Learning From Lithic Monuments at Marcahuasi, Peru

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Introduction

The Incan Empire can be characterized by a hybrid worship of native and Incan gods. By examining the empire in this way, it allows for the acknowledgement of varying and competing views and beliefs. The aim of this project is to test whether the locations of the distinguished land marks on this plateau in the Andean Mountain Range are related to known cosmological beliefs and customs of the populations who inhabited the site around 1400 A.D. The site of Marcahuasi itself is a plateau located in Peru, amongst the Andes mountain range. On this plateau, there appears to be dozens of anthropomorphic and zoomorphic figures. The site was originally discovered by Peruvian explorer Daniel Ruzo in 1953 and work has been continuing at the site since 2010. Surrounding the site are ruins of barracks and burial structures, called *chullpas,* that are characteristic of other Incan military construction found at other sites in Peru. Daniel Ruzo takes the presence and style of the architecture to mean that the Huancas originally inhabited the site until they were later violently absorbed into the larger and more powerful Incan Empire (Ruzo). The question then, is whether these six landmarks at Marcahuasi reflect known Andean cosmological phenomenon and whether the construction reflects either the occupied Marcahuasi population or the Pre-Inca population.

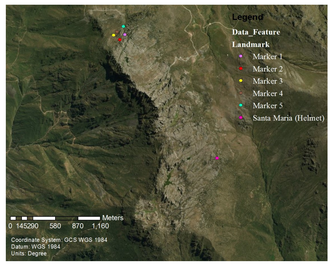
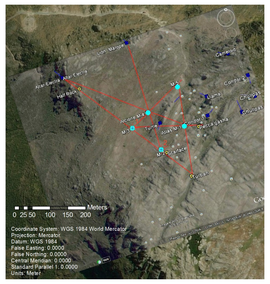


Figure 1. Marcahuasi site with landmarks symbolized

Materials and Methods

First, the DEM provided by Professor Carballo was imported into the Peru File Geodatabase (also provided). However, this DEM is problematic for my analysis because it does not extend to cover Santa Maria; it is instead concentrated on the other five markers. Next, an Excel (.csv) file containing latitude, longitude, elevation, and line of sigh of site data for the six landmarks was imported into the Peru geodatabase. The six landmarks were exported from the attribute table to a separate events feature class. These landmarks were symbolized as to more readily see the spread of the monuments. Ultimately, I used NOAA Solar Calculator to determine sunset, sunrise, and azimuth projections for July 1, 1400 at noon for each landmarks. The images were then georeferenced so that the projections aligned with its specific landmark. This analysis is also important in understanding the Inca-Huancas because researchers do not know if the landmarks were created by early ancestors of the Huancas or if they were built once the Incans gained control over the Marcahuasi area.

Figure 2. Marcahuasi site with georeferenced relationship between Markers 1 through 5 and the Pleaides constellation



Results

In order to reach a conclusion, I tried several different types of analysis. These analysis included Sun Position/Hillshade Analysis, Solar Radiation Graphics (Sun map), and attempted to manually input azimuth, zenith, sunrise, and sunset data into my GIS. However, I ultimately ended up using the NOAA Sun Calculator to visualize the sunrise, sunset, and azimuth projections for the Santa Maria. The next step was to establish vertices that reflected the line of sight orientation of each marker. Because of the time constraint of this project, this analysis was only preformed on Santa Maria and Marker 2. Since Markers 1 though 5 already have an established connection to the layout of the Pleiades constellation, it is unlikely that these markers have a relationship to the orientation of the sun. That being said, it seems that there could be a connection between Marker 2 and the path of the sun rise. They are closely oriented but as the distance of the segments increase, so does the distance between them. This could mean that while the orientation does not match the sun rise exactly, the appearance of the horizon/sun rise might and the difference in the angle might not be visible to the naked eye. The COGO Angle-Distance 2 point line tool allowed for the establishment of the line of sight for both Santa Maria and Marker 2, respectively (at N 45º E and N 69ºE). On the other hand, Santa Maria and the sunrise do not seem to be significantly correlated. This analysis revealed that while the line of sight for Santa Maria does align closely to the sun rise visualization, it is unlikely that the orientation of Santa Maria was based on it. This is because there is a slight difference between the sun rise projection and the line of sight for Santa Maria. However, it could be that this difference was caused by error in data collection or if the difference represented in the map is not as significant when looking from the actual object. Because of this, it is recommended that further analysis address these issues. Further analysis on the relationship between the landmarks at Marcahuasi and the sun's position should include important days in the Andean cosmology and religious holidays. Also, further analysis should include different times during the same day to see if the sun's path differs significantly according to time of day.

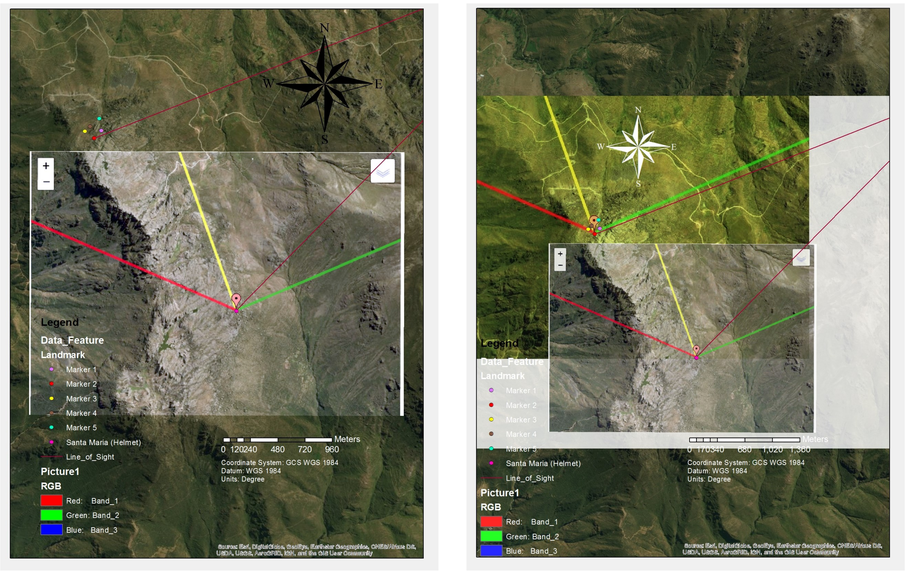


Figure 3. NOAA Sun Calculator Visualizations of Sunrise (green) Sunset (red), and Azimuth (yellow) of Marker 2 and Santa Maria, respectively

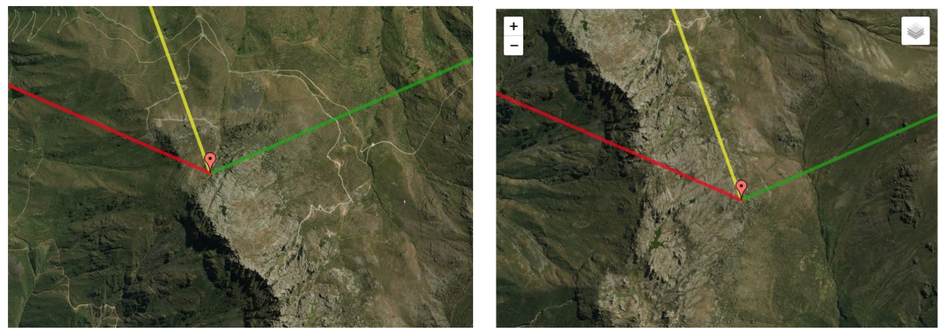


Figure 4. NOAA Sun Calculator Visualizations of Sunrise (green) Sunset (red), and Azimuth (yellow) of Marker 2 and Santa Maria, respectively

The use of DEM, line of sight, and NOAA solar data combined allowed for a complex analysis of the orientation of the Santa Maria (helmet) landmark and the relationship between it and the sun's position. The conclusions from this analysis could mean that the stone forest of Marcahuasi was the creation of a Pre-Inca influence population of Huancas or that the landmarks reflect a compilation of Andean beliefs and cosmology that is too complex to prescribe to one community.

Conclusions

As mentioned previously, it has already been established that the locations of Markers 1 through 5 is related to the orientation of the Pleiades constellation. Examination of Andean cosmology lead to a wide variety of astronomical phenomena that could possibly have a relationship with the orientation of certain landmarks. But because of the limited time span for this project, the sun's position in the sky was the only variable that could be analyzed at this time. That being said, each marker should be tested for a relationship with the sun's position because of the importance of the sun god Inti.

In the future, I would like to see more solar radiation graphics and other solar positioning-type analyses should be conducted for every monument at the site of Marcahuasi. For the landmarks that do not have a relationship with the sun, they should then be analyzed for other possible connections between their orientation and other astronomical phenomenon, such as eclipses.

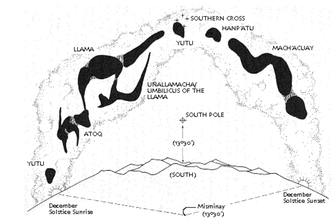


Figure 5. Important constellations in Incan cosmology

To conclude, while ArcGIS can be extremely helpful to archaeoastronomy, it is a completely different type of GIS than what we learned in class. There are very different methods of analysis that are required to compare landmark orientation with cosmological phenomena. Going further I would suggest that the class explore analysis types from a wide variety of topics and not limiting to just least-cost path analysis and resource availability.

Literature Cited

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Further Information

More information on the site and the ongoing projects is available through Marcahuasi-Ruzo run by the son of explorer Daniel Ruzo, Luis Ruzo.

https://www.marcahuasi-ruzo.com/