

New geophysics? Or bad geophysics? How to not be fooled.

Geophysics has played an important role in resource exploration for over 100 years. But it has always attracted entrepreneurs unfamiliar or unconcerned with the laws of physics and realities of geology.

Misguided scientists erroneously think they have found ways to bend or ignore scientific principles, and in some cases unscrupulous tricksters are willing to sell a bogus product to an exploration market desperate for competitive advantage.

Geophysics thrives on innovation. New science should be actively encouraged. But many millions of exploration dollars are wasted, and much damage is done to the business of exploration and the reputation of geophysics, by ineffective or bogus techniques. This document was created to give some guidelines to geologists interested in innovative methods, but wary of wasting money conducting useless surveys and drilling holes in the wrong places.

Hallmarks of voodoo geophysics

There are six factors that can be used to analyze a suspect system (adapted from Hodges, 2005¹). The better these factors fit, the more concerned one should be that the geophysics is not valid. No single parameter described below proves that a system should not be trusted, but the more it matches any of these parameters, the more cautious one should be.

Uniqueness and Business History:

Is the system (or systems) based on this principle only available from one source? Why? Geophysics is a competitive industry. If anyone has an effective system based on real physics, it's sure to become competitive.

Exceptional Sensitivity:

Does the system promise sensitivity or precision or depth far greater than more familiar systems? To win over doubters, voodoo geophysical methods have to offer sensitivity, depth, range of targets, and discrimination many times better than any competitor. Real geophysics doesn't work like that. If they offer 90% accuracy, be wary. Geology is too complex for exploration to be so easy.

Simple Field Operation:

Is it unusually simple? Generally, the more sensitive the system, the more complex the measurement. Does the operation seem very simple compared to principles of the "theory"? Perhaps just a box and some wires (and maybe a fellow in a top hat)? Sometimes, there's no field operations at all. There are many voodoo methods that are only modern versions of the magical pendulum on a map, supposedly finding mines and oilfields with beguiling simplicity.

¹ Hodges, G, 2005. "Voodoo Methods: Dealing With the Dark Side of Geophysics". Proceedings of the Symposium on the Application of Geophysics to Engineering and Environmental Problems (SAGEEP), Atlanta, USA, April 2005.

Dubious Theoretical Basis:

Is the method contrary to normal theory? Or maybe it's buried in pseudo-scientific technobabble, or deliberately vague? All legitimate geophysical methods have a long history of theory and development. The basics aren't that complex. Don't be impressed by claims that "It's based on quantum physics"! That means nothing. Patents mean nothing as well – anyone with time to spare and a few bucks can get one. If you cannot understand the principles, get some expert help or walk away.

Marketing:

Do the marketers avoid the experts and sell directly to non-technical managers? Beware of new systems that are promoted only through industry

news magazines and booths at conferences. They should have material published in reputable journals (not just industry magazines) and at technical conferences (not just sales brochures). If they won't talk to geophysicists, why not?

Secret:

Is the actual parameter and method of measurement kept secret, either by refusal to publish or insistence on non-disclosure or obtuse pseudo-technical jargon? This should be a big worry! Be cautious of systems that are protected from exposure by confidentiality agreements, litigation threats, or the embarrassment of their victims. If they say "it's patented", then they have no reason to keep it secret.

Practical suggestions

- Get your own expert geophysicist to evaluate the science.
- Insist on case histories and real data on similar targets, not just pretty brochures. LOOK closely at the data. Does the data look like geology, or just blobs on a map? Most geophysics looks like geology - it shows folds and faults and layers that follow the rocks. Is there enough data to see that the target response is actually characteristic of the target, and not just one of many red blobs?
- Is there a model that relates their geophysics to the rock property change you expect? What rock property does it actually measure? Or does it just "find gold"? Maybe it finds anything you're looking for (and willing to pay for), even though the rocks are completely different!
- Arrange test surveys on known targets (preferably unknown to the system seller) and have an independent expert verify the results before investing significant money. Again, does the geophysical response make sense with the geology?
- Make them PROVE to you that they have both theory and data that show that it works for your target geology. Extraordinary claims require extraordinary evidence (Carl Sagan).

This guidance note was compiled by Tim Archer of Reid Geophysics (UK) and Greg Hodges of Sander Geophysics (Canada). Between them, Tim and Greg have over fifty years of commercial experience in geophysical exploration.