APPLICATION OF MAGNETICS

Our world is magnetic; because of this natural fact, various application of magnetics become explorable to earth scientists.

The origin of this magnetics has been explained by scientists but the most prominent ones are spherical harmonic analysis of the observed magnetic field. This claim shows that over 99% of its source is due to sources inside the earth. Present theory is that the main field is caused by convection currents of conducting material circulating in the liquid outer core which extends from depth of (2,800 – 5,000km). The earth cores assumed to be a mixture of iron and Nickel, both good electric conductors. The magnetic source is thought to be a self excited dynamo in which highly conductive fluid moves in a complex manner caused by convection.

Magnetic methods of exploration has been proved very resourceful in the demarcation of drillable and non – drillable area; location of shallow features capable of trapping hydrocarbon and for mapping of buried structures.

These applications are possible as a result of the presence of magnetic minerals in rocks especially magnetite which is a useful property for magnetic Anomaly. This is the idea behind magnetic exploration.

Mapping of geological features is sometimes possible to delineate the major structural features because the succession includes magnetic horizons. These may be ferruginous sandstones or shales, tuffs or possibly lava flows. In such circumstances, anticlines produce positive and syncline negative anomalies. Faults and dykes are indicated on isomagnetic maps by linear belts of somewhat sharp gradient or metamorphic basement rock which underlies the sedimentary sequence and are the predominant influence controlling the pattern of anomalies since they are usually for more magnetic than the sediments above.

Another application of magnetics is the areas of survey. Magnetic method is best suited to locating bodies of magnetic ores such as iron or chromium. This is because the magnetic susceptibility (k) of Basement and Metamorphic rocks are quite enormous than those of sedimentary rock. This magnetic susceptibility is a fundamental parameter in magnetic prospecting since the magnetic response of rocks and minerals is determined by the amount of magnetic materials contained in them. The parameter; k is extremely variable and dimensionless in SI unit. Its amplitude depends on grain size and mode of dispersion.

Magnetic field survey requires some field procedures which if not strictly adhered to qualitative data may be impaired and data obtained may be versed in error.

The field procedure is to;

- **Remove all magnetic materials in the vicinity of the survey field; such as belt, wrist watch and other metallic materials etc.**
- **Establish a reference point (base station) and cut traverse when the area is not accessible.**
- **Select station interval based on the known width of the target. The interval must be less than the width of the target. If the width is unknown, an arbitrary station interval is chosen.**
- **Peg along the traverse station interval chosen numbering from beginning to end place instrument (magnetometer at each station interval.**

The data collected are corrected of Diurnal variation.

Diurnal variation is the correction applied to correct temporal measured on field. The magnitude of diurnal variation of the earth magnetic field can be up to about 30nt so efforts are made to reduce the magnetometer reading for this variable

The variable is usually carried out by taking repeated reading at the base station at specific time interval. The variation is calculated using the relationship.

$$yc = \frac{y_1 - yf}{tc - tf} \text{ (dimensionless unit)}$$

When y_1 = reading at base station 1 at time t1

yf = reading at base station 1 at time

If Diurnal variation is positive, the correction is subtracted from magnetometer reading and when it is negative, the correction is added to magnetometer reading.

Magnetic logging is another application of magnetics in determing magnetic field intensity in borehole and magnetic susceptibility of rocks surrounding hole. This method is used to study rock lithology and correlation especially in igneous rocks.

Magnetics is not only limited to exploration but also applicable in the field of medicine.

This is referred to as magnetic therapy. The application of magnetic field to an injured area helps to restore the normal electromagnetic balance. The magnetic field relaxes capillary walls as well as surrounding muscle and connective tissues; thus allowing for increased blood flow, more oxygen and nutrients which are transferred to the injury site while pains and inflammatory related electro chemicals are more efficiently removed.

Clinical studies in the U.S. have shown magnetic therapy to be an effective method for relieving pain and discomfort.

Magnetic containment: the quest for sustainable energy source has been a major problem of the world. Efforts are constantly made to get dependable cleaner energy other than the environmental downgrading fossil fuels.

Scientists have proved that nuclear fusion reactor can be operated to generate power from deuterium and tritium as fuel.

The only fear in this is that plasma must not be allowed to come into containment vessel causing energy loss.

The only apparent solution which proves satisfactory is the application of magnetic field. If a magnetic field can be formed which is closed on itself in all directions, then charged particles will always be deflected when try to move radially outwards and will be able to escape if the field is not strong enough.

Recent work in Electro- magnetics method of exploration now is the "application of controlled source Electro-magnetics" (CSEM) in exploration Appraisal and Development Project.

Higher frequency Sources EM are now being used around the world to help evaluate the fluid content of reservoirs, define reservoir extent quality.

The first (SEM was carried out in West Africa some years back and there after about seventy–five surveys have been carried out around the world; many of them for appraisal and development.

CSEM has possesses a stand-out advantage of distinguishing between low saturation, low resistivity reservoirs and thick high resistivity, high saturation reservoir which are more likely to be indicating economic sized hydrocarbon accumulate.

Conclusively, because our world is magnetic, the application of magnetics is yet to be exhausted. Further research in magnetic application in presents and nearest future promises to give this method of geophysical exploration a boost a head of others.

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