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Is Geology a Real Science?

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Is Geology A *Real* Science?

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"Geology holds the keys of one of the kingdoms of nature; and it cannot be said that a science which extends our Knowledge, and by consequence our Power, over a third part of nature, holds a low place among intellectual employments."

William Buckland, *Vindiciae Geologica* (1820, p. 7)

William Buckland, early 19th century English geologist, paleontologist, and Dean of Westminster, recognized geology as an intellectual endeavore and a real science; a science with much to offer in understanding nature. But, we are now in the 21st century and viewpoints have changed. Better educated (?), more enlightened (?) bean counters and high-level academics feel otherwise. In the last issue of *The Compass* I bemoaned the closure of the Geology program at the University of Northern Iowa (Davis, 2012). I still strongly believe the closure is a bad idea, but I also sense the the closure is a symptom of a larger issue. Geologists, and geology as a scientific endeavor, are simply not held in very high esteem by many academics or the general public. The message seem to be that geology is not a *real* science, and, therefore, not really important.

I sense a few hackles are being raised at the moment by the readers of this editorial, and this is understandable since most of you are probably geologists. So where did I get this notion? From the TV sitcom *The Big Bang Theory*, where else? In one episode Sheldon, the nerdy (and very irritating) physicist, proclaims "geology is not a real science". There you have it! *The Big Bang Theory* is filled with science and mathematics humor and some of the mocking humor is directed at geology and paleontology. I'm a bit thin skinned on such matters. [As an aside, I recently discovered mathematicians don't like the useage of 'math' for mathematics, so be forewarned. Talk about thin skinned!] And, yes, I do watch *The Big Bang Theory*, but my wife is always careful about making sure my rock hammer is nowhere around because she doesn't want me throwing it at Sheldon.

A number of years ago, my daughter, who wanted to major in psychology, was on a college tour being conducted by a staff member in the Psychology Department. As one might expect from the daughter of a geologist, she asked about taking one or more geology courses to fulfill her core requirements in science. She was quickly told, "not a good idea because geology is not a real science. Furthermore, taking a geology course shows a fear of science." Needless to say she immediately reported back to me and I went to see the Chair of the Geology Department,

who then confronted the Chair of the Psychology Department. After a fairly lengthy discussion, the chair of psychology ended the conversation by saying, "But, geology really isn't science." The Chair of Geology was speechless. How does one respond to such a statement?

There is more evidence for suggesting geology is not a real science. Evelyn Mervine (2010) posted on her *Georneys: Geological Musings, Wanderings, and Adventures* blog that the stereotypical 'jock' (student athletes) take introductory geology as an easy way to fulfill their science requirement for graduation. I would be very surprised to hear of any faculty member who has **not** heard Introductory Geology called 'rocks for jocks. Mervine (2010) further states that some MIT faculty members consider the geology department to be part of the humanities, and she even finds herself saying, *"Oh, I'm at MIT…but I'm only in the Earth and Planetary Science department",* which is very sad.

Recently, I came across the definition of a geologist as reported by the Uncyclopedia: The Content-Free Encyclopedia (http://uncyclopedia.wikia.com/wiki/Geologist) and had a good chuckle reading the quite lengthy twaddle about geologists. I particularly enjoyed the section on "How to spot a Geologist" (fig 1), which must have been written with Jeff Foxworthy's *You Might Be A Redneck* in mind. As I read the first couple of descriptions, I thought, "Nope, that's not me", but by the 5th or 6th description my thoughts changed to, "Well, I suppose that's true." A few of my favorites, of which I am guilty, include:

1) Someone who, when asked what this rock is says, "Leverite, so leave her right there."
2) Someone who walks out of a bathroom and asks if you noticed the fossils in the stall dividers.
3) Someone who eats dirt and claims to be "getting an estimate of grain size."
4) "Someone who plans extra time on trips to investigate road cuts along the way."
5) "Someone who walks into an art museum and looks at the floors and columns commenting on the stylolites and fossils, rather than looking at the paintings."

Figure 1. Caricature of a geologist. Drawing by Dr. Jim Poff, biologist and artist, College of St. Benedict/St. John's University, Collegeville, MN.

The very first description in 'How to spot a Geologist' was, *"Someone who has the longest occupational description on Uncyclopedia (and has looked at all the other occupations to confirm while consuming large quantities of alcohol)."* Now, I wasn't consuming alcohol, but I did look up the other occupations, and it was true, Geologist had the longest occupational

description. The description of a physicist was incredibly short and there wasn't a description for a biologist, chemist, astronomer, or any other type of scientist. Apparently, geologists and physicists are the only scientists who are the brunt of other people's jokes.

Let us not forget Sir Ernest Rutherford, who, according to Birks (1962), made the comment *'all science is either physics or stamp collecting'.* If (which seems to be a big IF) geology is a science, then at least Rutherford lumped geology in with chemistry, biology, and astronomy. It is interesting to note, though, Rutherford received his Nobel Prize in chemistry and not physics. As a kid my three passions were collecting rocks and minerals, arrowheads, and stamps, and my friend Dr. Jim Poff still collects 'bugs' (Jim is an biologist/entomologist), so maybe there is some truth to Rutherford's comment. [As an aside, I've seen Rutherford's quote on several occasions, typically on posters in Physic Departments, but I have never found a specific reference to Rutherford's comment, nor does Birks (1962) provide a citation. If anyone happens know specifically when and where Rutherford made this statement, I'd be interested in hearing from you.]

And then, there are the jokes. A psychologist put a 3rd grade teacher, a mathematician, and a geologist in separate rooms containing a table and three spheres. A short while later, the psychologist opened the room of the teacher and found the teacher seated at the desk with the spheres in the corners. The mathematicians had the spheres on the desk in a column. Upon entering the geologist's room, the psychologist discovered one sphere had been lost, another sphere was broken, and had the third sphere was hidden in the geologist's lunch bucket. Not quite sure the moral of that story beyond the fact that always keep an eye on a geologist in the presence of anything valuable. A psychologist asks a physicist and a geologist, "what is two times two?" The physicist replies, "two times two is precisely 4.0000000000", whereas the geologist after several minutes of calculations on the back of an envelope, states, "hmmm, two times two is somewhere between three and five." The moral of the story, 'mathematics (not math!) is the language of science, geologists are math-phobic; ergo, geologists are not scientists'. I'm guilty. I hated calculus and have yet to see the point of it. On the other hand, my good friend and geologist, Dr. Robert Eves at Southern Utah University, is a cracker-jack mathematician. Dr. Eves is also a chemist but proudly claims to be a geologist (poor, demented fool)! The answer to the problem 2 x 2 is somewhere between 3 and 5, and sounds good to me! It's like saying *Tyrannosaurus rex* lived 65-70 million years ago or that zircons in a sandstone conglomerate in the Jack Hills of the Narryer Gneiss Terrane of Western Australia are dated at 4.404 billion years +/- 8 million years. When considering 4.6 billion years, do we really need to worry about a mere 8 million years? But, apparently *real* science works with more precise mathematics.

Because geology is not a real science, the lay public has little understanding of geology or what geologists actually do. Allen Glazner (2011), Distinguished Professor of Geology at the University of North Carolina-Chapel Hill, commented that at social functions, upon hearing that he is a geologist, people will often ask, "been out on a dig?" I've had the same question asked of me many times. As a paleontologist, I have 'dug up' dinosaurs, but what people typically want

to know is whether or not I have dug up any humans or artifacts – the job of archeologists or anthropologists, not geologists. Glazner (2011) shared another common question of conversation, which is stated with the rolling of the eyes – "seen any good rocks lately?" How do you answer that question? My response would be, "why yes. Let me tell you about them!" But, likely that is a response no one wants to hear, and they are thinking, 'boy, this guy has a boring job'.

By now, it should be clear to the reader that geology is not a real science and in the grand scheme of things, not really important, especially when thinking about which academic departments to chop. The obvious answer is chop the courses in the humanities – classical and modern languages (other than Spanish), art, music, geography, and geology - although I am not sure why geology seems to be considered a humanities. Please note, I am not in favor removing geology from the 'chopped list', while continuing to delete other programs. Rather, I would like to see some of the gladiator programs, e.g. football, basketball, etc., being placed on the chopping block. I fail to see how gladiator programs contribute to finding solutions to problems facing humankind.

At this point, maybe it would be useful to reflect on what people other than William Buckland had to say about the value of geology. Sir Archibold Geikie (1900, p. 251-252), a 20th century Scottish geologist and writer, stated

> *"Apart from its healthful mental training as a branch of ordinary education, geology as an open-air pursuit affords an admirable training in habits of observation, furnishes a delightful relief from the cares and routine of everyday life, takes us into the open fields and the free fresh face of nature, leads us into all manner of sequestered nooks, whither hardly any other occupation or interest would be likely to send us, sets before us problems of the highest interest regarding the history of the ground beneath our feet, and thus gives a new charm to scenery which may be already replete with attractions."*

To me, Geikie's (1900) statement about *'healthful mental training as a branch of ordinary eduction'* means the study of geology provides a well structured way of viewing the world regardless of one's ultimate educational or professional goals. Geology is well-suited for those individuals seeking a liberal arts education. A degree in Geology does **not** mean one has to be employed as a geologist! Geology is as just as useful for entering law school as a degree in history; geology is just as useful for entering politics as a degree in political science. Do not forget Herbert Hoover, who trained and worked as a geologist, became the 31st President of the United States (Merriam, 2012). Geology is more than learning the names of minerals and rocks; geology is about observing, analysing, and thinking, which are all characteristics of scientific endeavors.

As I stated in an earlier editorial (Davis, 2012), geology and its 'sister sciences' (biology, chemistry, physics), along with mathematics, computer science, engineering and social sciences,

are all important in the study of Earth's systems. The sciences, *including geology*, should not, must not, be viewed as separate disciplinary silos; they [the sciences] are all related. Charles Lapworth (1893, p. 696), a 20th century geologist, makes this same point when he states,

> *"Darwin was a biological evolutionist, because he was first a uniformitarian geologist. Biology is pre-eminent to-day among the natural sciences, because its younger sister, Geology, gave it the means."*

Biology and geology are sister sciences; they are related to, and dependent upon, each other in order to fulfill their individual objectives. The same could be said about the relationship of geology to the other sciences. Geology is a *real* science and when geology is marginalized, science in general is diminished. In the words of Hugh Miller (1860, p. 87), a 19th century geologist, writer, and evangelical Christian,

> *"Nature is a vast tablet, inscribed with signs, each of which has its own significancy [sic], and becomes poetry in the mind when read; and geology is simply the key by which myriads of these signs, hitherto indecipherable, can be unlocked and perused, and thus a new province added to the poetical domain."*

Glazner (2011) points out that the price of oil, gas, various metals and construction materials (sand, gravel, building stone) continue to soar, and earthquakes, floods, and volcanic eruptions devastate parts of the world. Geologists understand where resources are located and why natural disasters occur, consequently geologists (geoscientists) should be the go-to-people for information. Only geologists can provide the information needed for correctly assessing where a building, road, or dam should be sited. Geologists will play an important role in assessing the impacts of global climate change. Consider how many people live on coastal plains and islands and the potential impact of sea level changes on humankind. Stutz and Pilkey (2011) point to the potential for significant climate and sea level change this century, which underscores the need to improve our understanding of the depositional setting, climate, and tidal regime within a coastal region.

As Gonzales and Keane (2010, p. 550) point out, "society is inextricably linked to the resources and natural processes that exist and occur on our planet", and that "our dependence on resources and the impact from processes is becoming increasingly apparent." We need to increase the number of students entering into the geosciences (geology, physical geography, geophysics, soil science, oceanography, hydrology, and the atmospheric sciences), but achieving this goal will be a challenge. Figure 2 illustrates the numbers of undergraduate and graduate degrees awarded in science and engineering from 1973 to 2009. Note that while geology has vied with chemistry and physics for last place over the years, currently, geology is in last place. Gonzales and Keane (2010) identify the lack of exposure to the geosciences in high school as a major reason for the low number of students entering the geosciences in higher education. Students typically fulfill their earth science education in grades 6-8, and most states do not

require earth science for high school graduation (AGI, 2009). According to the AGI (2009) more than 50% of the workforce needed in the natural resource industries in 10 years is not in the present workforce, and it is unlikely that the supply of new students into the geosciences will fill these vacancies in the workforce.

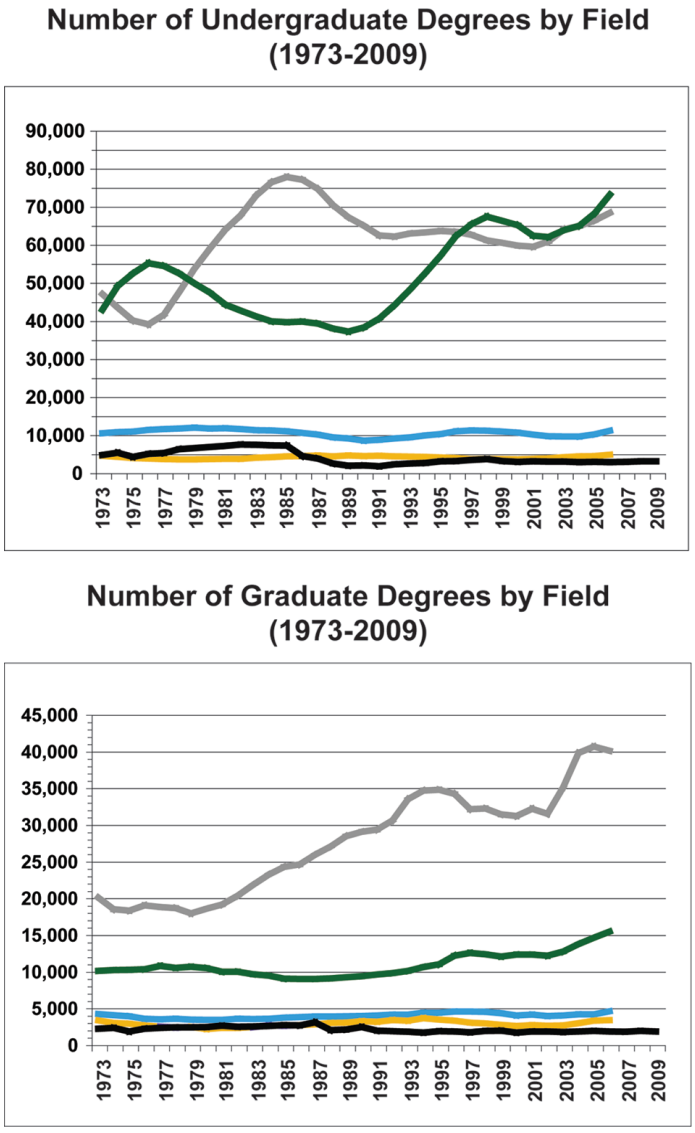

Figure 2. Number of undergraduate and graduate degrees awarded by fields in science and engineering between 1973 and 2009. Line color is by discipline: gray (engineering), green (biology), blue (chemistry), yellow (physics), and black (geosciences). Figure is from Gonzales and Keane (2010, p. 551)

We have a mission to inform college and university administrations, as well as the general public, that geology impacts nearly every aspects of modern life. Geology IS a *real* science and geologists are real scientists, who play a key role in the continuing efforts to understand the relationships between our planet and humankind. The bottom line of the financial statement is important, but should not, and cannot, be the only reason for eliminating an educational program. Doing so marginalizes the entire higher education science program. As my father often said to me, "son, you can pay now, or pay later, but the latter is going to be much more expensive."

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