Apr 8th, 1:00 PM - Apr 22nd, 6:00 PM

Joint Orientation Readings from the Gorge of Massies Creek, Greene County, OH

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Abstract:

It is often assumed that jointing in the dolomite bedrock of Massies Creek Gorge influences the course that the stream follows. These assumptions are based off of knowledge from previous work. In order to provide evidence for or against these assumptions, strike and dip measurements were taken on vertical joints, or fractures, within the bedrock walls of the gorge, with the focus being on the strike. These measurements, numbering 315 in total, were taken on both the north and south walls of the gorge, as well as in locations outside of the gorge, again on both the north and south sides. Care was taken to avoid any collection bias to get data that better fits reality, avoiding jointing that resulted from rockfalls or roots. These measurements, consisting of azimuth orientation readings, were then input into various programs, specifically Stereonet Desktop and Oriana, to analyze the statistical distribution of the horizontal orientation. This was done with the purpose of determining whether or not the formation of Massies Creek gorge was influenced by jointing in the Cedarville and Springfield dolomites. Compared with satellite imagery of the gorge, this data shows the relation between the joints and the stream course. It is concluded that there is very likely no correlation between the orientation of joints, and the stream's course.

Goal:

The goal of this project is to provide better understanding of the history of Massies Creek Gorge and its formation. This will allow the Geology department to teach future students with more recent and localized data.

Methodology:

For this project, strike measurements were taken on vertical joints in the Cedarville and Springfield dolomites along the walls of Massies Creek Gorge. To avoid collection bias, care was taken to avoid focusing on jointing perpendicular to the gorge path, as these were the easiest to find. In practice, this meant flat surfaces along the cliff faces were examined to determine whether they were joint planes. The measurements were taken using a combination of Brunton compass readings and the use of the Stereonet Mobile app developed by Rick Allmendinger. The measurements were then inputted into Stereonet Desktop to determine general trends, and to get an overhead view of the distribution of readings. After a suitable number of readings were acquired, they were inputted into Oriana, a statistics analysis program, to get the statistical distribution of orientations for the final data (Fig. 2-6).

Results:

The mean orientations for each site are nearly perpendicular to the stream course, with site 2 being the only one with a p-value of less than 0.05. With the exception of site 5, which is well outside of the gorge, all sites exhibit mean orientations that suggest a preferred orientation. This preferred direction is nearly perpendicular to the stream's course along the study area. This lead to the conclusion that there is no relation between joint orientations and the current course of Massies Creek.

Recommendations for Further Work:

One area that I would suggest further work be done in is looking closer at the areas outside of the gorge. If I had more time, I would definitely have wanted to get more data regarding jointing in the surrounding areas. This could be helpful to determine whether jointing has a preferred direction on a much larger scale than I was able to work with. I feel this could be an interesting focus for a future project.

Acknowledgements:

I would like to thank Dr. John Whitmore and Thomas Rice for their advice and assistance over the course of this project. I would also like to thank my fellow students Hunter Kraynak, Maria LeFaive, Ethan Mansfield, and Michael McCain for their input and suggestions.

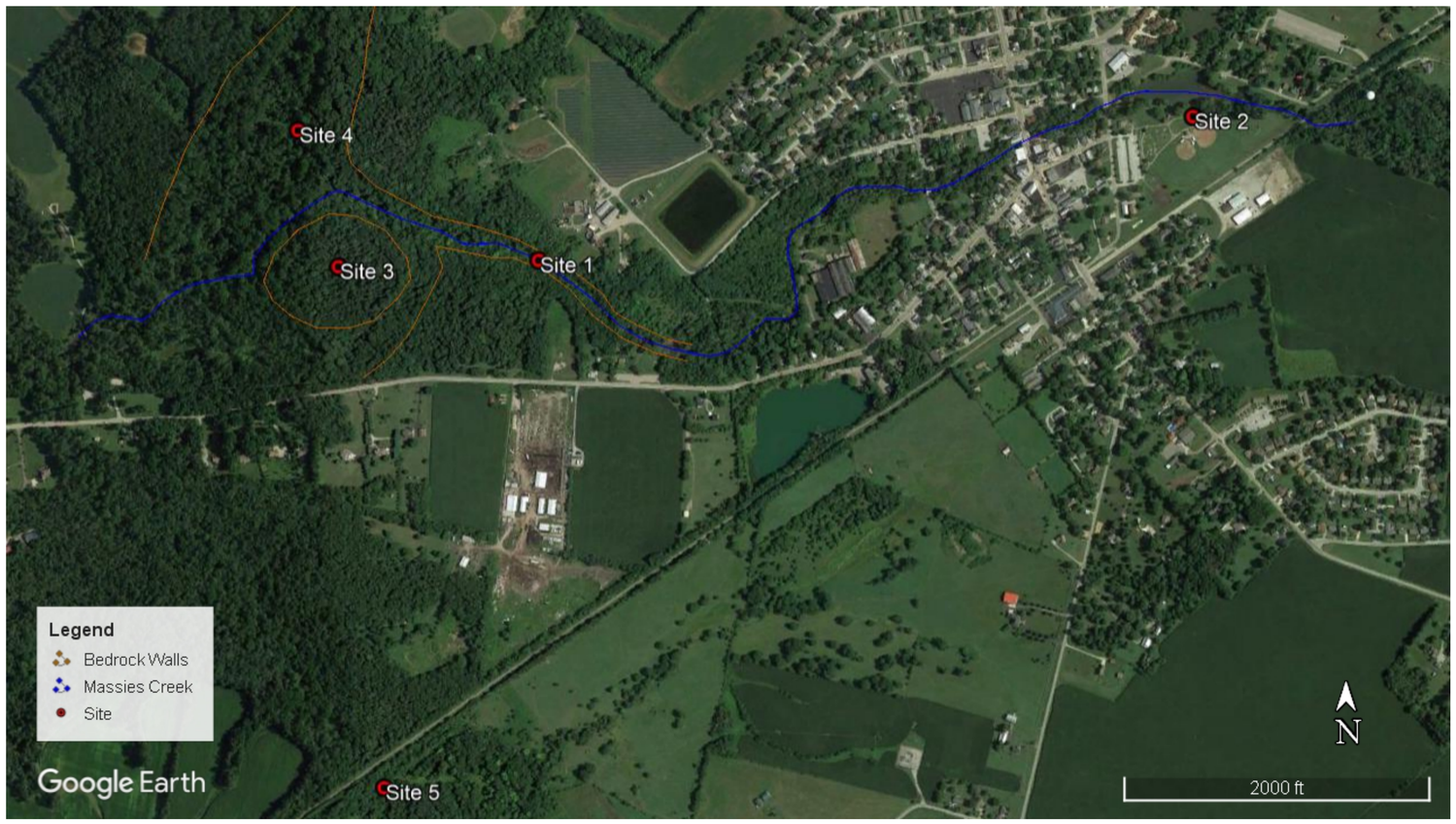

Fig. 1: Map generated using Google Earth of approximate site locations. Measurements were taken along the bedrock walls (marked in brown).

Fig. 2: A bedrock wall in the gorge along site 1. Note the corner where two joint faces meet, forming a nearly 90° angle.

Fig.3: Exposed bedrock from site 2. Note the lines of grass marking the locations of joints.

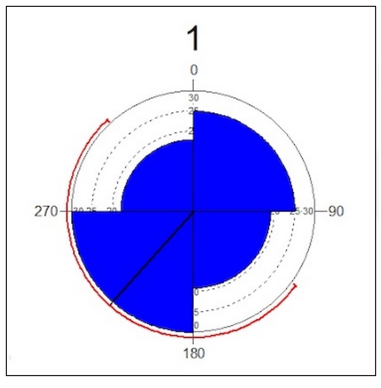

Fig. 4: Rose diagram for data from site 1. Mean orientation is 221.703° with a p-value of 0.501.

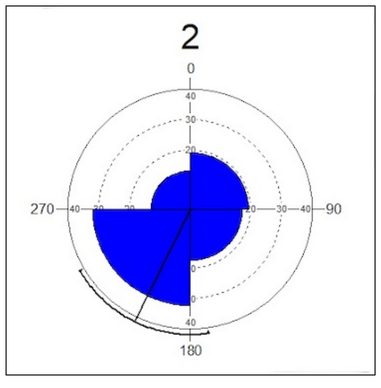

Fig. 5: Rose diagram for data from site 2. Mean orientation is 206.088° with a p-value of 0.006.

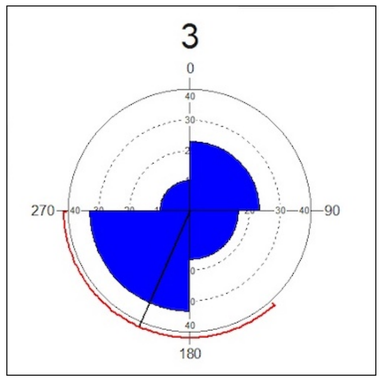

Fig. 6: Rose diagram for data from site 3. Mean orientation is 203.749° with a p-value of 0.236.

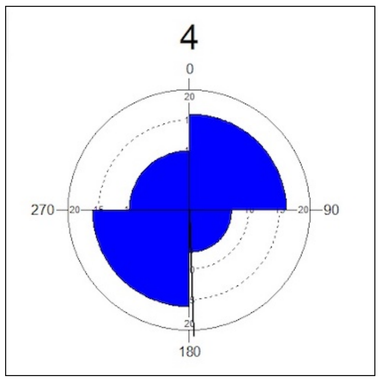

Fig. 7: Rose diagram for data from site 4. Mean orientation is 177.974° with a p-value of 0.850.

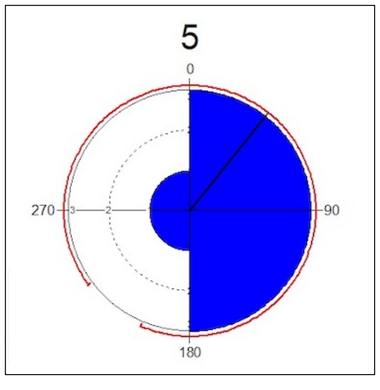

Fig 8: Rose diagram for data from site 5. Mean orientation is 38.448° with a p-value of 0.521.