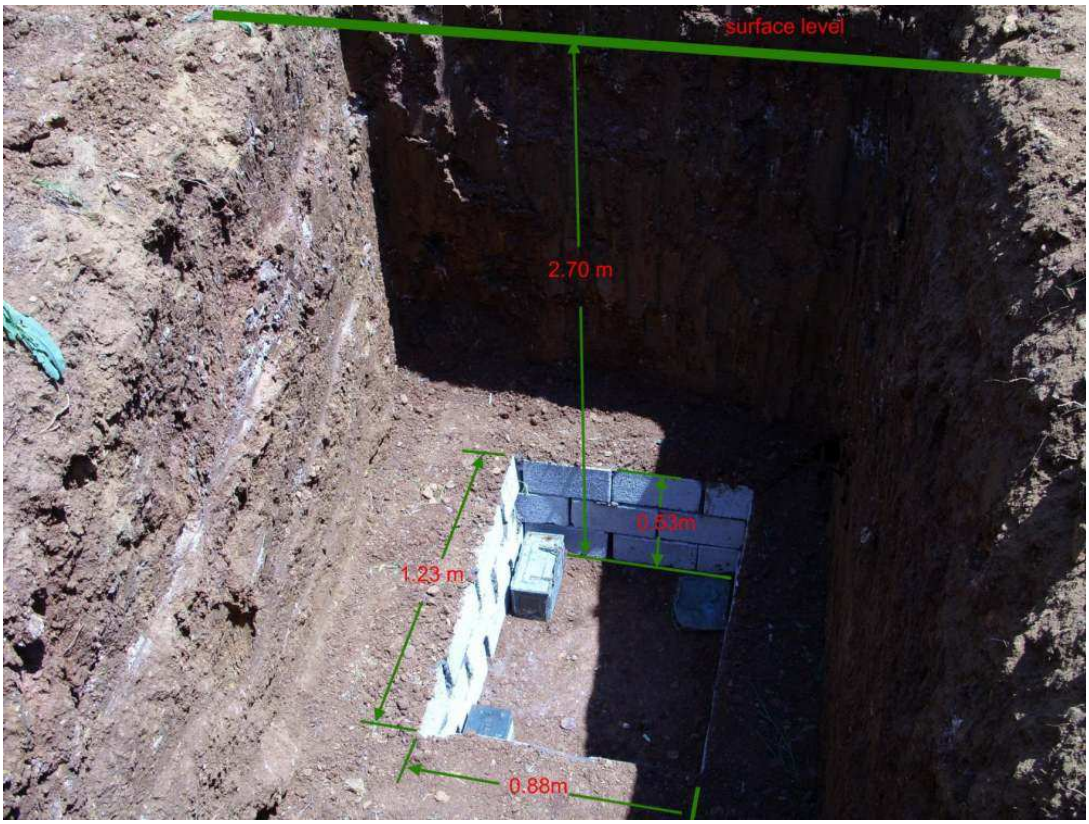


Test3


Iron Sheet 40x40cm 2.5Kg 1.8m deep Gradient=45nT
Iron Sheet 35x20cm 0.5Kg 1.2m deep Gradient= 25nT
45682
45684
45686
45688
45690
45692
45694
45696
45698
45700
45702
45704
45706
45708
45710
45712
45714
45716
45718
45720
45722
45724
45726
45720
45700

Test 4

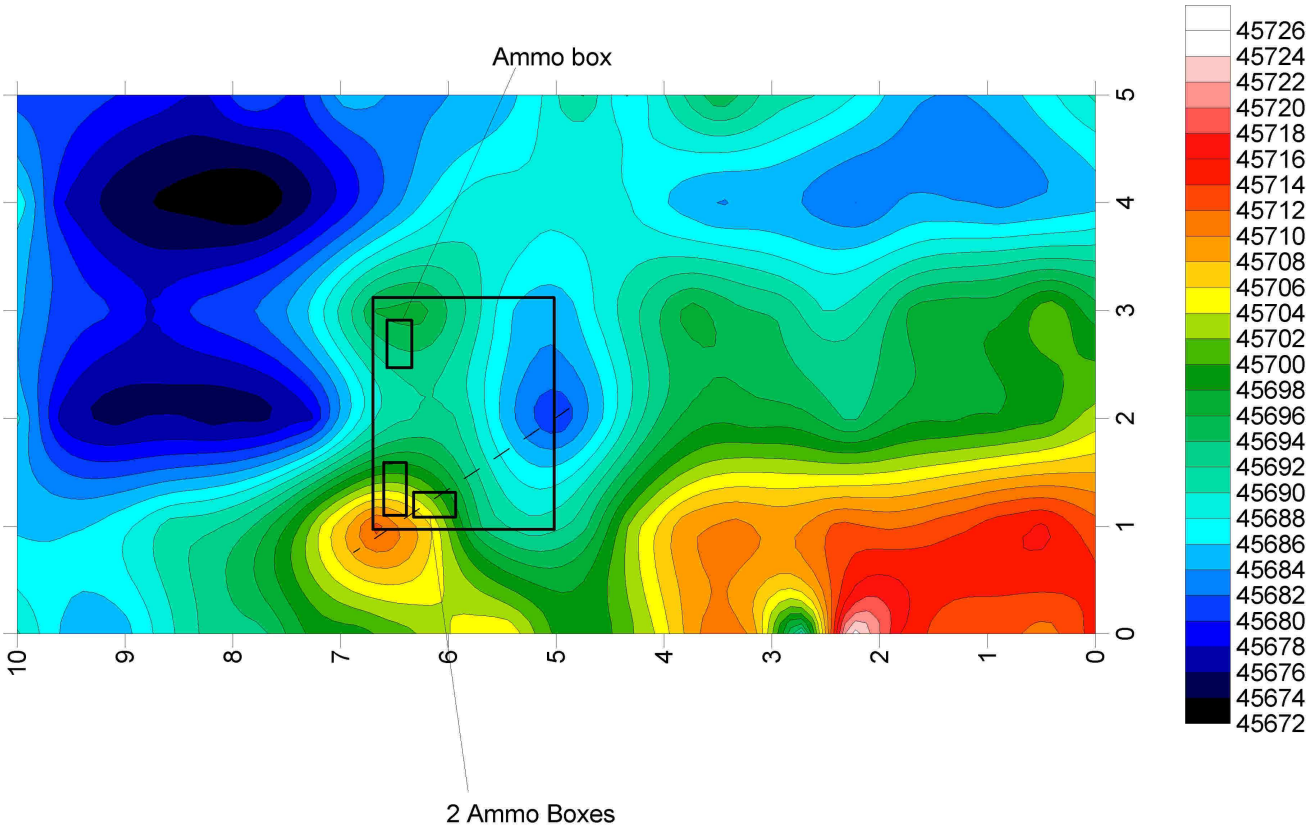
Three ammunition boxes filled with copper wire and buried 2.7meters deep.




IRON BOXES
net weight: 7.5 Kg
Copper : 48 Kg
copper
18 cm
15.5 cm
copper
copper sheet
30 cm


sensor on "low" position


sensor on "normal" position


Ammo box
2 Ammo Boxes
45726
45724
45722
45720
45718
45716
45714
45712
45710
45708
45706
45704
45702
45700
45698
45696
45694
45692
45690
45688
45686
45684
45682
45680
45678
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3
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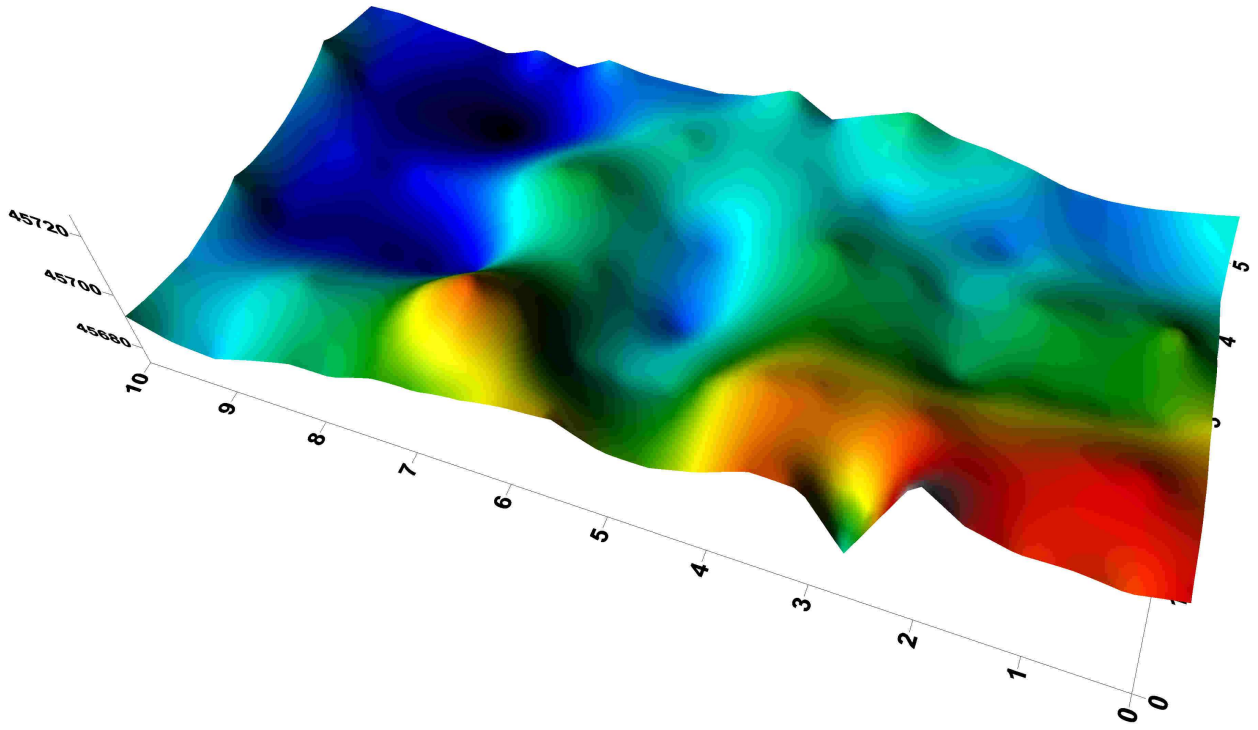
45720
45700
45680
10
9
8
7
6
5
4
3
2
1
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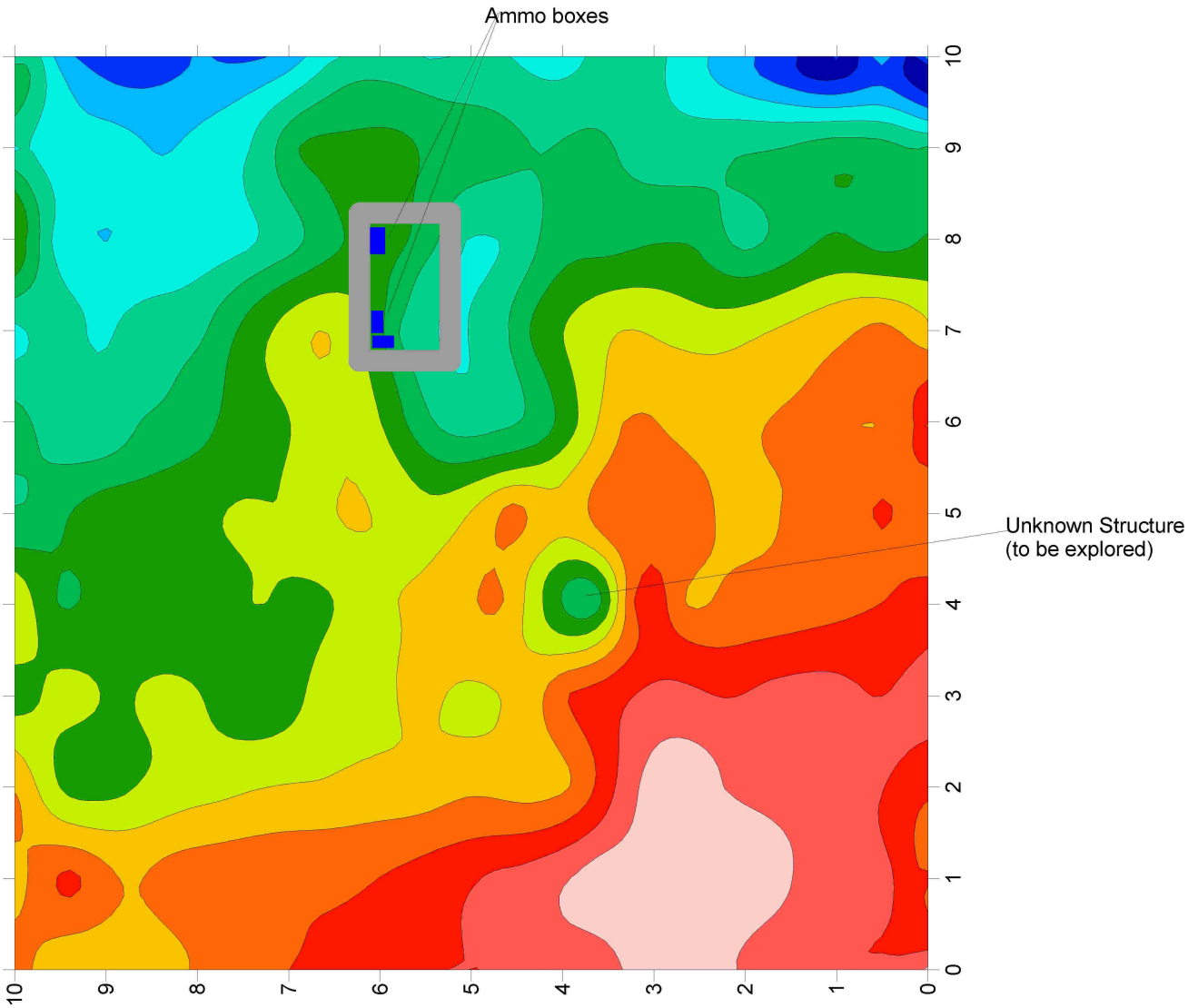
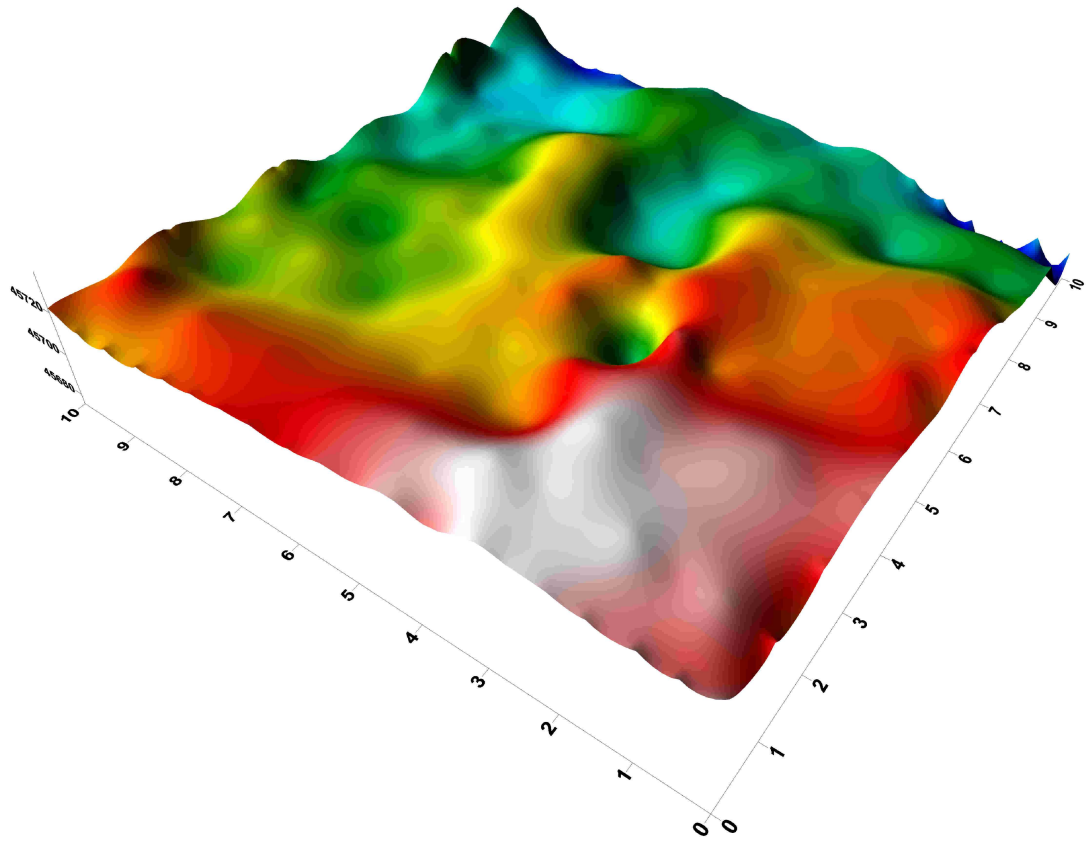
0
5

Larger Survey Area





Depth Test

This is the nice results of a series of benchmark tests with the PPM-Markiii made by one of our good clients.
A tunnel has be dug at a depth of 2.7m under a road and a bunch of empty ammunition boxes have been put in the tunnel. Survey grids were then made over this deep target and the results plotted in 2D and 3D.
The rightmost plot is with 4 boxes, next is 7 boxes, next is 11 boxes and the last, leftmost plot has been made with 11 boxes elevated in the tunnel to reduce the depth to around 2m.
Note that an (expensive) EMI sensor device (those so-called 'deep target', two-boxes types of detector) has been used for making surveys in the same conditions and this did not even detect the presence of the last 11 boxes.