

The expertise of Professor Paul Younger – Part 1.

Hydrogeology and hydrocarbon exploration

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Posted on 24th August 2016 by [Professor David Smythe](#)

Introduction

This post tries to explain why Professor Paul Younger, currently an employee at my own *alma mater*, the University of Glasgow, objects to my views on fracking. In July 2014 he started a campaign of disinformation, claiming that I lacked expertise and qualifications in the field of fracking and its potential for groundwater contamination. In January this year his internal university campaign resulted in my being cut off from the academic research database which is my research lifeline. This termination is about to result in a court case to recover my rightful access.

Here are some samples of what Professor Younger has communicated to me and others in the University, and externally:

*“... and then proceeding to **misrepresent not only geosciences generally, and hydrogeology in particular (of which you are clearly deeply ignorant ... issues of groundwater pollution, which you pretend to know about, despite your utter lack of hydrogeological background. ... holding forth on a topic in which you are not properly versed (in your case, environmental hydrogeology).**”* [email to me, copied to BBC Scotland, 1 July 2014]

*“I relish scientific debates; what I do not appreciate is **pretended knowledge in a field other than his own being publicly peddled as authoritative insight ...**”* [internal email 4 July 2014]

*“... my dismay at Smythe making **untruthful and misleading claims** which potentially damage our reputation.”* [internal email 30 July 2014]

*“All I want is distance between his **uninformed views** and those of us who actively work and publish peer-reviewed papers on these topics.”* [internal email 15 August 2014]

*“... he is **making representations on areas outside his expertise, but within those of myself and Dr Rob Westaway.**”* [internal email 13 October 2014]

*“on the same platform as one of my present-day Glasgow Univ colleagues (a genuine, peer-review published research in shale gas) **peddling contrary nonsense, not research-based, also in the name of Glasgow Univ.**”* [internal email 12 March 2015]

*“We shouldn’t let Smythe open up a new front in his endless attempts to **pretend he knows Hydrogeology when he demonstrably doesn’t.**”* [internal email 14 June 2016]

It is evident from the excerpts quoted above that Professor Younger believes that I am “*deeply ignorant*” about hydrogeology, his own field. He goes further, stating that I am generally ignorant of the geosciences, and that I “*peddle ... nonsense*”, so that I am therefore unqualified to speak professionally about fracking and its environmental risks. His attacks raise (at least) three questions:

1. Do I really know nothing about his own speciality of hydrogeology?
2. Is hydrogeology the only essential skill in the debate, as he implies?
3. What are the relevant skills and expertise required to debate the science behind fracking?

Relevant skills

I start with our respective skills and experience. The overriding skill required in studying or questioning the hydrocarbon exploration companies which are now involved in unconventional exploration is not hydrogeology, but **hydrocarbon exploration**. This ought to be self-evident. Such companies employ geologists, geophysicists and petroleum engineers. They do not in general need hydrogeologists.

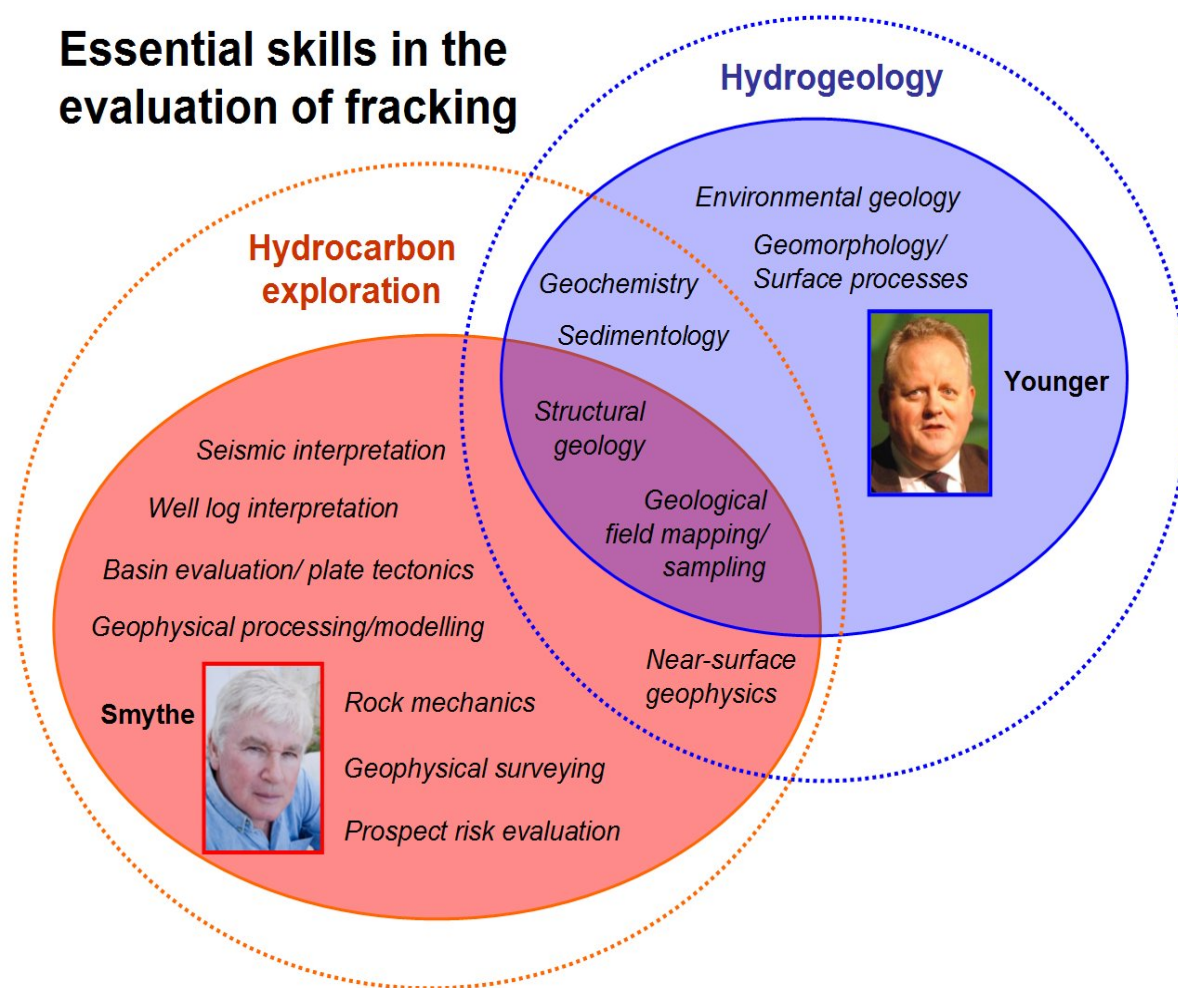


Fig. 1. Venn diagram illustrating disciplines within hydrogeology and hydrocarbon exploration.

Figure 1 is a Venn diagram illustrating the disciplines within each of the two fields. Hydrogeology is the dashed blue area on the right, and hydrocarbon exploration is in dashed red on the left. I have taken the disciplines useful or necessary in hydrogeology from a [careers statement](#) by the Geological Society of London. On the hydrocarbon side I have listed the disciplines from my personal knowledge. Within each area there is a coloured area representing the slightly incomplete coverage of skills encompassed by Professor Younger in hydrogeology, and by myself in hydrocarbon exploration. So, for example, Professor Younger is not versed in near-surface geophysics, and similarly, I would not consider myself expert at the professional level in geochemistry or sedimentology, because these are subjects which I have not studied formally since my bachelor's degree. Within sedimentology I include stratigraphy and palaeontology.

There is an overlap of a couple of subject areas. Structural geology is very important; it is the architecture – the folding and faulting – of geological layering. It is essentially the small scale detail within the bigger picture of sedimentary basin formation or of mountain-building. These broad subjects are themselves part of the global paradigm of plate tectonics.

Hydrogeology is concerned with the water in the uppermost rock layers, typically within the topmost 500 m of the Earth's surface. There may be exceptions, of course. Hydrocarbon exploration is concerned with the rocks and fluid content of sedimentary layers typically from 300 m to 4000 m depth. But the uppermost layers, including the unconsolidated material at the surface, need to be studied as well, because

accurate images of the deep layers require a knowledge of the shallowest layers, even though oil or gas is not generally to be found at shallow depth.

An example

I give one example to illustrate the skills required for tackling the problem of potential contamination from fracking. Figure 2 is a cross-section through Cuadrilla's proposed well location at Roseacre Wood in the Fylde, Lancashire. It is a composite picture made up from a Cuadrilla interpretation, extended to the SE by a cross-section made by the British Geological Survey (BGS). It is at true scale, so that the vertical depth is just over 3 km. It should be remembered that this sort of picture is an interpretation, not hard fact.

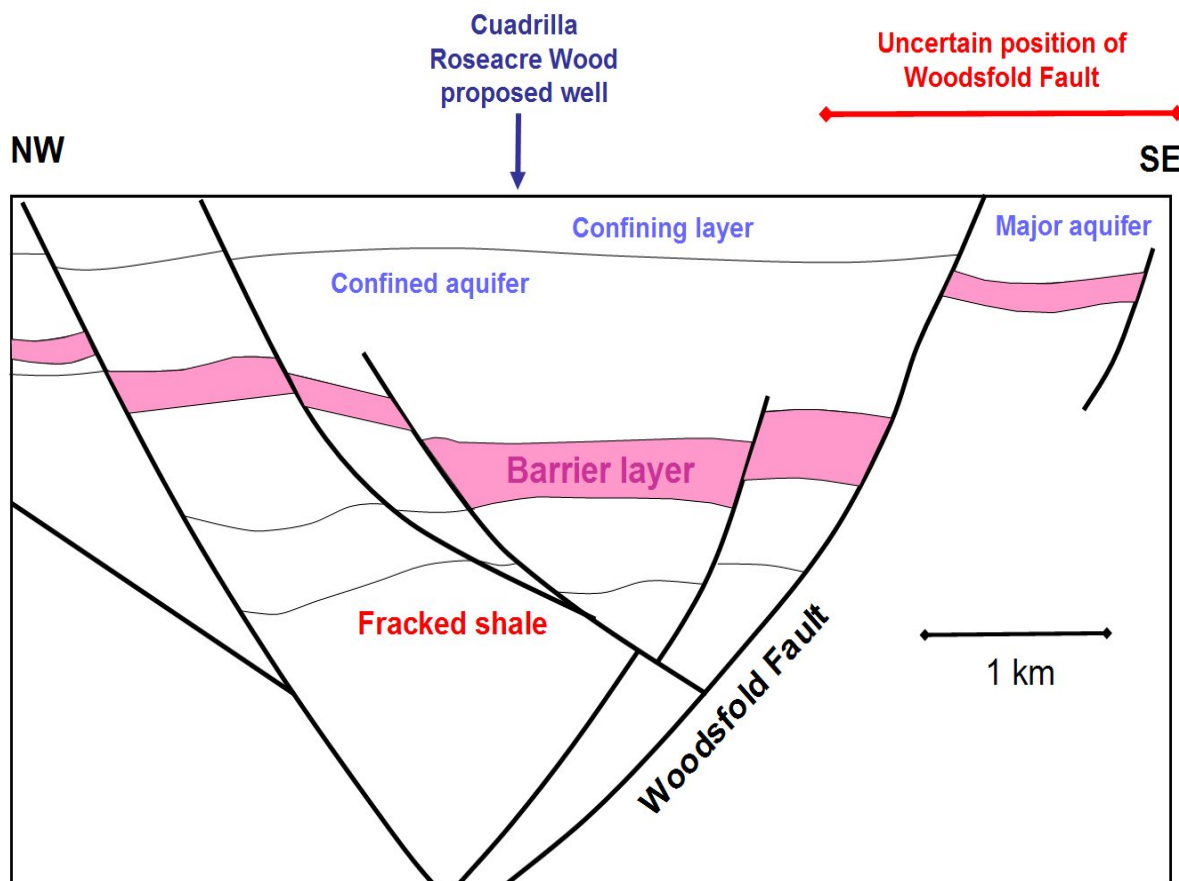


Fig. 2. Geological cross-section interpretation through proposed Roseacre Wood well. Faults are shown by thick black lines; geological layering by thin lines. The Woodsfold Fault separates the main groundwater aquifer of NW England from the Fylde area to the west where the same aquifer is 'confined' (i.e. covered) by impermeable younger rocks.

Looking at this picture, various questions can be asked, including:

- How accurate are the depicted fault lines?
- Why does the supposed barrier layer (in pink) vary in thickness across the faults?
- The position shown for the major Woodsfold Fault is only one of four possible positions at the surface; since we can't locate that fault more precisely than to within 1800 m at the surface, what faith can we have in the reality of the other faults depicted?
- Are the faults likely to act as conduits or as barriers to fluid flow?
- How impermeable or otherwise are the various layers to fluid flow?
- If the shale to be fracked (and thereby made permeable) releases methane and produced water, what is the risk of contamination of shallow groundwater resources?
- Given that 70,000 unconventional wells have been drilled in the USA, what is the evidence for wellbores being a source of leaks?
- Given that faults need to be avoided when fracking (if only for commercial reasons), what

confidence can we have in the ability of the developer (Cuadrilla) to avoid inadvertently fracking into fault zones?

These questions are all entirely within the domain of expertise of the hydrocarbon explorationist. Some of them require specific expertise and experience in the realm of seismic reflection imaging (my own speciality), because that is the primary method used to create the image. The primary aim of the explorationist is to identify and evaluate potential pools of oil or gas that could be drilled economically. As well as seeking direct indications of hydrocarbons (which is firmly within the realm of geophysics) before drilling starts, various scenarios and risk factors also have to be estimated. This is all about hydrocarbon generation and migration, and trapping – in other words, fluids.

Other questions, which might appear to be within the hydrogeologist's domain, but which can equally well be addressed by the explorationist, are:

- Given the existing database of shallow boreholes and water sampling, is the confined aquifer (the layer west of the Woodsfold Fault) potable or not?
- Is there a hydrogeological connection across the Woodsfold Fault at shallow depth, linking the two aquifers?
- If so, is the flow westwards or eastwards? Could it be altered as a result of fracking?
- Do the groundwater flow modelling studies carried out by the Environment Agency (EA) east of the Woodsfold Fault have any relevance in this area?
- What is the basis for the EA concluding that the confined groundwater resource above the fracked zone is saline and therefore not potable?

In addition, we have another question concerning tectonics and rock mechanics, following the triggering of earthquakes by fracking at the nearby Preese Hall-1 well in 2011:

- What are the stress conditions within the Earth that might lead to triggering of earthquakes by fracking?

That question cannot adequately be addressed by a hydrogeologist, but is well within my domain of expertise as a geophysicist.

Discussion

My own credentials in hydrocarbon exploration in particular, and in earth science in general, are not in question. What may not be apparent from [my CV](#) is that I consulted intermittently over about nine years for oil companies and a government, between 2002 and 2011 or so. I am also probably the only person who has ever sat on both sides of the table at the DECC interviews for awarding exploration licences in the UK sector, once with the government team in 1985 and twenty years later representing a UK operator. I can supply considered answers to all the questions listed in the example above, whereas Professor Younger cannot.

As the name implies, a hydrogeologist deals with water in rocks. The fluids of interest to the explorationist are threefold; gas, oil and water. As can be seen from the example discussed above, the range and depth of geology encompassed by the explorationist is far greater than that of the hydrogeologist.

While I may not be a practitioner of hydrogeology *sensu stricto*, I understand the methods and results of hydrogeological research; it is not rocket science. On the geochemistry of groundwater, Professor Younger's particular area of expertise, I would limit my discussions to the basic issues of salinity, acidity and hardness – the same chemistry that I use in regulating the water in my swimming pool. Is Professor Younger suggesting that a doctorate in hydrogeology is required for such basic chemistry? On the more complex questions of groundwater modelling, using computer methods, my knowledge is well up to the standard of reading, and commenting critically on if required, the latest hydrogeological research.

Conclusion

I therefore submit that in the field of fracking my own expertise and experience are far greater and more relevant than those of Professor Younger. I am sorry to say that his absurd argument to the contrary merely illustrates his own limitations and lack of imagination. If anyone at the University of Glasgow should refrain from commenting on fracking it is he; however, I prefer to weigh up the scientific content of what a person says, rather than fall back on labels such as 'hydrogeologist' or 'geophysicist'. It is regrettable that senior staff at the University seem to have uncritically accepted these labels, along with the misleading bias given them by Professor Younger.

It is further regrettable, in view of his expertise discussed above, that Professor Younger was a member of two influential committees which drew up reports on the risks of fracking; the Royal Society / Royal Academy of Engineering [report](#) of June 2012, and the Scottish government's Expert Scientific Panel [report](#) on unconventional oil and gas of July 2014.

I shall comment on Professor Younger's specific contributions to the fracking debate in a future posting.

Categories: [Frackademics](#), [Paul Younger](#)



[Professor David Smythe](#)

I am Emeritus Professor of Geophysics in the University of Glasgow (a courtesy title). I retired from the University in 1998 and live in France, where I continue my research in geology and geophysics.

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Response to The expertise of Professor Paul Younger – Part 1. Hydrogeology and hydrocarbon exploration



1. [Kevin Ogilvie-White 26th September 2016 at 10:17 pm](#)

[Reply](#) ↓

Dear Professor Smythe,

I despise the way in which you have been treated and I admire the way in which you have responded to your critics. I first heard about you when researching fracking after learning that ST04, ST14 and ST24 were licensed to South Western Energy. We started Frack Free EQS in response to this threat. I have contributed what little I can to your crowdfunding fighting fund and will do so again if needs be.

I follow all your posts and read all peer reviews to your latest paper (withdrawn). I hope you have a lot of fight left in you. We need you.