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GLOBAL GROUNDWATER SHORTAGE
AND
THE BIOPHYSICAL METHOD

by

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GLOBAL GROUNDWATER SHORTAGE AND THE BIOPHYSICAL METHOD

ONE THIRD OF THE WORLD'S POPULATION HAS NO ACCESS TO RELIABLE DRINKING WATER

THEREFORE:

there is a desperate need to tap the world's available shallow, but small scale, groundwater resources for rural development. In view of the magnitude of the problem, the conventional exploration methods (geophysics and exploration drilling) cannot cope with it neither effectively nor economically. The biophysical method however could provide a low cost and effective technique for the exploration of these small scale occurrences. The advantage of the biophysical method is, apart from its extremely low cost, that it can draw from local experience available. Namely most countries today still have surprisingly large numbers of water dowsers. A close cooperation between hydrologists and local dowsers should be fostered to make controlled use of this valuable human experience. Moreover the technique being simple, and based upon a natural neurophysiological function of man's biosystem, can be easily learned by most people. In this way newly taught dowsers could become very useful in reconnaissance level exploration for shallow groundwater.

The biophysical method is versatile and has large range of applicability in various geological settings. Because it can be applied on different exploration levels, the method can be easily integrated in a conventional hydrogeological exploration survey. This might improve the effectiveness of the latter, but also permits a reduction in expensive exploration techniques like drilling, trenching and geophysics.

THEREFORE:

THE USEFULNESS OF THE BIOPHYSICAL METHOD AS A LOW COST COMPLEMENTARY TOOL IN THE EXPLORATION FOR SHALLOW GROUNDWATER DESERVES SERIOUS CONSIDERATION.

C. D. H. A. E.

THE BIOPHYSICAL METHOD

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THE BIOPHYSICAL METHOD

A rapid, LOW COST investigation of groundwater systems, using human sensory perception.

THE BIOPHYSICAL SURVEY

is a continuous recording profiling technique and can be carried out on foot, by car and from the air.

HYDROGEOLOGICAL TARGETS:

- . buried river channels
- . buried permeable gravel and sand lenses in alluvium
- . concealed faults and fracture zones
- . concealed dikes
- . karst cavities in limestone
- . direction of groundwater movement

ADVANTAGES:

- . low cost and easy operation
- . simple and inexpensive equipment
- . multi-platform operatable - continuous recording
- . versatile - resolution unaffected by E.M. shielding
- . operators can be trained easily

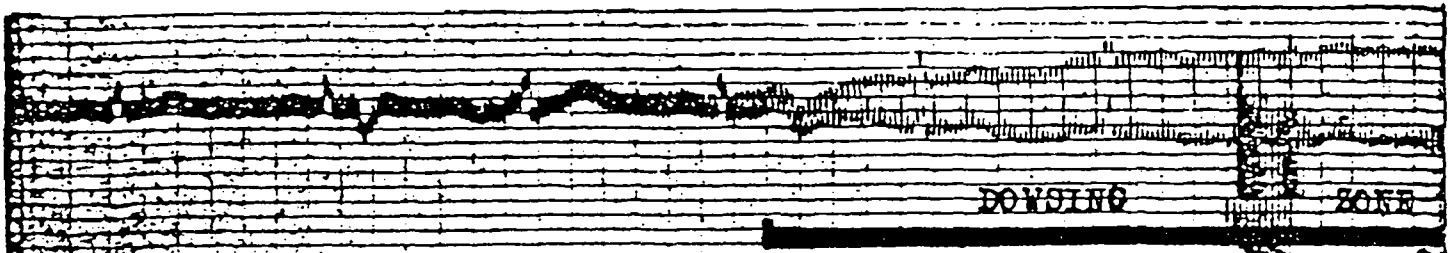
THE BIOPHYSICAL EFFECT OR DOWSING REACTION

is a natural reaction of the human nervous system to small perturbations of the geophysical field, related to geological discontinuities, that may contain groundwater or ore. (Tromp, Sochevanov, Matveyev, Ogil'vi, Chadwick, Jenson, Barnothy, Presman et al.)

THE BIOPHYSICAL EFFECT is measurable by variations in:

- . Electro-Cardiogram (E.C.G.)
- . Electro-Encephalogram (E.E.G)
- . Electrical Skin Resistance
- . Muscle Tone Reflex (M.T.R.)

Example: A typical E.C.G.



Humming effect occurring in the E.C.G. of a dowser passing from outside a dowsing zone into the centre of the zone.

THE MUSCLE TONE REFLEX

is the specific contractions of the forearm muscles due to a subconscious stimulation of the autonomous nervous system, which is caused by small perturbations in the local geophysical field.

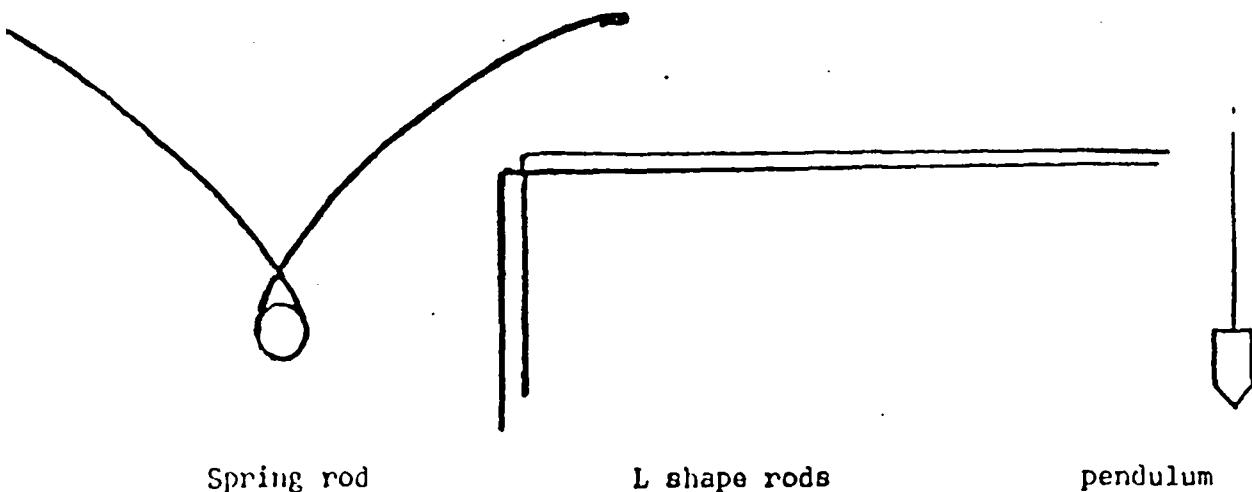
THE DOWSING TECHNIQUE

in order to make these slight and imperceptible muscle contractions visible, a "dowsing rod" which merely functions as a simple mechanical amplifier, is held in both hands under slight muscular tension. The changes in Muscle Tone Reflex are recorded by movement of the dowsing rod in dynamic equilibrium with the changing muscular tension. The deflection of the dowsing rod therefore indicates indirectly the geological discontinuities that may contain groundwater or ore.

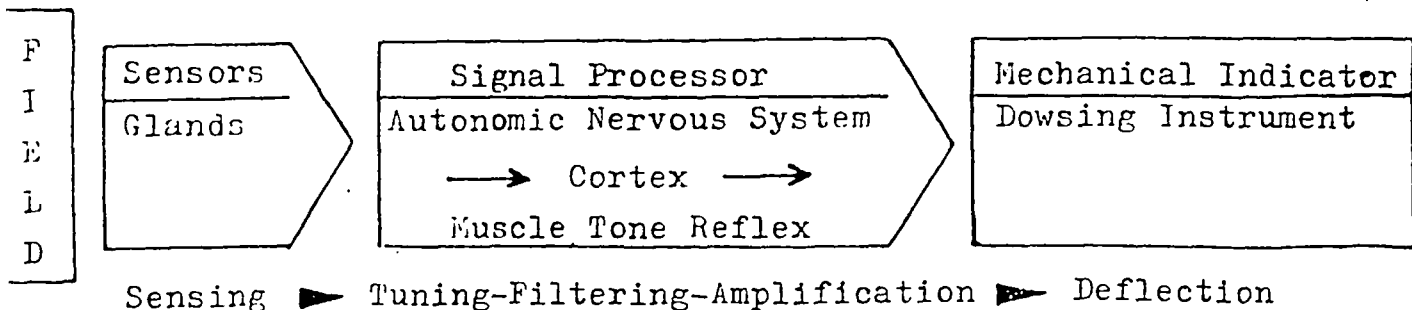
THE BIOPHYSICAL PROSPECTING EQUIPMENT

are inexpensive, simple in design, lightweight and easy to operate.

high gain mechanical amplifiers



THE BIOPHYSICAL MEASURING SYSTEM



C. J. A. E.

PRESENT DEVELOPMENT OF THE
BIOPHYSICAL METHOD APPLIED TO
GEOEXPLORATION

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Introduction

Present investigations into dowsing, the ancient art of locating water, minerals and other objects, have developed it into a new branch of applied science with particular relevance to water and mineral exploration. Much of the recent work has been done in the Soviet Union where dowsing is carried out in conjunction with geological and geophysical exploration surveys and has been called the biophysical method (B.P.M.) or biophysical effect (B.P.E.). Biophysics itself is the application of physics to biology and is a rapidly developing branch of the biological sciences. The influences of the fields of forces (electrical, magnetic, etc) on bio-systems may now be relevant to the earth sciences as well, in the form of scientifically controlled dowsing.

The equipment and field technique are both simple. The operator holds a dowsing rod in his hands and moves systematically over the area to be investigated. The ground location and sometimes also the intensity of the operator's reaction are noted in much the same way as with a conventional continuous recording geophysical profiling survey. The commonest type of dowsing rod is a simple and inexpensive wire construction, which is held in such a way that very slight contractions of the forearm muscles cause the rod to move in dynamic equilibrium with the muscular tension. Hence the dowsing rod acts merely as a high gain mechanical amplifier to make these otherwise imperceptible muscle contractions perceptible. These muscle contractions are due to sub-conscious stimulations of the autonomic nervous system, which in turn, can be shown to be caused by small perturbations in the local geophysical field. The human body serves as an electrical conductor and as it moves through the earth's field small electric potentials are generated in the system. Since it is a geophysical field which is registered by the human biosystem, the system can be used to obtain information on geological discontinuities which may hold water or indicate mineral potential. The biophysical method is in principle a geophysical method.

Validation of the Method

Elaborately controlled but little known investigations were carried out by the Dutch geologist, S.W. Tromp, who obtained a large volume of data over a period of 25 years. Tromp measured the changes in electrical skin resistance and recorded electrocardiograms of professional dowsers as they traversed various test areas, both indoors and in the field. He repeatedly demonstrated significant correlations of the dowsing reaction, which he termed the Muscle Tone Reflex (M.T.R.), with small changes of magnetic gradient (both artificial and natural) and also with zones of low soil electrical resistivity. He showed the correlation of the biophysical effect with physiological functions normally controlled by the autonomic nervous system, as for example, in characteristic electrocardiogram patterns. A summary of this work is given in Tromp, 1972. G. Blundell and M. Cade (pers. comm.) have more recently shown typical electroencephalograph alpha wave patterns in dowsers.

In 1971, D.G. Chadwick and L. Jensen of the Utah Water Research Laboratory, Utah State University, published the results of a study of the statistical distribution of the biophysical effect among people. They tested 150 novice dowsers over an area which was later surveyed in detail by magnetometry. They showed that 99% of the subjects obtained the dowsing reaction and over four trials of each subject there were significant correlations at the 95% confidence level between trials and small magnetic anomalies.

This work and others like it indicates that the biophysical effect is a natural neurophysiological reaction which occurs in most human beings.

The Search for a Mechanism

A.N. Ogil'vi (1962), S. Tromp (1958), D.G. Chadwick, L. Jensen (1971), A. Hopwood (1979) and others suggest that the human nervous system is sensitive to magnetic and/or electromagnetic fields. Z.V. Harvalik (1970) has proposed, on the basis of experimental evidence, that the sensors are located in the adrenal, pituitary and pineal glands and form a 3-dimensional pattern recognition facility. It is interesting to note that the function

of the pineal gland is not yet fully understood, but it is known to be an ancient structure in vertebrate evolution and its homologue in birds and amphibians is at least light sensitive. Tromp (1972) suggested that infrared thermal radiation causing minor disturbances of hypothalamic thermo-regulation mechanism may be involved. The situation may be yet more complex. The author has obtained valid dowsing reactions in both moving land vehicles and aircraft although one would expect that the vehicle frames would act as a Faraday cage which should mask electromagnetic radiations in frequencies normally detectable to conventional instruments.

Development of modern physics, especially the relativity theory and quantum mechanics, has led to a revolution in the concept of physical reality. According to H. Nieper (1972), J.M.J. Kooy (1979) and others a sub-atomic particle field, (the so-called graviton field) interacts with living systems. Such an all-penetrating field could very well be the carrier of biophysical information.

Application of the Biophysical Method

In Eastern European countries the biophysical method has been adopted for more than a decade by geologists and hydrogeologists as an inexpensive and versatile complementary tool in geoexploration. The method is now used in conjunction with traditional methods such as photogeology, geophysics and geochemistry. The B.P.M. has attracted great interest among Soviet geologists in particular. Conferences on the subject were held in Moscow in 1968 and 1971. The last attended by over 100 scientists from 40 research establishments. (T. Williamson, 1979).

T. Williamson (1979), discusses the work of the Russian geoscientists N.N. Sochevanov, V.S. Matveyev and others (1974) who used the biophysical method in conjunction with gravity, magnetic, self potential and electrical resistivity surveys. They claim that the biophysical results correlate better with the geology, as subsequently revealed by exploration drilling, than did the results of the conventional geophysical surveys. Therefore the B.P.M. could play a useful part in complementing exploration geophysical data.

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Sochevanov and his colleagues have listed many cases of application of the B.P.M. including successful water well siting and work in engineering geology. Statistics published in the USSR indicate that the success rate of productive water well location using the B.P. method at least matches and occasionally surpasses that achieved by geophysical methods in the same area.

Investigations in Saudi Arabia and the Netherlands

The author, a professional geophysicist has empirically investigated the applicability of the biophysical method in Saudi Arabia and the Netherlands in a systematic way over the past 3 years.

During the field experiments the effectiveness of the B.P.M. in locating sub-cropping and concealed geological features became apparent. Among these features were faults, dikes, buried river channels, buried gravel and sand lenses in alluvium, contacts between lithologic units, gossans, mineralized zones, and also cavities. The surveys were not only carried out on foot but also from moving land vehicles and aircraft showing the same effectiveness. Many different B.P. operators tested were able to produce identical and repeatable results. A high percentage of people could be immediately used as biophysical operators.

The experiments have been carried out in cooperation with: the Netherlands Organization for Applied Scientific Research (T.N.O.); Bureau de Recherches Geologique et Minieres (B.R.G.M.)-. United States Geological Survey (U.S.G.S.)-. and Riofinex Limited geological missions in Saudi Arabia; Shell Minerals Exploration; Arabian Shield Development Co.; Deputy Ministry for Mineral Resources and Ministry for Agriculture & Water of Saudi Arabia; King Abdul Azziz University; etc. Further valuable experience has been made during assignments on groundwater investigations for the Ministry of Defence & Civil Aviation of Saudi Arabia and the Netherlands Airport Consultants using specifically the biophysical method. Numerous sitings of well locations for drilling companies as well as for individuals were carried out during the last three years. This work was followed up by test drilling, which offered unique opportunities to test the method.

In the course of the above mentioned groundwater exploration activities, an advanced degree of sophistication was developed by the author in applying the method in different geological settings. Therefore it is now possible to report that today in Saudi Arabia geoexploration with the aid of the biophysical method is passing from the experimental stage into fully fledged application.

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