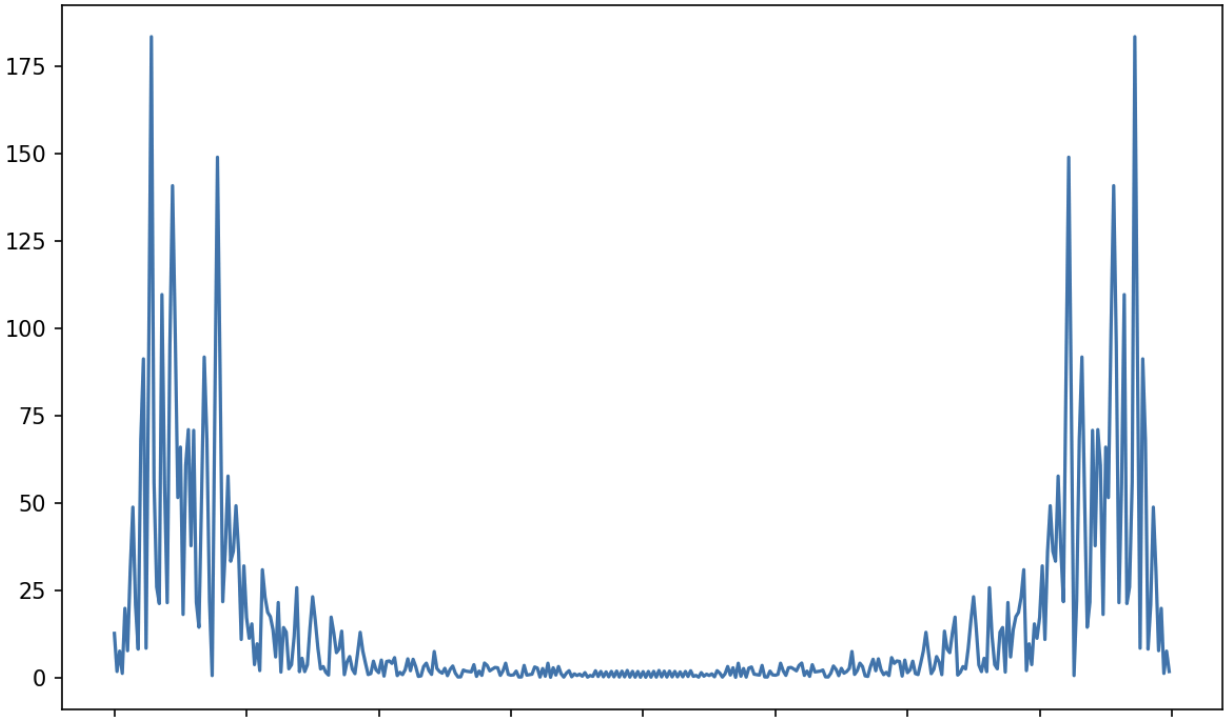
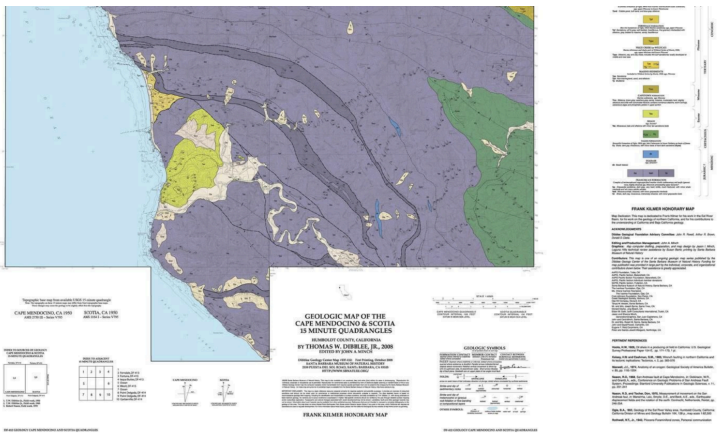
Is it possible to find a statistically significant correlation between seismographic data and local geological composition? I sought to find out, using the STanford EArthquake Dataset (STEAD), I began my search.

There were a number of preliminary explorations and data digestion that I did to understand the dataset, but the important part is how I ended up. I turned all of the waveforms for each sensor into one graph (per sensor). This graph was the output of the average relative amplitudes of each component frequency of a portion of the data from each reading. One of them looks something like this



Due to the nature of what I was trying to do, which was effectively eyeball a rather complex connection, I had to do a lot of preprocessing to get these graphs. And corresponding to these graphs, I had to find the geological data for them. Luckily, that is public information, which can be found at the National Geologic Map Database. These maps looks somewhat like this one below



Now. I initially had some promising results. I looked at how two receivers had similar peaks and troughs, and when I looked at their maps, they were very similar in composition!

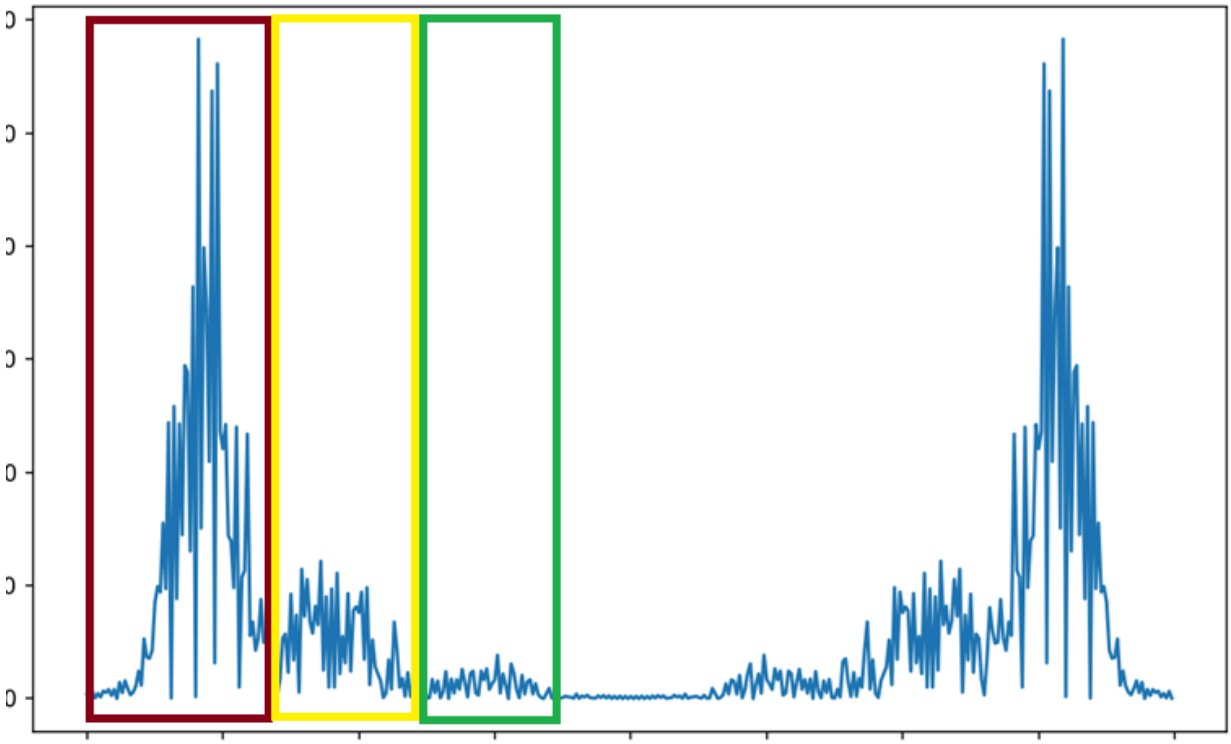
Except, woe is me, they were also within a couple of miles of each other, and that makes all of the

comparison moot to begin with. Whoops.

Later I found even more similarities between graphs that I double checked were not super duper close to each other and found…

Nothing. There was no similarity between the two locations based on geologic survey data. I checked some more disparate locations and measurements, and mostly found that they all had a few common resonant frequencies and nothing else. Certainly nothing statistically significant. In fact, part of the reason I felt comfortable eyeballing some of these relationships was that the standard deviations of a lot of my data was high enough to make subtler shapes dubious at best.

That all being said, there definitely *are* some interesting conclusions to be made here. For instance. This image here is one of the best ones I've found that clearly shows some of the resonant frequencies present in the crust. (I appear to have cropped out the axis representing what those exact frequencies are). Almost every other graph has its largest peaks along one of the three primary peaks in this graph. This suggests that there are common resonant frequencies in the earth (not surprising), and that there is not a strong connection between geologic composition and seismological data.



In thinking about why that might be, I realized that it is likely that there actually *is* a connection, but that due to the inherent complexity and chaos of the data that can be collected, it would most certainly be overshadowed and hidden by much larger patterns and structures. Akin to trying to find the resonant frequency of each metallic crystal in a tuning fork, the larger structure makes measuring the smaller details at this scale almost, if not completely, impossible.