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"Can a Single Bubble Sink a Ship?"

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Abstract—Anomalies are the source of all scientific investigation and discovery. The mysterious disappearance of ships at sea has long been recognized as a standard type of anomaly. A new theory proposes that the catastrophic release of giant methane bubbles from the ocean floor can possibly account for the disappearance of some ships. The theory is both novel and plausible. However it has limited applicability.

Keywords: anomalies—bermuda triangle—Charles Fort—Thomas Kuhn—methane

Introduction

The first popular expositor of anomalies was Charles Fort (1874–1932). Fort's seminal publication, *The Book of the Damned*, was first published in 1919. The title refers to those phenomena that science has damned by virtue of their failure to fit into predetermined modes of thinking and understanding the world. Properly understood, Fort was a forerunner to Thomas Kuhn (1922–1996). Kuhn's ideas were accepted by academics and serious scholars while Fort's writing has been of more interest to thinkers. I am sure there is some overlap between these categories.

Although I have read Kuhn's *The Structure of Scientific Revolutions* from cover-to-cover, I have to admit that I have never done more than browse through *The Book of the Damned*. Some marvelous aphorisms and witticisms can be found in *The Book of the Damned*. Here are two examples (Fort, 2002):

> There is very little deliberate misrepresentation in the writings of scientific men . . . they are quite as guiltless in intent as are other hypnotic subjects. (Chapter 8)
>
> It is useless to argue that peasants are out in the fields, and that scientists are shut up in laboratories and lecture rooms. (Chapter 8)

The latter quote is reminiscent of Roger Bacon (c. 1220–1294 AD) who described the experimental method three hundred years before Galileo was born (Bridges, 1914):

> [The experimental scientist] is ashamed that any things should be known to laymen, old women, soldiers, [or] ploughmen, of which he is ignorant. (p. 21–22)

But the reader is also apt to run into this sort of thing in Fort's writing (Fort, 2002):

If it is our acceptance that, out of the Negative Absolute, the Positive Absolute is generating itself, recruiting, or maintaining, itself, via a third state, or our own quasi-state, it would seem that we're trying to conceive of Universalness manufacturing more Universalness from Nothingness. (Chapter 15)

This tripe is bad writing at its worst: it is more than a sensitive person can bear to read.

As a youth of age seven or eight I was introduced to the world of anomalies by Frank Edwards' (1908–1967) book *Stranger Than Science*. Unlike Fort, Edwards was a superlative writer. I am now less credulous that I was at age eight. But I have always considered those who disregard or laugh at accounts of anomalies to be ignorant. Kuhn (1996) argued that anomalies are the source of all scientific breakthroughs:

Discovery commences with the awareness of anomaly ... (p. 52)

Unfortunately, very little of Kuhn's message has penetrated into the witless technicians who pass today for scientists.

Why Study Anomalies?

There is another benefit to the study of anomalies. Such readings go a long way to enriching the imagination, arousing the curiosity, and stimulating interest in science. Few can digest Courant and Hilbert's *Methods of Mathematical Physics,* but everyone can read *Stranger Than Science.*

Around 1966 or so my father took me to a Frank Edwards book signing at Hook's drugstore in Indianapolis. In my youthful imagination I had envisaged Edwards as sort of an Indiana Jones, forging intrepidly through the world of anomalies. After all, the cover of his newest book, *Flying Saucers—Serious Business* (Edwards, 1966), said:

The Book That Smashes through the Barrier of Official Silence with the Exclusive Story!

I was shocked to discover that Edwards was a big, fat slob,[1] the quintessential old-time newsman. His shirttail was hanging out, his suit was disheveled, and he was chomping on a cigar. Any "smashing" that Edwards might have done had been accomplished with a typewriter.

Edwards's books were followed by innumerable imitators. Anyone who read more than one of these books soon realized that there were standard categories of anomalies. These included:

- flying saucers
- the abominable snowman
- spontaneous human combustion
- pre-Columbus European artifacts in North America

- fish, frogs, and chunks of ice falling from the sky
- the Bermuda Triangle

The Theory of Rising Methane Bubbles

The mysterious disappearance of ships and airplanes in the area known as the Bermuda Triangle was one of the staple categories. Lost ships are not limited to the Bermuda Triangle. Historical disappearances of ships at sea include (Spencer, 1975):

- 1880: British ship, *Atalanta*, en route from Bermuda to England
- 1918: U.S. Navy ship, *Cyclops*, en route from Brazil to Norfolk, Virginia
- 1926: freighter *Suduffco*, en route from Newark, New Jersey, to Los Angeles

Now we have a proposed scientific solution for the disappearance of ships at sea that is both novel and plausible. May and Monaghan suggest that it may be possible for ships to be sunk by the catastrophic release of giant methane bubbles from the ocean floor. They don't mention the Bermuda Triangle, but instead refer to an area of the North Sea known as "the Witch's Hole". The "Witch's Hole" is known to be a site from which methane gas is bubbling, and the wreck of a 1930s fishing vessel has been located there by sonar.

To the best of my knowledge, the first person to suggest that rising methane bubbles could sink ships at sea was Richard D. McIver.[2] In an article published in the *American Association of Petroleum Geologists Bulletin*, McIver (1982) speculated:

> Intermittent natural gas blowouts from hydrate-associated gas accumulations . . . might explain some of the many mysterious disappearances of ships and planes—particularly in areas where deep-sea sediments contain large amounts of gas in the form of hydrate. This may be the circumstance off the southeast coast of the United States . . . an area noted for numerous disappearances of ships and aircraft. (p. 792)

The mechanism proposed by McIver was that the gas would lower water density causing ships to founder.

> If the hydrate seal . . . were broken abruptly, the gas . . . would be ejected . . . [and] would rush to the surface, breaking into smaller and smaller bubbles during its ascent through the water column. . . If the gas escape were rapid and localized enough . . . there would be a patch of highly agitated frothy water of very low relative density. . . . Any vessel accidentally encountering this patch would lose buoyancy and sink very quickly. (p. 792)

The Bermuda Triangle is also infamous for the mysterious disappearance of aircraft. On December 5, 1945, five U.S. Navy bombers on a routine training flight in the Bermuda Triangle vanished (Edwards, 1959, p. 71). McIver speculated that engines on low-flying aircraft could be suffocated by gas clouds.

> If the gas flow were large, a plume of free gas would rise above the ocean surface. Any low-flying aircraft passing through the concentrated gas would experience engine failure and might crash. (p. 792)

In 1984, McIver's ship-sinking hypothesis was dealt a blow in an engineering study by Jerome Milgram and Paul Erb (1984). Writing in *Petroleum Engineer International*, they concluded:

> Common wisdom in the oil industry suggests that floating drilling vessels will sink suddenly if a subsea blowout occurs beneath them. Well-control schools and texts on floating drilling often describe how the gas bubbles "aerate" the water and rob the vessel of buoyant support. This belief is completely false. (p. 64)

May's and Monaghan's Hypothesis

In contrast to previous ideas, May and Monaghan do not suggest that sinking occurs by alteration of water density. They propose that sinking is caused by water movement related to the rising of a single large hypothetical bubble. In a Monash University press release (www.monash.edu.au/news/newsline/bubble.html), one of the authors (Monaghan) explained how a large rising gas bubble could precipitate the foundering and sinking of a ship.

> The sinking occurs because a mound of water is raised above the region where the bubble reaches the surface. The flow from the mound creates a deep trough on each side of the mound, and the flow from the mound carries the boat into the trough ... Whether or not the ship will sink depends on its position relative to the bubble. If it is far enough from the bubble it is safe. If it is exactly above the bubble, it is also safe because the boat is not carried into trough. But once carried into the trough, the boat will sink.

The author's methodology consists of both scaled-down laboratory experiments and two-dimensional numerical modeling. I did not attempt to duplicate their results nor do I intend to try at any time in the future. In that respect, we shall have to rely upon peer-review and wait and see if the results can be repeated. Mathematical models of physical realities are approximate representations that frequently rely upon obscure simplifications and assumptions. However, in this case modeling seems to be a useful adjunct to the experimental approach. The results are also intuitively reasonable and in accord with expectations based on our everyday knowledge of how water flows.

Discussion

Although the May and Monaghan hypothesis is original and intriguing, it may not have wide applicability because the occurrence of methane hydrates in the oceans is limited to polar regions and the outer continental margins. Methane hydrate is essentially a frozen mixture of water and methane that is found in the pore spaces of sediments on the ocean floor. A cubic meter of methane hydrate is equivalent to as much as 164 cubic meters of methane gas at "standard conditions" (Kvenvolden, 1993, p. 281). The phase—gas or solid—is determined by both pressure and temperature. Frozen methane hydrates can be found even at the equator because ocean bottom waters are cold. Lately, methane hydrates have been the subject of much theoretical research because of their potential viability as a fossil fuel. The total amount of carbon found in hydrates exceeds all of the other fossil fuels put together, including oil, natural gas, tar sands, coal, and oil shales. Despite the promise of the resource, extraction of methane to date has been limited to experimental trials. Production is complicated by a thermodynamic limitation, and therein lies another potential difficulty with the May and Monaghan hypothesis. To produce methane gas, frozen hydrate has to be melted. The methane released from the melted hydrate has ten times the energy required for the melting, but it is difficult to find an efficient way to introduce heat into the frozen sediment and extract the released gas. For a large methane bubble to be produced quickly—as required by the May and Monaghan hypothesis—methane would probably have to be released by a catastrophic drop in pressure. It is possible for this to occur if there is a submarine "landslide" ("seaslide"?). That such events occur is shown by the presence of what geologists call *turbidites*, rocks resulting from several meters of sediments deposited catastrophically from a *turbidity current* initiated by a large undersea mass movement. On November 18, 1929, six telegraph cables on the seabed offshore of Newfoundland, Canada, were broken by a turbidity current precipitated by an earthquake (Friedman & Sanders, 1978, p. 515). Larger slides have been known to occur in the geologic past. A major submarine mass flow took place in the Storegga area offshore of Western Norway about 30,000 years before present. This was followed by two smaller slides that occurred 8,000 and 5,000 years ago. The combined slides left a scar 290 kilometers long and transported a total of 5,580 cubic kilometers of material as far as 800 kilometers (Jansen et al., 1987).

Summary

In summary, this is an interesting and novel hypothesis. However, the hypothesis has limited applicability. The world in part will continue to remain a mysterious place, and for that we can be thankful.

Notes

[1] These are terms of affection, not insult.

[2] I am indebted to Timothy S. Collett at the U.S. Geological Survey in Denver for bringing the McIver paper and many others to my attention. Dr. Collett is a leading authority on the geologic occurrence of methane hydrates.

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