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Commentary

Physics AND geology make geophysics

Michael Micenko
Associate Editor for Petroleum
micenko@bigpond.com

Seismic interpreters often forget the physics part of geophysics.

At the ASEG-PESA 2015 conference I attended an interesting keynote talk given by Mike Glinsky. When I spoke to people afterwards I found there were mixed reviews – several people commented that there was too much physics and maths. Come on … what do you expect at a geophysics conference!

This year the conference and exhibition was held in Perth, which allowed me to attend, but also allowed me to do a few hours in the office each day – out of town conferences are much more fun. A highlight at this conference was the quality and number of keynote speakers, especially in the oily sessions. There were some excellent presentations by prominent presenters and I commend the organisers for arranging such a high quality line up (details can be found in the last issue of *Preview*). Now back to Mike Glinsky.

Mike is a plasma physicist but has worked for exploration companies for many years. His keynote address 'Geophysics of Stratigraphic facies identification: emergent phases of self organisation and the Mallat scattering transform' had a super geeky title. But the talk can be summarised with a single slide (Figure 1). Actually some heavy maths was required and it has been a long time since I had much to do with partial differential equations so I was struggling. Mike began describing the concept he researched while working at the CSIRO, and developed further after he spent some time in France. Whilst the title is rather academic the concept is quite exciting because Mike can describe a geological system with a couple of partial differential equations and only four parameters and some boundary conditions. Why is this interesting? It means that without having to specify much, it is possible to describe a geological system with mathematics and make predictions. Each geological system has a unique set of parameters and these parameters are unique to the geological system.

To do this doesn't require knowledge of plasma physics, whatever that is. We already have the tools on most interpretation workstations and just have to develop a workflow. Perhaps this is the ultimate metric as Mike describes it. A video of Mike presenting this work can be found at:
http://online.kitp.ucsb.edu/online/geoflows-c13/glinsky/

Another more understandable example of where our physics needs to improve is seen in some of the interpretation software I regularly use. One company recently announced they were providing a wavelet extraction and other wavelet processes using depth domain data as input. They know it is wrong but say their user base requested it. That's OK, but do the users realise there may be pitfalls?

Seismic is recorded in time. Seismic waves are generated at a source point and propagate away over time. But modern data is increasingly being delivered in the depth domain following pre-stack depth migration processing. The depth domain is easier for geologists, engineers and managers to understand and they struggle with seismic in the time domain. But the basis behind most wavelet processing is time based because in the depth domain the wavelet shape varies as velocity varies and velocity is still subject to uncertainty. If you use these processes in the depth domain because it is convenient be aware that there may be traps for the unwary.

Now I've looked at the physics I should give the geology a plug. I'm a big fan of geology field trips for interpreters. I've been on several trips in exotic places like the Taranaki coast, the Pyrenees, Bay St Michel and the Flinders Ranges, just to name a few. They all help to understand the environment and sedimentary processes involved and they don't have to be long – day trips are really interesting. As a geophysicist I don't have to examine everything like a geologist with a field lens and compass but I do look at the rocks and observe the structures.

Perhaps my favourite geology field trip was held in conjunction with the ASEG conference in 2009. Named 'Rocks, soil and wines of the McLaren Vale region' and led by Nick Lemon it also included chemistry. After spending a morning checking out different soil types in this wine region we adjourned to a local pub and got to taste a wine grown in each terroir. If you get a chance to do this trip, take it.

Feedback: My article on Nintendo geos has sparked a bit of correspondence mostly along the lines of 'you idiot – the picture was of an Xbox controller'. But there was some lamenting the art of hand contouring and that may be the subject of a future article.

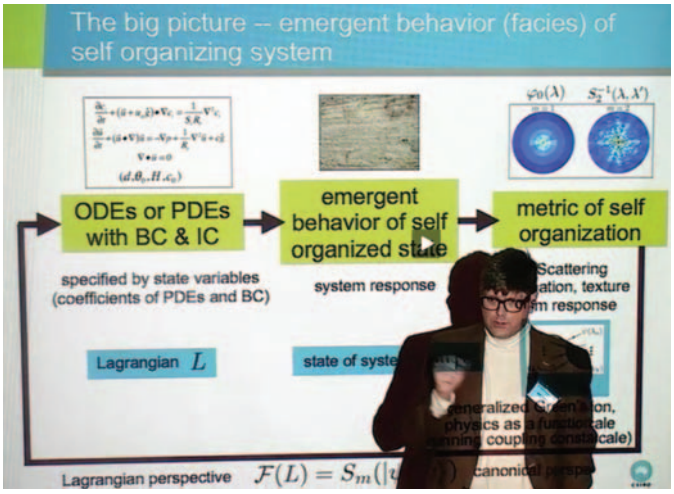

Figure 1. *Mike Glinsky in front of the answer to the universe.*