

Updated Results of the Geochemical Data Analysis of Homestake Elastic Wave Speeds

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Elusive Mineral Wave Speeds

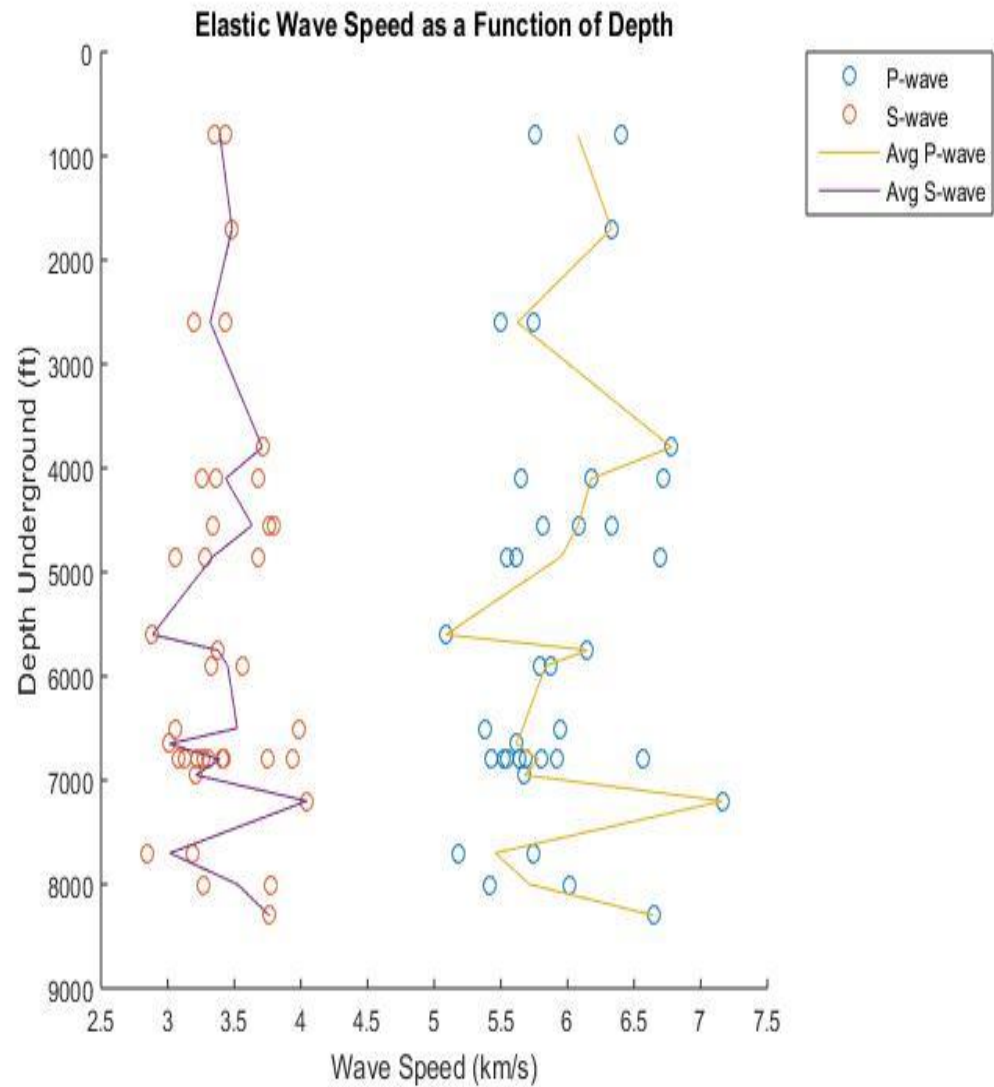
- Due to the nonexistence/elusiveness of certain mineral wave speeds, appropriate proxies were used (with the help of Victor and Gary):
 - Grunerite → Hornblende
 - Na-amphibole → Hornblende
 - Fe-chlorite → Chlorite
 - Mg-chlorite → Chlorite
 - Ankerite → Dolomite
 - Arsenopyrite → Pyrite

Table 1 (Right): Mineral wave speeds based on [1]. Those lead by ° were found in [2].

Mineral	P-wave velocity (km/s)	S-wave velocity (km/s)
Quartz	5.942	3.982
Hornblende	6.810	3.720
Biotite	5.074	2.453
Sericite/Muscovite	5.450	3.080
*Mg-chlorite	5.900	3.300
Intermediate Plagioclase	6.438	3.473
Rutile	9.357	4.653
° Graphite	3.060	1.860
Siderite	6.930	3.580
*Ankerite	7.013	3.965
Calcite	6.347	3.227
° Pyrrhotite	4.690	2.760
Pyrite	7.812	5.032
*Grunerite	6.810	3.720
*Na-amphibole	6.810	3.720
*Fe-chlorite	5.900	3.300
Garnet	8.415	4.776
Albite	6.070	3.940
*Arsenopyrite	7.812	5.032
Epidote	7.430	4.240
Magnetite	7.385	4.195

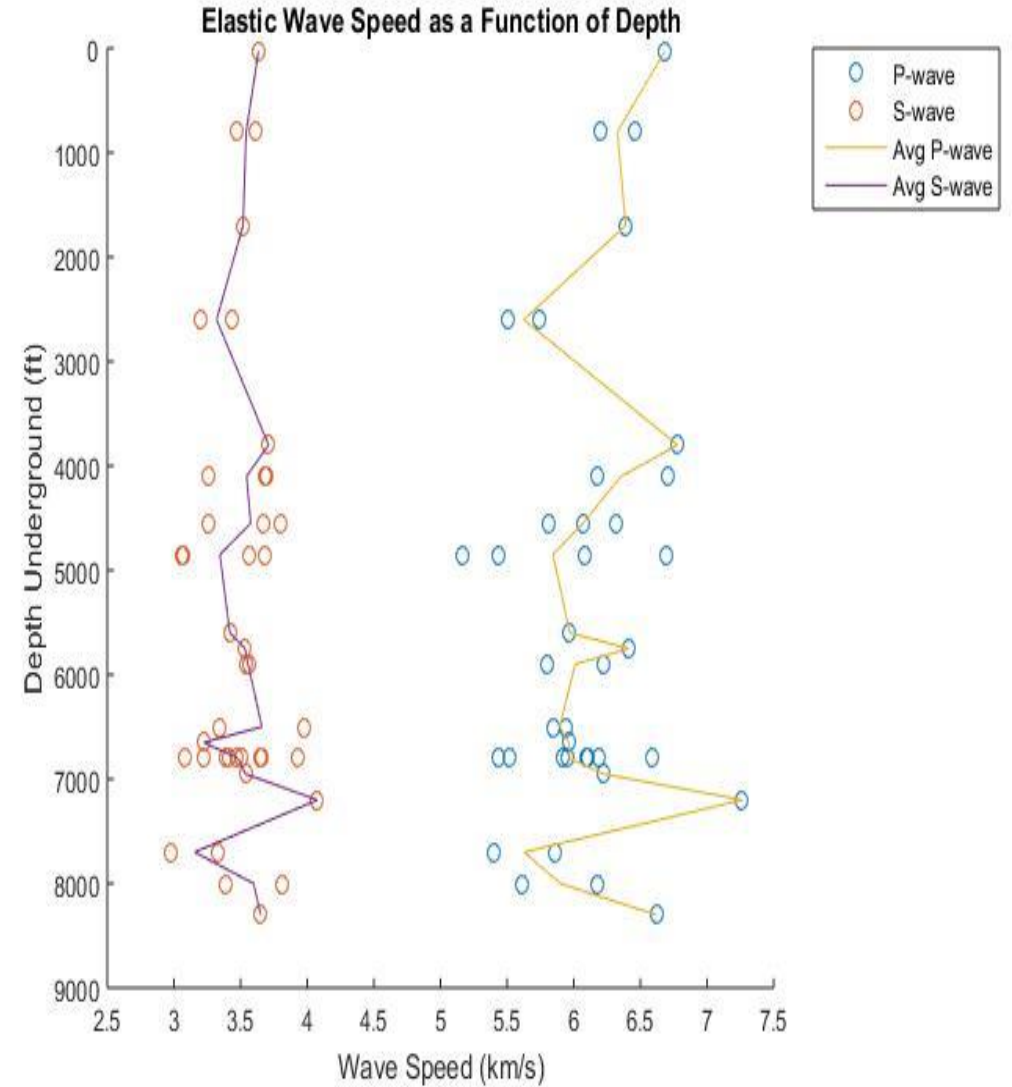
Initial Work

Fig. 1



Updated Work

Fig. 2



Observations

- Preemptive conclusions
 - Effect of using proxies: Smoothing—especially noticeable around 4000 - 6000 ft.
 - Does seem (on average) to be constant across depths: $V_S \sim 3.6 \frac{km}{s}$, $V_P \sim 6.3 \frac{km}{s}$
- Potential problems
 - Still quite irregular/large variations from above values
 - Do not yet know errors, so intricacies of model is unknown

Comments

- Last Meeting:
 - We saw: “[V_S] measurements at 2000 level: ~3500 m/s in the Homestake formation, ~3300 m/s in Ellison, and ~3700 m/s in the mixed rock environment near Ross.”
 - This is nearly met by geology work:
 - 1700 Homestake: 3.518 km/s
 - 2600 Ellison: (avg) 3.320 km/s
 - 4100 level Ross Shaft: 3.686 km/s
- Future Work:
 - Calculate errors associated with minerals and wave speeds
 - Compare with Gary’s 2000-level data: look at anisotropy, fracturing, porosity of rocks and their effect on depth-dependent wave speeds

Resources

[1] Mineralogical wave speed data retrieved from:

http://petrowiki.org/Isotropic_elastic_properties_of_minerals

[2] Carmichael, Robert S. *CRC Handbook of Physical Properties of Rocks*. v.2. (1982). Print.

[3] Caddey, S., & Geological Survey. (1992). *The Homestake Gold Mine : An Early Proterozoic Iron-formation-hosted Gold Deposit, Lawrence County, South Dakota*. Print.