THE DOWSING REACTION ORIGINATES FROM PIEZOELECTRIC EFFECT IN BONE

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Presented at the 6th International Svedala
Symposium on Ecological Design

May 19-21, 1988
Svedala, Sweden

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1 INTRODUCTION

The divining rod is used for prospecting water or ores. The use of the rod is called dowsing. The rod can be made of a Y-shaped or L-shaped metal or plastic wire but usually a Y-shaped wooden twig is used. Some dowsers use a pendulum, which is said to be more sensitive. A few dowsers work without any rod.

When dowsing the dowser walks with the rod in his hands, not too slowly, usually in lines over the investigated area. Y-shaped rods bend vertically and L-shaped wires move in a horizontal plane. The experienced dowser can tell if the rod movement, the dowsing reaction, indicates water or something else.

Knowledge of dowsing is very old. In the Bible Moses finds water with a stick. I would not say that he was dowsing but writings from the 16th century certainly tell about dowsing.

Figure 1 shows one of the first pictures of dowsers working with ore prospecting. A wood-cut after Georg Agricola in De re Metallica (1556)

Many attempts have been made to explain and verify the dowsing reaction. Agricola (1556) mentions dowsing as a way of ore prospecting. Agricola established that the dowsing reaction is caused by the dowser. The involuntary reaction of the dowser is magnified by the rod. Today, this is the general idea of how the rod works. Dowsing was probably not used in Scandinavia at this time since it is not mentioned by Magnus (1555).

Barret (1926) gives a broad insight into dowsing research where old and new findings are included. During the 18th century many studies were made. The French Academy of Sciences tested dowsers and especially one man Bleton who was an extremely gifted dowser. Linné studied the divining rod in Sweden during this time. In the beginning of our century there were professional dowsers and well diggers in England. No water no charge according to Barret.

2 MODERN RESEARCH

Ekström (1932), professor at the Swedish Geological Surveys suggested that the reaction of the diving rod is caused by slight muscle movements in the hands. Tromp (1949), professor in Geology at Cairo University, made laboratory tests on dowsing using alternating magnetic fields. His tests were followed by many. Rocard (1969) showed that the rod responds to electromagnetic fields. The dowsing reaction occurs at individually different magnitudes of the magnetic field. Rocard also showed that the dowsing reaction cannot depend on induced currents.

Tromp and Rocard inspired others and several tests have been done in magnetically isolated rooms. Alternating electromagnetic fields operated by random signal generators are used. The dowsers are to locate the magnetic field source. Usually, in field tests, 10-20% can operate the rod but in these tests 80-99% of the dowsers were successful. The difference between field tests and laboratory tests are supposed to depend on the extreme conditions of the laboratory environment.

Tests carried out in the laboratory show that the dowsing reaction occurs in electromagnetic fields. However, Engh (1982) reports about a field test in which the dowsing reactions could not be correlated to magnetic anomalies. One explanation is that it could be a matter of frequency rather than amplitude of the magnetic field. Engh also reports that dowsing reactions occurred when the dowsers walked over a hidden permanent magnet.

A Rumanian researcher, A Apostol, gave a lecture on dowsing at Luleå University of Technology. He suggested that the dowsing reaction originates from mechanical stress concentrations underground. Stress concentrations occur in fractures and fissures and since such underground openings in most cases are water conducting the rod can indirectly indicate water. In a field test, at Kallax moor where the bedrock is covered with 30 m of sand, he demonstrated his skill with the wooden twig by detecting fracture zones in the bedrock. He could also tell the direction of the fracture zones. His results were found to be remarkably good compared to geophysical measurements carried out before his visit.

3 REFLECTIONS BY THE AUTHOR

In literature on the divining rod I have found that different countries have different approaches to dowsing. In Finland there are reports on how trees and animals react at spots where the rod responds (Peltonen, 1978). Fruit trees get on poorly at such spots. A number of animals are attracted while others dislike such areas. Ants always build their hills on a cross-point, a spot where two or more dowsing lines meet. The ant tracks follow the dowsing lines.

From Swedish folk tales and literature, dowsing has many links with the disease of rheumatism. Dry, sunny weather is favourable for successful dowsing and also for relief of rheumatic pains. It is also a well known fact that if you frequently sleep over places where the rod reacts, you do not sleep well and get rheumatic like pains. Dowsers are now and then asked to detect "bad spots" in rooms where people sleep. A few dowsers are able to neutralize the bad spots by some kind of "earthing". In Switzerland such spots are neutralized by placing a certain kind of quartz crystal on the spot.

It Sweden it is also quit common to ease rheumatic pains by beestings. On the west coast of Sweden people ease the pains by the stings of jellyfish and in other places they use stinging nettles for the same reason. It is said that these treatments ease the pains for a couple of weeks. Medical research has accepted the fact that a bee sting can ease rheumatic pains. They have even tried to imitate the poison of bees to make a pain-relieving medicine.

In my opinion it is not the poison of the bee, jellyfish or stinging nettle that is the secret. It is the stinging needles themselves that result in the ease of pain. The needles of the stinging nettle and the jellyfish are of pure quartz. The sting of a bee is not made of quartz but of a substance which is found in the shells of all insects. There have recently been articles in Swedish papers about ant juice which is a very old Chinese medical treatment for rheumatism. It is reasonable to assume that the shells of insects are piezoelectric since the skeleton of animals (including man) is. The piezoelectric qualities of bone organize the bone building process in animals and probably in insects too. Thus the common quality of the bee, the jellyfish and the stinging nettle is the piezoelectric property of their stinging needles.

A piezoelectric material "consumes" electromagnetic energy by transforming it into mechanical energy. The idea is that the field which is causing rheumatic pains is consumed by piezoelectric needles in the skin. Thus, the Swiss quartz crystal consumes the field which causes the dowsing reaction and consequently it does not reach the piezoelectric skeleton. If underground stress concentrations are the origins of the dowsing field this could be a result of varying stress in a bedrock which has piezoelectric qualities. Japanese reports on flashes of lightning, from a blue sky, before earthquakes could be of the same origin.

4 PRINCIPLE OF DOWSING REACTION

The general idea of the function of the divining rod can be described by the principle outline in Figure. 2. A transmitter is located underground. The body of the dowser is the receiver. The received signals result in slight involuntary muscle movements, which are magnified by the divining rod.

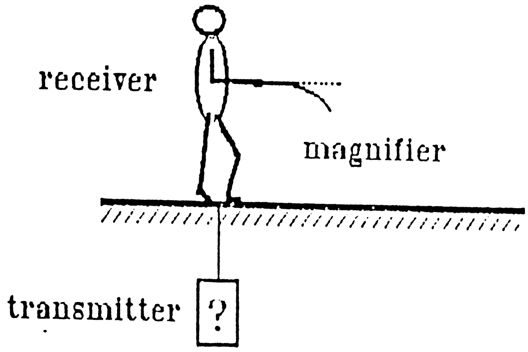

Figure 2. The principle of the dowsing reaction.

4.1 Transmitter

The underground transmitter is unknown today. However, it is a fact that dowsing reactions occur in electromagnetic fields. The dowsers also react to permanent magnetic fields. The explanation could be a matter of change rather than magnitude of the electro-magnetic field. Thus, in the case of the permanent field only a moving dowser would be able to detect the field. The dowsing reactions are not always correlated to magnetic anomalies. We have to consider that we do not know if electromagnetic fields are directly or indirectly causing the dowsing reaction. It could be some other field which is depending on the electromagnetic field.

4.2 Receiver

Where is the receiver in the body? My suggestion is that the skeleton and especially the bone of the forearms work as receivers of magnetic and electromagnetic field changes. This idea is based on the piezoelectric qualities of bone which could result in involuntary muscle movements which cause the dowsing reflex. Piezoelectricity and its connection to the dowsing reaction is discussed in detail later in this paper.

4.3 Magnifier

The received signals are magnified by the rod itself. What kind of muscle movement is bending the Y-shaped rod vertically? Grip a Y-rod professionally; hold firmly, upper arms vertical, forearms horizontal and the palms facing upwards. It is not possible to bend the rod by turning the wrist in the rod movement direction. However, the rod bends strongly if the forearms are slightly turned perpendicular to the rod movement as shown if Figure 3. A small turn in the direction where the palms are facing each other means that the rod is bending down. A turn in the opposite direction means that the rod is bending upwards.

The L-shaped rod must be held loosely if special handles are not used. The arms are held as for the Y-rod but the hands are held with the palms facing each other. The fingers are closed around the short part of the L-wires. The dowsing reaction, the horizontal movement of the L-shaped wires, is caused by a slight turn of the forearm inwards or outwards as shown in Figure 3.

The conclusion is that the dowsing reaction is caused by slight wrist turning movements perpendicular to the rod-movement-plane both for the Y-rod and for the L-shaped rod. The involuntary muscle movements involved are electrically or mechanically influenced by piezoelectricity or piezoelectric effect.

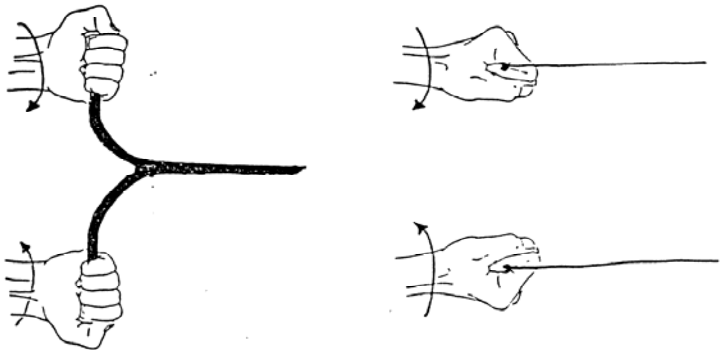

Figure 3. The dowsing reaction is caused by a wrist turning movement which make the Y-rod bend vertically and the L-shaped rod to move horizontally.

5 PIEZOELECTRICITY

Piezoelectricity is the amount of electricity, created when certain crystals are subjected to compression or tension. The direction of the electric current under compression is opposite to the direction of the current under tension. The piezoelectric effect is the volume change of a crystal, subjected to electromagnetic fields or currents. Alternating fields result in dependent volume changes. If the frequency corresponds to the natural frequency of the crystal, resonance occurs and the amplitude becomes considerably larger. The crystal frequency can reach 1 MHz. The piezoelectric current is proportional to the deformation of the crystal. Quartz is one example of a piezoelectric crystal. Bone is another piezoelectric material. The piezoelectricity of bone is further explained in Figure 4.

5.1 Piezoelectricity in bone

Fukada and Yusuda (1957) discovered that "dry bone" has piezoelectric qualities. Continued research showed that "wet bone" and bone "in vivo" are also piezoelectric. This discovery resulted in treatment methods for electrically induced healing of bone. A considerable list of references is given in Herbst (1983).

5.2 Piezoelectricity causes dowsing reaction

The piezoelectric properties of bone in the forearm could be the reason for involuntary muscle movements which cause the dowsing reaction. This could be explained both mechanically and electrically.

In a relaxed arm an electromagnetic field change causes nothing but a small imperceptible volume change of the bone. In the strongly loaded arm of a dowser the piezoelectric effect causes both mechanical stress and electric voltage.

When holding a divining rod the muscles of the forearm are tensed resulting in mechanical stress in the bone. In an electromagnetic field the volume (length) of the bone is changing resulting in a changing mechanical stress. The dowser is trying to hold the rod at constant force. This is not possible without changing the muscle force since the length of the forearm bone is changing. Varying stress of the bone means piezoelectric generation. The mechanism that results in the wrist turning movement could be caused by muscle changes which occur when the dowser is trying to hold the rod at constant stress.

Another possible explanation is that the generated piezoelectricity directly influences the nerves which are operating these muscles. If the electromagnetic signals are alternating the reaction of the bone is also alternating at the same frequency. Consequently, this should entail quivering of the forearm muscles which is many times reported by dowsers.

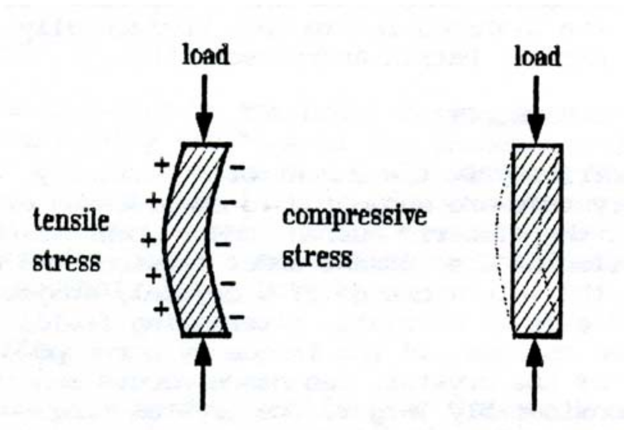

Figure 4. Bone subjected to a mechanical load generates an electric potential between the compressed and the stretched side of the bone (left). As a consequence of the electric potential bone is deformed on the compressed side resulting in an optimized stress load of the bone (right). After Herbst (1982).

6 PRELIMINARY LABORATORY TESTS

The "forearm" bones of pigs were used in the laboratory tests. At the beginning strain measurements were made to confirm that length changes occur in a bone which is subjected to electromagnetic fields. Strain gauges were used but they were too sensitive. The strain gauge detected the length change of the bone caused by heat radiation, so this way of studying the piezoelectric effect was abandoned.

Voltage measurements were much easier to carry out. The first attempts were made on bone subjected to bending. A simple volt meter was used to measure the generated voltage. In the next tests the ends of the bone were grouted in gypsum so that the bone could be placed in a standing position for vertical loads. Two pins were nailed into each side of the bone to get contact pins for the voltage measurements as shown in Figure 5.

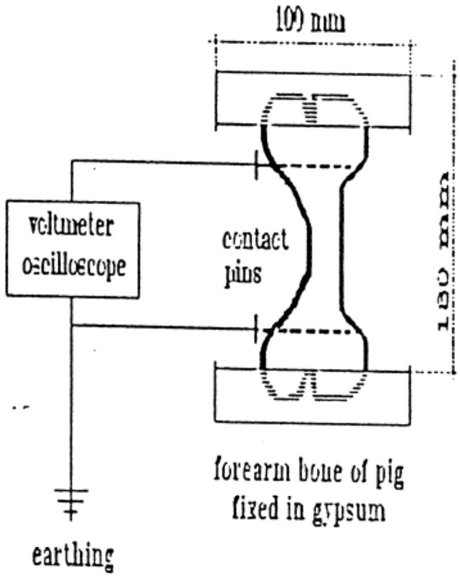

Figure 5. Both ends of the test bone were grouted in gypsum so that the bone could be placed in a standing position for vertical loads.

The first tests were done by frequent knockings, using the fist, on top of the bone. The response was read on the volt meter. At first the voltage was low but after a while the voltage increased and became stable. The voltage also increased with knocking frequency. More powerful knocks also resulted in an increased voltage. The fresh bone started to smell sour which meant that the bone had to be kept outdoors. In that way it was noticed that frozen bone (-20 C) does not give any response.

To get a better understanding of the obtained voltage the volt meter was replaced by an oscilloscope with a memory. This made it possible to keep the graph of the voltage curve. By earthing one of the contact pins of the bone it was possible to use the best resolution (1 mV/cm of the screen) of the oscilloscope.

The knocking test was repeated and a typical voltage graph can be seen in Figure 6. The voltage is on the vertical axis and time is on the horizontal axis. A voltage of 5 V can easily be obtained. The graph shows that the voltage is increasing faster than it is damped. The maximum positive voltage is higher than the maximum negative voltage. The area of the negative voltage graph is equal to the area of the positive graph which is the expected behaviour of a damped wave.

The negative part of the graph indicates that the mechanical pulse which creates the piezoelectricity is reflected when reaching the end of the bone. In some of the tests the graph shows that the pulse is reflected two and three times before it is damped.

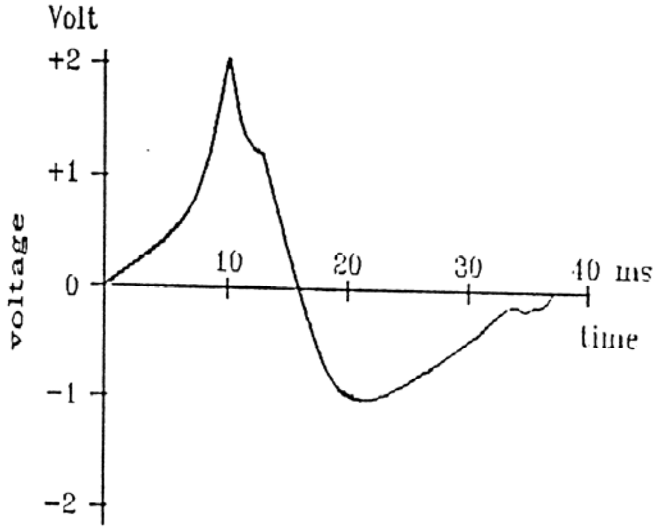

Figure 6. Typical graph of the voltage curve obtained by frequent knockings (using the fist) on top of the test bone.

The preliminary tests were made to give ideas of how to make proper tests on the piezoelectricity of bone. Thus a lot of tests were made to find out what the bone reacts to.

The bone reacts to light from a television. The bone was standing on a chair 0.5 m from the screen. The light of the TV was darkened as much as possible and suddenly the light was turned to its maximum. The bone reacted immediately in an increased voltage between the pins.

An electric cable, to a lamp, was placed on top of the test bone. The resolution of the oscilloscope was 1 mV/cm. Initially the cable was not conducting electricity and the oscilloscope showed the background voltage field of the room. When switching on the light the amplitude of the voltage curve increased to three times its initial value. When repeating this test by placing the cable under the test bone the resulting amplitude of the voltage curve was decreased by 1/3 of its initial value. This implies that the bone can detect the direction of the current.

The bone was placed on the floor under a fluorescent tube located on the ceiling. When switching on the light no voltage change is observed but when switching it off the oscilloscope shows a fast voltage peak. An electric bulb gives no voltage change.

The test bone can also detect the electric field change when a person is moving about in a room. Fast movements result in larger amplitudes and if the movement is really slow a person can come very close to the bone before a response is detected on the oscilloscope. Movements close to the test bone mean larger response. By moving the hand quickly towards the test bone a strong positive voltage is obtained. Slower movements give lower voltage. By removing the hand quickly the obtained voltage is negative.

7 CONLUSIONS

As a result of modern dowsing research I strongly believe that there is no doubt that the dowsing reaction is a physical reality. This does not mean that research has proved that the divining rod reacts to flowing groundwater but it is a fact that dowsing reactions occur under certain conditions.

To summarize the preliminary tests I would say that the bone is responding to electromagnetic fields as expected. The reaction is directly or indirectly a result of an electromagnetic field. Indirectly means something unknown which depends on the electromagnetic field.

The test bone reacts to changes rather than to the amplitude of the electromagnetic field. In the magnetic field of a permanent magnet the changes occur when the dowser moves in the field.

The tests done show that bone gives a voltage response to repeated mechanical loads. A voltage of 5 V can easily be obtained by frequent knockings on top of the test bone. The electric qualities of bone are not only piezoelectric since the voltage is increasing up to a certain limit as a response to repeated knocks. A constant load gives no voltage increase between the pins of the bone. A frozen bone gives no voltage response.

The test bone reacts to TV radiation and fluorescent tubes. An ordinary lamp gives no reaction.

The test bone has never been tested in a field test because of the problems with the mains operated 220 V oscilloscope.

8 SUGGESTIONS FOR CONTINUED RESEARCH

I would point out that too little attention has been directed towards the piezoelectric qualities of bone in the human body. In the USSR it is considered a health risk to work and to live close to power lines. For this reason they have legal restrictions about the minimum distance between power lines and dwellings. The piezoelectric qualities of bone could be a starting point to understand the genesis of pains, skin complaints and other problems which are reported in connection with fulltime work at computer screens. The electromagnetic field gets weaker with distance but only a magnetic material can act as a barrier for the field. The bones of the skeleton act as receivers of the field and in tensed parts piezoelectricity is generated.

The cause of rheumatism (rheumatic arthritis) is supposed to depend on an unspecified virus. As a medical layman I have read scientific papers on rheumatism and I have found that there are basically two opposite types of rheumatism. Other types are probably stages in between the two. One type results in cavities on the sliding surfaces of joints while the other type results in crystal-like additions of bone mass. A sufferer usually has both types. A symmetrical occurrence is often found. Bone is transported from the excavated part of the joint to another area where bone mass is deposited. In both cases rheumatic pains occur. With a piezoelectric approach to rheumatism this is explained by positive and negative voltage depending on compressive or tensile stresses of the bone. Bone mass is transported to the compressed area.

The orientation of migratory birds is another field of research that could benefit from a piezoelectric approach. It is more or less accepted that their sense of locality depends on the magnetic field of the earth. Efforts have been made to find the receiver of the magnetic field. In some birds magnetic minerals have been found but in most cases not. Assuming that the skeleton of the migratory bird is piezoelectric the explanation is much easier. The wings of a flying bird are subjected to compressive and tensile stresses. The magnetic field is detected by the wing bones and piezoelectricity is generated. The direction of flight should influence the voltage generation.

In continued research we have to make an effort to define clean and clear tests to seek relations between dowsing and the piezoelectric qualities of the skeleton. I believe that it is a good idea to separate the research field into three parts:

1/ transmitter 2/ receiver 3/ magnifier

It is not an easy task to find out the transmitter or the transmitted field. Measurements of small electromagnetic fields are difficult to do and in this case we are not even sure on what we should detect. Mechanical stress concentrations in fractured zones of bedrock could be a clue. A piezoelectric explanation is not excluded if the bedrock contains piezoelectric minerals.

As for the receiver I believe that my ideas, based on the piezoelectric qualities of bone, is a fruitful approach.

In my opinion the divining rod itself is of less importance to explain dowsing. The rod bends for one reason only, a slight turn of the forearm. The transmission of muscle force to the rod is, however, of interest and especially the transmission of electric and/or mechanical energy to the muscles.

Both laboratory tests and field tests are necessary. Finally, it would please me very much if some of my suggestions gave impulses to further studies.

ACKNOWLEDGMENT

I would like to acknowledge the Swedish Association for Water Hygienic and the Institution for Environment and Health Protection at the University of Umeå. They encouraged me to collect my research by inviting me to give a speech on dowsing at their symposium in Umeå, Nordell (1985). I am grateful to Mr. Ulf Bergman who helped me to find and understand relevant literature on rheumatism. I acknowledge the Association for Ecological Design for their invitation to present my ideas at the symposium today.

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