The Geoelectric Structure of the Canadian Cordillera

(A Poem)

By: Wesley Kasha

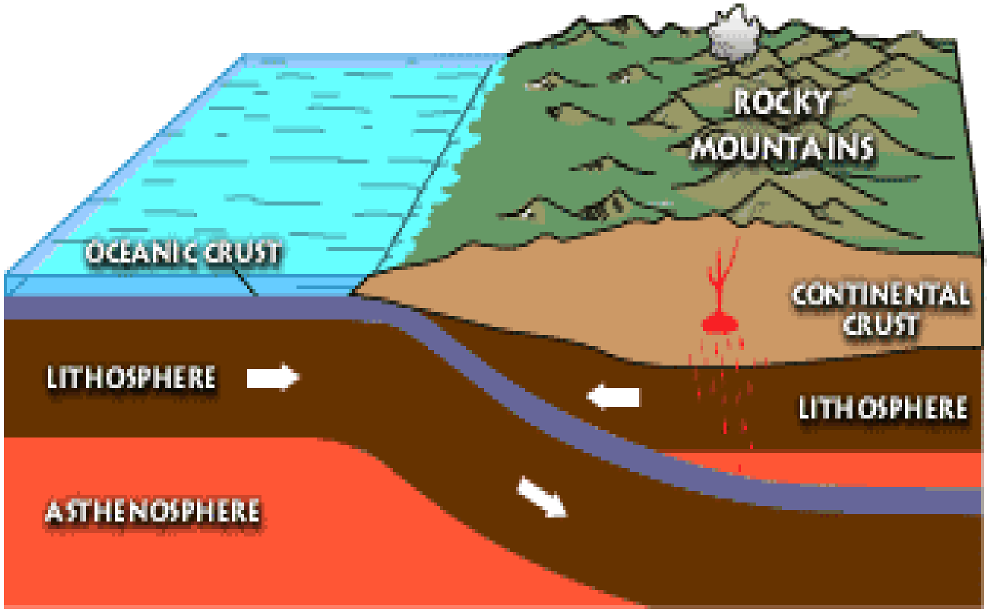
A long time ago
In the land of the free,
Where in place of cold snow
Stood Albertan palm trees.

The west coast of Canada
Was much further East
With no cordillera
On which one could ski…

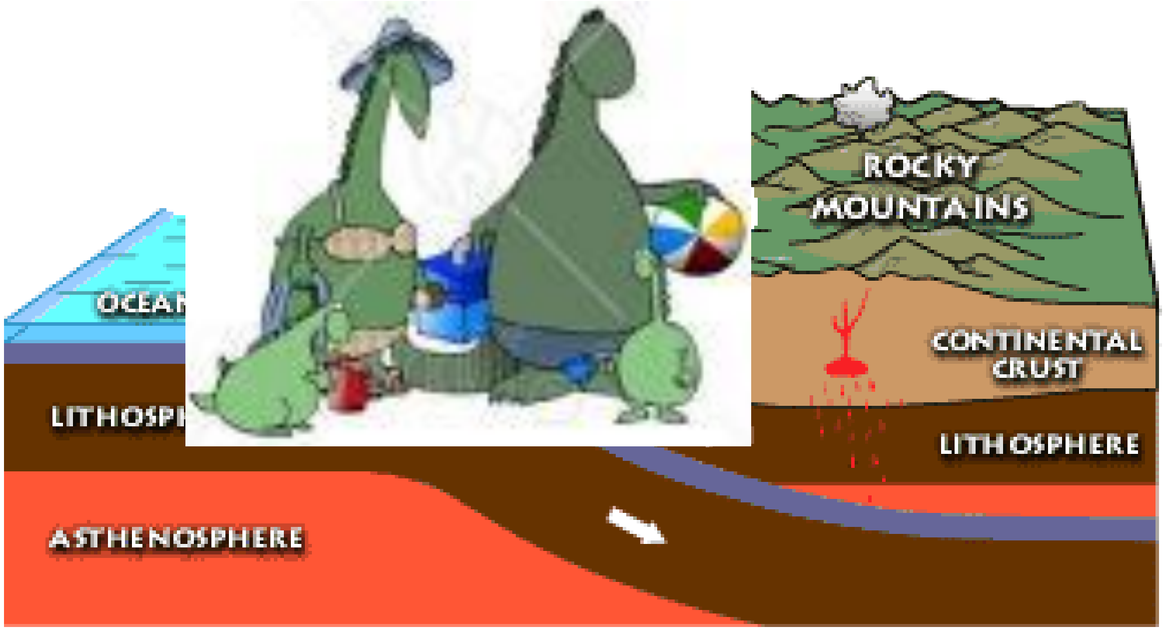
But how did these mountains
Achieve such great heights?
Rocky and barren
And covered with ice?

Tectonic motion
The strong, mighty hand,
Spreading the oceans,
And moving the land!

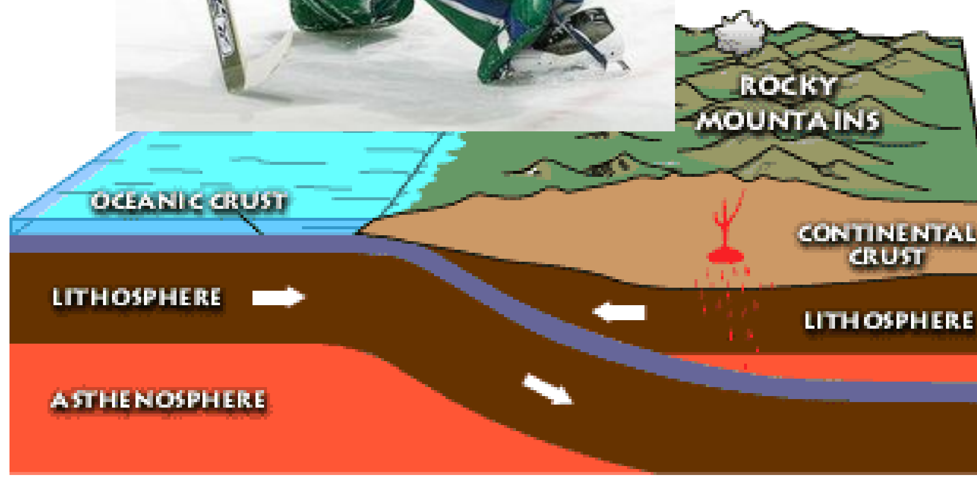
Beneath this warm coast
Lay a hot ocean plate,
Subducting and melting
As it did migrate.



Basaltic seafloor
Was forced beneath land,
As dinosaurs covered the
Warm beaches' sand.



Today it’s convergent,
Just like long ago,
But now it’s out west,
With R. Luongo.



When, what on the horizon?
Look, far out at sea!
Some strange foreign lands
Had now broken free!

We call them *terranes*,
These islands of rock,
Which accreted much slower
Than snails could walk.

Some mafic, some not,
They all held their course
Straight for America
With little remorse.

The first to accrete
Met the bare craton shield,
Folding and faulting -
The mountains revealed.

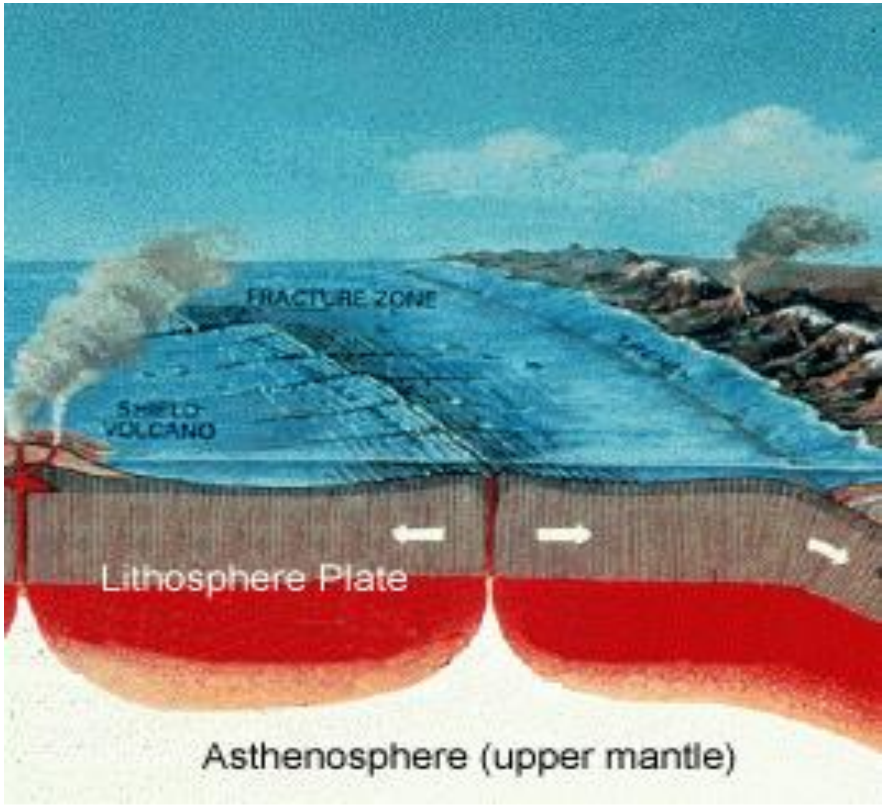
The one called *Wopmay* shows
A “low app_res” structure,
Named after this man,
A brave pilot fighter.

Who just for your interest,
Was born and raised here,
Until he left E-town
To fight without fear.

For hundreds of years
These lands kept accreting
Piling up high
Alberta’s beaches, deleting.

Mountains were forming
At very low speeds.
Processes we call
The *orogenies.*

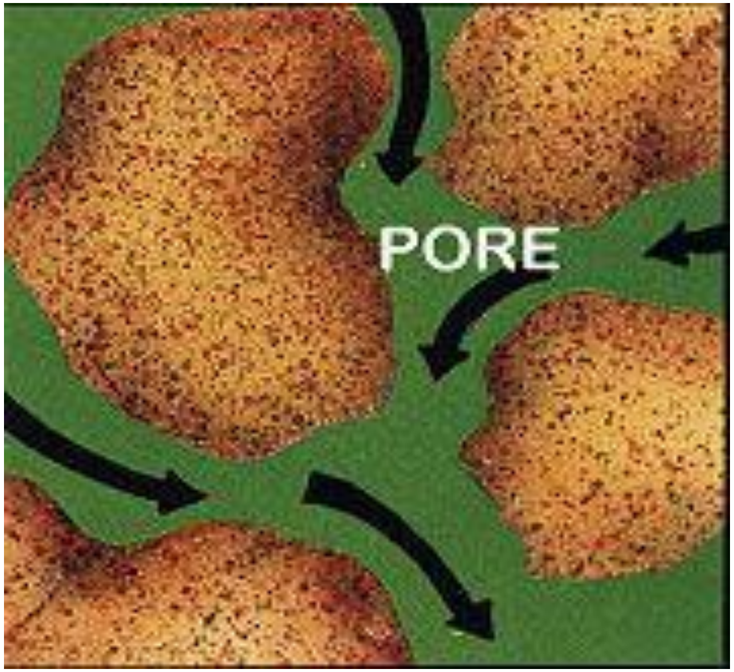
These forces that made
The tall mountains fracture,
Had also affected
The deep basement structure.



Compression, extension,
They both played a role
Where fractures were present,
Fluids filled holes.

The fluid was water
From subducting rocks,
Filling the pore space
Like dirt in your socks.

And this oozing water
Made melting points low,
And with partial melting
Came more current flow!



Increasingly permeable,
These rocks were more free
To attenuate current
As was shown with MT.

“With liquid in pores
Resistivity falls.”
This stated Archie
In his well known law.

It falls if this liquid
Conducts very well,
Otherwise I’d pay you
To drill oil wells.

$$\rho_{ROCK} = \rho_{FLUID}\ A\ \phi^{-m}$$

It should be no surprise,
What we see with MT:
'Neath high cordillera
Lie conductive anomalies.

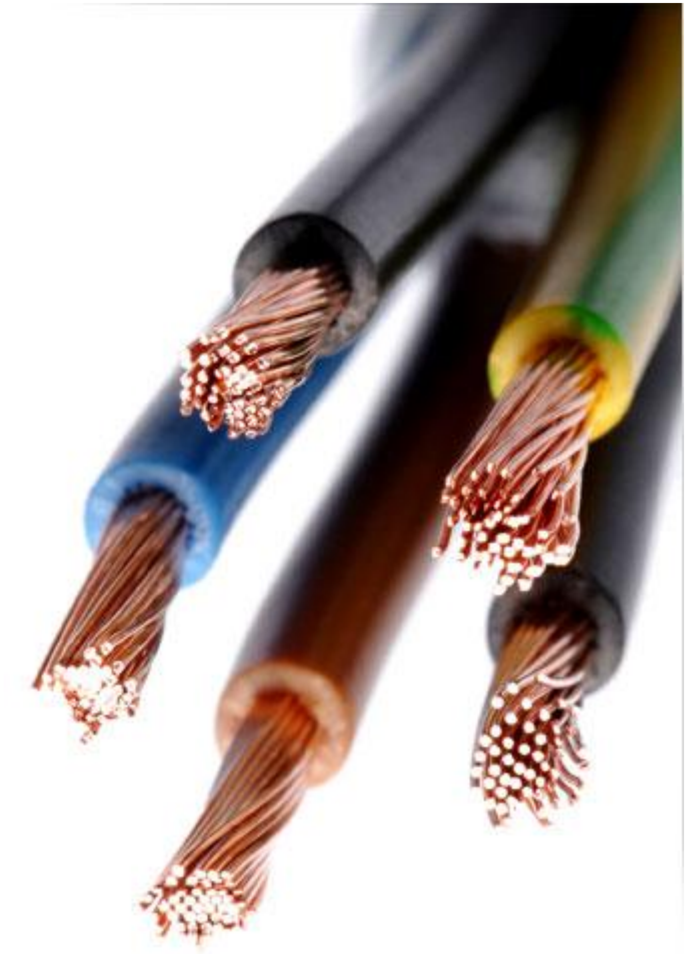
Fluid alone's not
Decreasing the rho,
Changing mineral structure
Could this also show.

But how to change structure?
How can this be?
Is a rock not a rock,
Like a tree's just a tree?

Serpentinization!
Yes, this is how!
Listen intently, and
I’ll explain now…

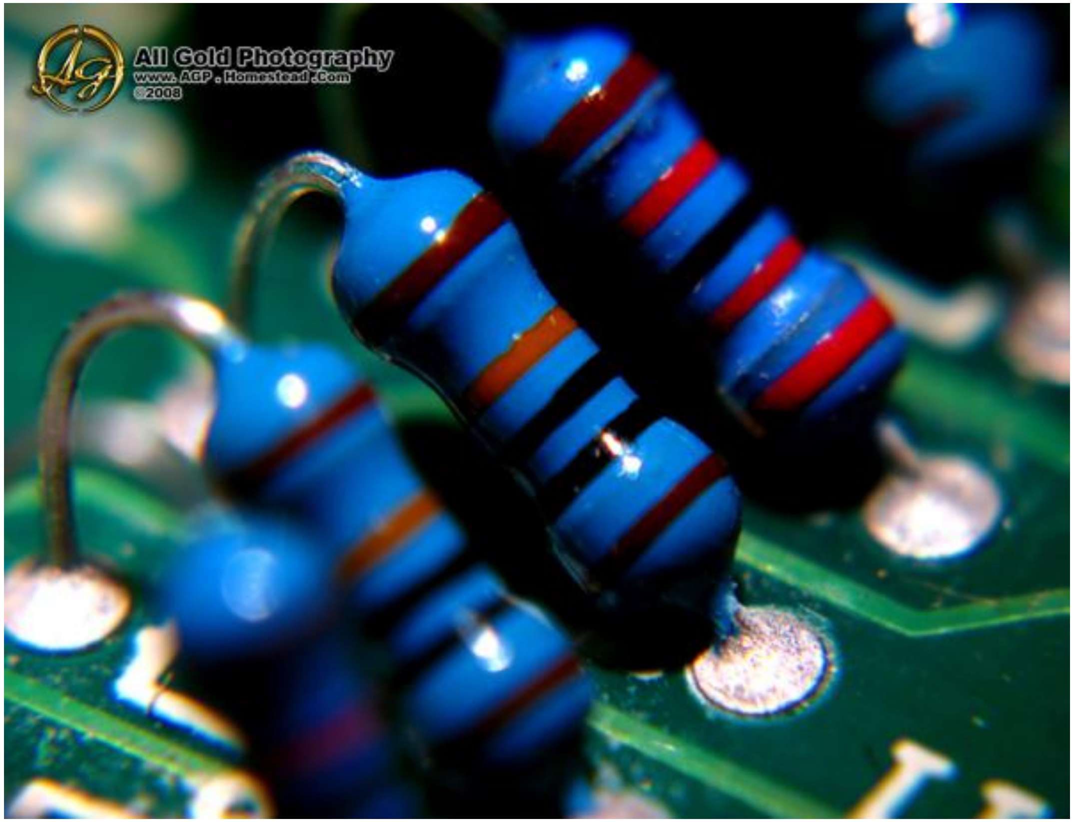
This process that alters
The chemical structure,
Forms serpentine minerals
But are they conductors?

Is this all you need?
No warm salty water?
With no need for Archie,
Or melting, or fracture?



Not quite exactly,
Listen, here’s why:
This stuffs resistive
As long as it’s dry.

But soak it in water
And there’s no surprise,
It starts to conduct well but
You’ll realize…



That seismic refractions
From far down below,
Have speeds that are measured
As really quite low.

But there's a conductor
Quite shallow and queer,
Magnetotellurics has
Shown it quite clear.

The *Cascadia region*
Is where this is found,
Fifty kilometers
Under the ground.

It's hot way down there!
Might this be it?
Could melting of rocks be
Causing the blip?

"Fifty kilometers?
Should it *not* be hot?
This is quite normal!"
Or so I thought…

There's a smart chap!
That man with the beard,
He has proposed something
Really quite weird.

"*A shallow asthenosphere*
Hot and convective!"
(He says this would make
The earth less resistive.)

But what lies below this,
One can't be sure,
We know it's quite hard
To see 'neath conductors.

The region in question,
In southwest BC,
Has just proved to be
Martyn’s hot cup of tea!

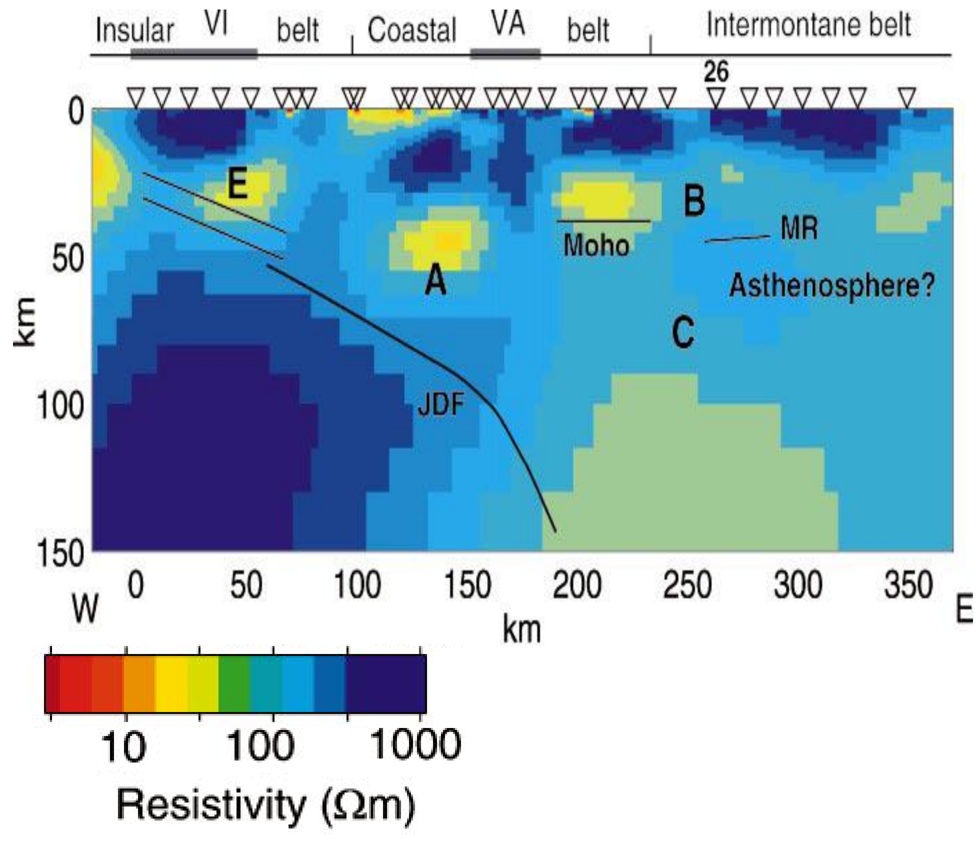
The place that he researched
Has lava and hot springs,
Supporting the notion
That something is melting…

So how much rock melts?
I know some might ask me,
>4 percent changes from
Hard into squishy.

Sure this makes sense far
Beneath backarc crust,
But what as we move closer
To the west coast?

As we go westward
We see quite a shock -
Beneath Juan de Fuca lies
Resistive bedrock!

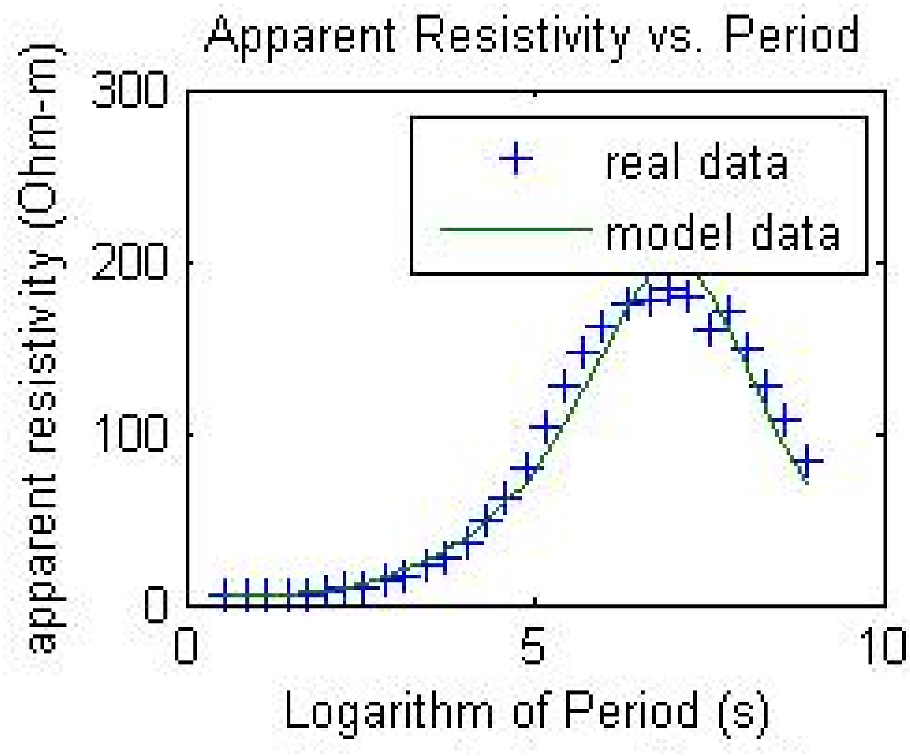
This shallow asthenosphere
Shows up quite well,
Except further west 'neath
The Insular belt.



But could it be minerals?
Big pockets of graphite?
Would this let conduction
Reach much greater heights?

The minerals in question
Would not just appear,
You'd need some subduction,
And CO_2 here.

If graphite were present,
Then what would we see?
A sudden sharp drop in
Apparent resistivity.



And this is precisely
What’s shown in the data,

But is it from graphite?

And this is precisely
What's shown in the data,

But is it from graphite?

Or water?

And this is precisely
What's shown in the data,

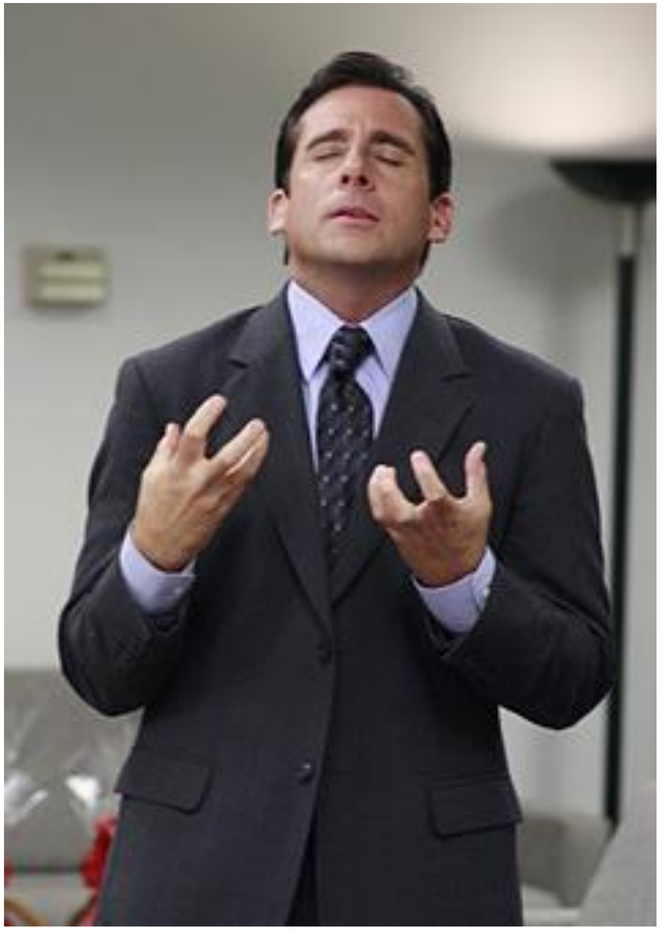
But is it from graphite?

Or water?

Or lava?

These are the questions
That often will surface,
Such is the problem we
Call non-uniqueness!

So many models, yet
Which one to choose?
How can you know which
Will win or will lose?



Many great theories
Proposing solutions,
I wonder if there can be
Just one conclusion?

The anomalies present
Present quite a problem:
How can we ever know
Just what creates them?

Who will we go to
To find out the truth?
Don’t look at me,
I’m only a youth!

Here’s the solution,
I’ve got a plan!
Leave it to Dennis,
And his graduate clan!

But if to them only
This puzzle does fall,
Then why would we take
GEO 424?

“Quaecumque vera!”
The U of A’s saying,
Reminds us that truth
Is there for the taking!

Look at these students
All cheery and bright,
I’m sure at least someone
Will have some insight!

While we are the future,
This problem still looms -
But don’t fret, the answer
Might sit in this room!

The End

(Or is it just the beginning?)