

ESSAY TITLE:

The Application Of Magnetics In Minerals, Oil & Gas
Exploration In Near Surface Geophysics.

Abstract:

The magnetic method in exploration in mineral and petroleum
inducing is concerned almost entirely with the air borne
technique.

The magnetometer presuitly in widest use is capable of
measuring the magnetic field to 1 gamma (10⁻⁵ oersteds).
Instrument with a capacity of two orders of magnitude greater
sensitivity under survey conditions. Particularly, this is to
determine the attractive nature of the earth, upwards or
positive anomaly or downward denoting a native anomaly with
respect to the formation of deposits available in the strata of
the earth.

Key Words: Anomaly, Susceptibility, Anticline, and Magnetite.

INTRODUCTION: 1.0

Magnetic airborne surveys are done with respect to determining the attractive nature of the earth, upwards or positive anomaly and downward denoting native anomaly with respect to the formation of deposits available in the strata or crust of the earth at any point in time.

For example, the mineral magnetite (an iron oxide) owes U. S name to its decharacteristics physical property of being attracted to a magnet. If on the earth's surface, a large body of magnetites are present, then compass needles are directed towards the magnetic bodies rather than magnetic north.

The magnetic properties reside in the electrons of the atoms or ions of individual minerals. On the principles of move mechanics, the electron, moving is a closed path about the nucleus can be considered as a current behaving like waves and this moving current generates a magnetic field. When the crystal is placed in an external non-uniform magnetic field, there will be a force tending to align the magnetic fields of the

atoms to produce a magnetic moment for the whole crystal.

MAGNETIC SUSCEPTIBILITY X

This is the ratio of the resulting magnetic moment M, to the strength of the external field H.

$$X = M/H$$

The behaviour in a magnetic field of all crystalline materials may be classified under the following headings

Diamagnetic: have a small negative value of x and are slightly repelled by the field.

Paramagnetic: have a small positive value of x, and are weakly attracted by the field.

Diamagnetic and paramagnetic substances do not retain magnetic moment in the absence of a field. Iron bearing

mineral structure is paramagnetic.

The difference in magnetic susceptibility are sufficient to be of very great help in separating pure fractions of concentration of minerals from crushed rocks or ores by the use of a high intensity magnetic field. By varying the strength of the electro magnets minerals of varying magnetism can be separated from one another as stated below:

Highly magnetic minerals: magnetite, pyrrhotite (magnetic pyrite)

Moderate magnetic minerals: siderite, iron-garnet chromites, ilmenite, and haematite, Wolfram.

Weakly magnetic minerals: tourmaline, spinels, and monazite.

MAGNETIC ANOMALIES

Magnetometer is an instrument used by geophysics to measure the strength of the earth's field of magnets. The

strength of the earth's magnetic field varies from place to place, just like gravity; a deviation from average readings is called an anomaly.

The broad regional anomalies are usually as a result of the circulation patterns in the liquid outer core or to deep-seated causes.

Any of these anomalies depicts the variation in the rock type and then deposition type present therein for the magnetism of near surface rocks adds to the main magnetic field generated in the core.

A positive magnetic anomaly is a reading of magnetic field strength that are higher than their normal regional average.

Fig 1.0 below shows three geologic situations that can cause positive magnetic anomalies.

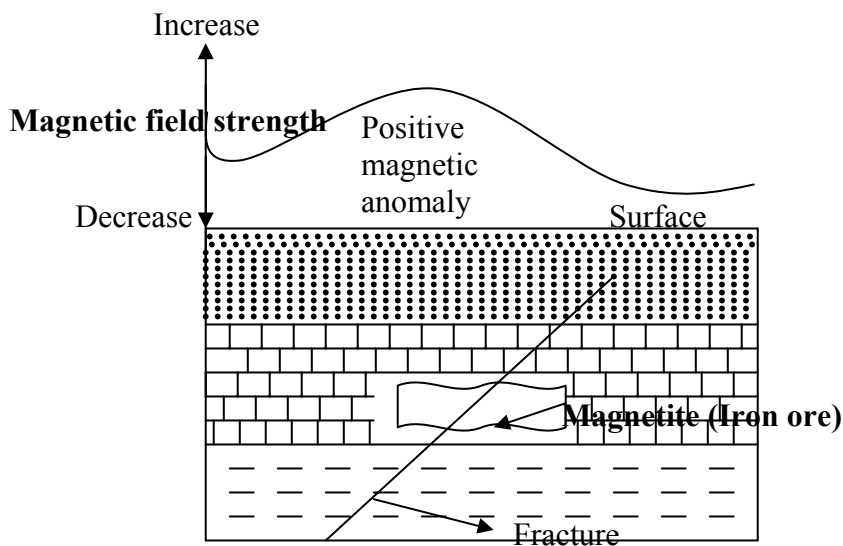


Fig. 3.0 .A strongly magnetic minerals

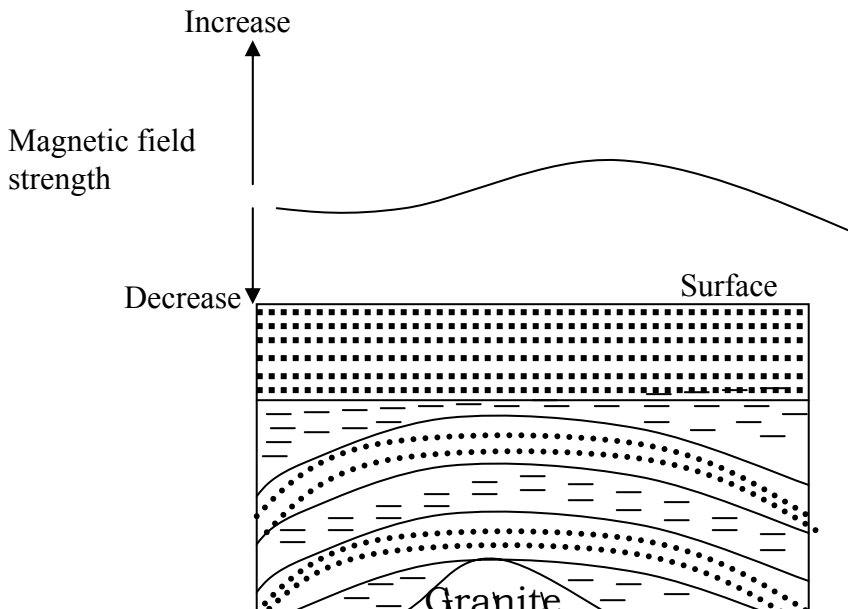
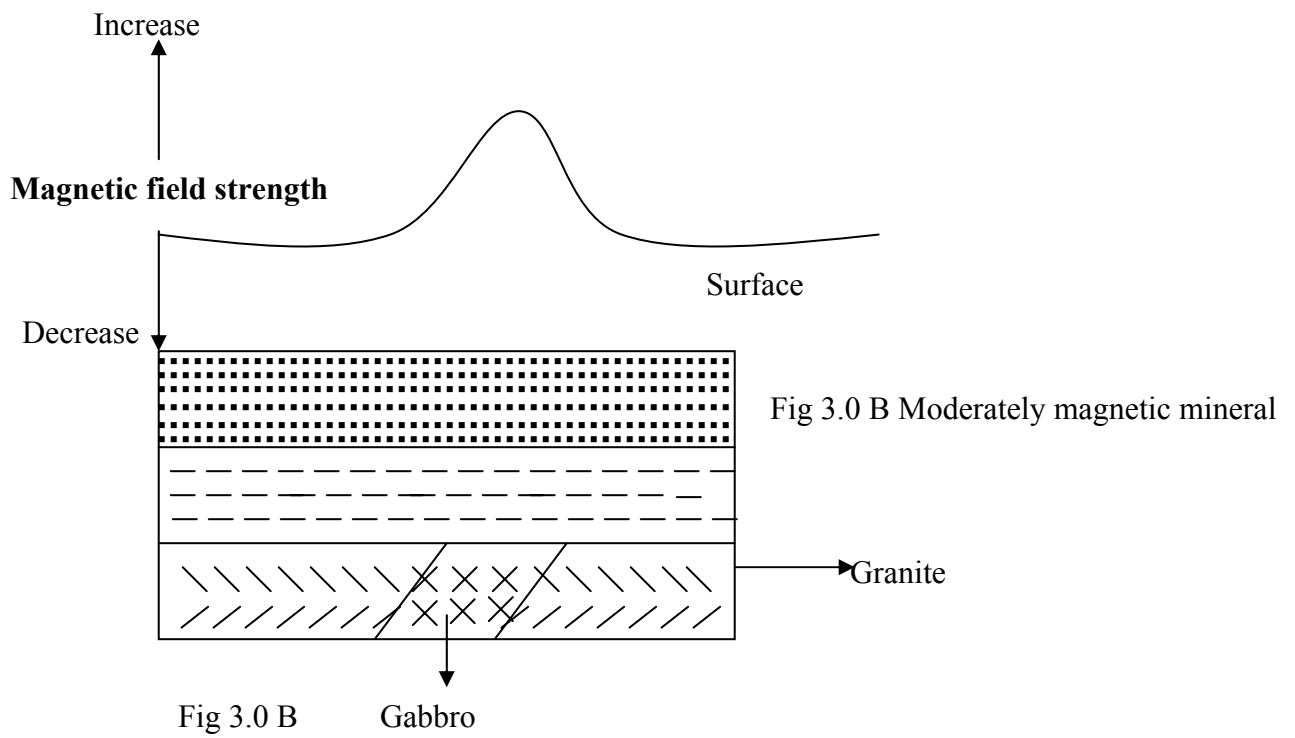


Fig 3.0 C weakly magnetic mineral

In figure 3.0A, a body of magnetite ore (a highly magnetic ore of the metal iron) has been emplaced in a bed of limestone by hot-solutions rising along a fracture.

In figure 3.0B, a dike of gabbro has intruded into granite basement rocks. Because gabbro contains more ferromagnesian minerals than granite, gabbro is more magnetic and causes a positive magnetic anomaly.

Figure 3.0C, gives a granite basement high that has influenced later sediment deposits, causing a hilltop compacted less than thicker sediments to the sides. Most petroleum traps are found in structures such as these. The granite in the hill contains more iron in its ferromagnesian minerals than the surrounding sedimentary rocks, so a small positive magnetic anomaly occurs where the granite is closer to the surface

4.0 OIL AND GAS TRAPS

One of the conditions that favour the accumulation and retention of petroleum is the “Anticinal trap” formed from the process of positive magnetic anomaly such as that in figure 1.0C above in a given province. Anticlinal traps are one of the best structures that hold oil.

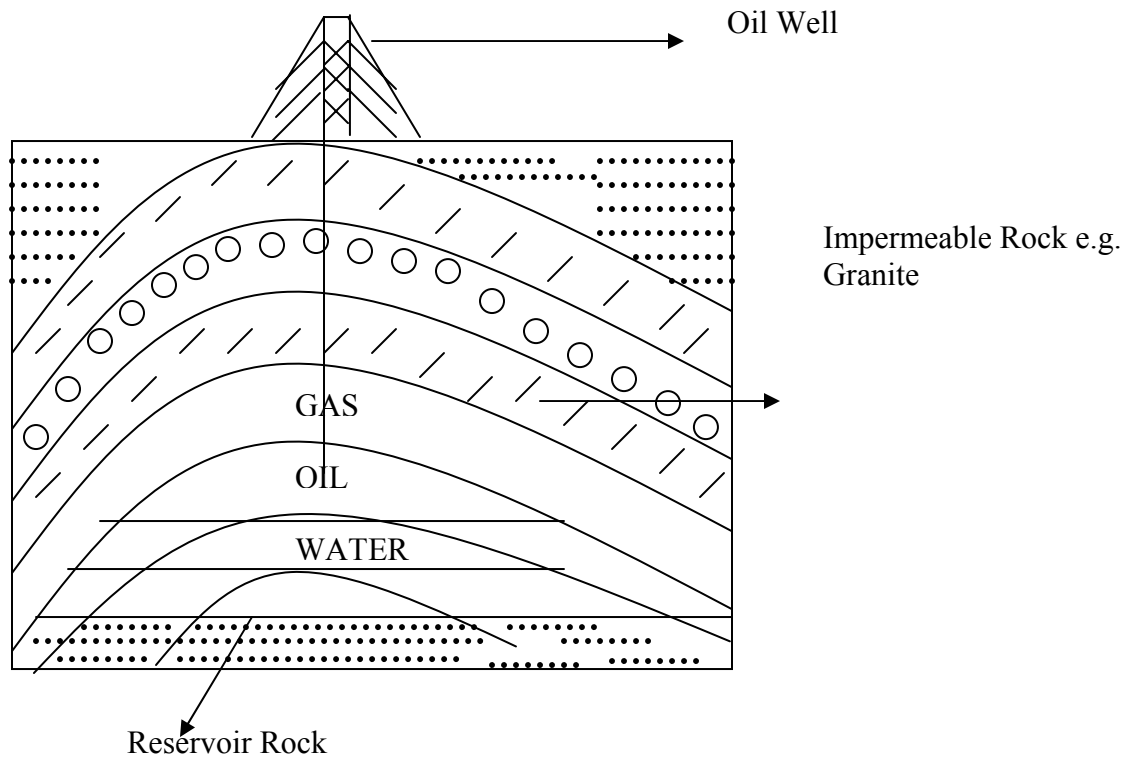


Fig. 4.0.

Figure 2.0 explains the principle behind the entrapment of oil and gas in a formation because of the presence of an anomaly that is positive, showing the presence of granite in the rock that makes its magnetic to be fairly upwards to the near

surface.

This anomaly leads to the formation of the sedimentary deposits on the sides of the Anticline, which also eventually leads to the accumulation of oil and gas.

Geophysics discovered these by looking for the indication of anticline exposed at the surface and beneath with magnetometer instrument.

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