GEOCHEMICAL AND STATISTICAL ANALYSIS OF PROJECTILE POINTS IN THE RGV

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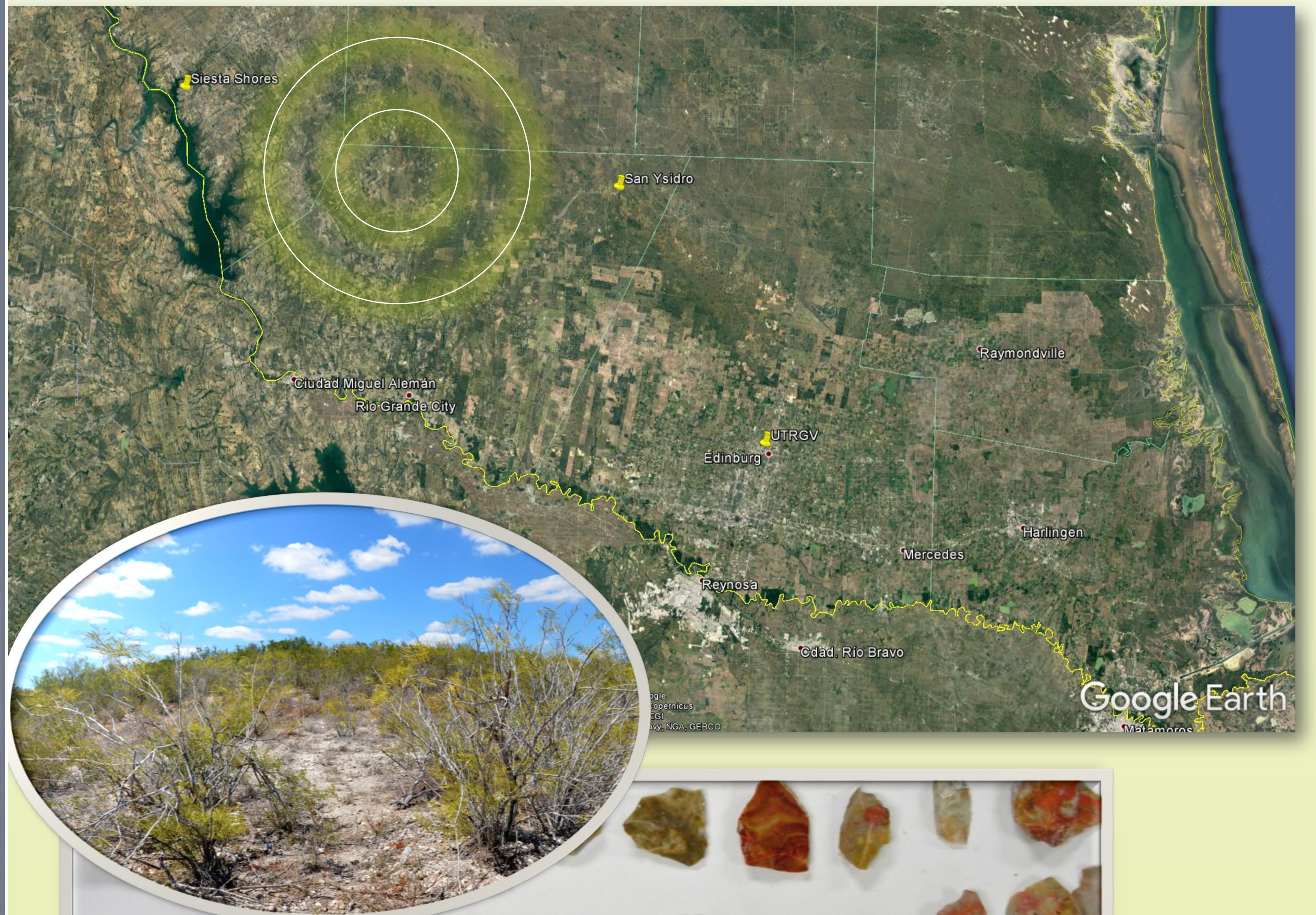
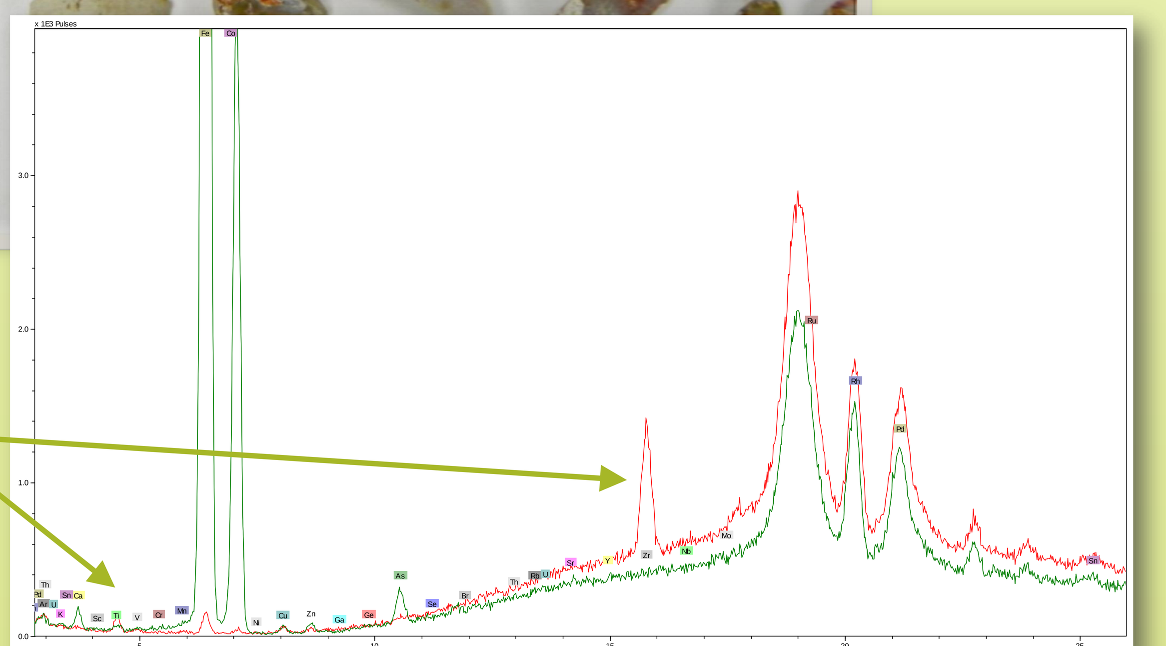




Overlaying the spectra of two samples shows the defining characteristics of El Sauz chert spectra: the significant Zr & Ti peaks.

Introduction:

Chert is one of the most important resources for prehistoric peoples, used to manufacture projectile points and tools for thousands of years. However, the RGV area is lithic poor, so poor that coastal communities resorted to using shells for their tools. It is assumed that local prehistoric peoples relied on gravel deposits for their lithic materials, which would have limited their options when manufacturing their tools. However, recently an outcrop of geochemically unique high quality chert has been identified and described in Starr County, Texas. Named El Sauz chert, it features smears of bright red and yellow in a dull grey background with opalized vugs. Is it possible to geochemically identify artifacts made from this resource?

In this poster, we review the pXRF data of 300 modified and unmodified lithic materials from the RGV in order to identify statistically significant ratios of elements in El Sauz chert. These ratios should help to identify artifacts made from this resource in future studies.

Method:

The portable X-Ray Fluorescence (pXRF) spectrometer detects elements present in a sample as well as provides a proportional quantification of those elements. The elemental intensities (displayed as spectra) were analyzed in Artax 7.4 using a Bayesian deconvolution to remove background and any interfering peaks. The quantified net elemental counts were analyzed with statistical treatments in Excel.

Sample Description:

300 pXRF spectra of modified & unmodified lithic materials from RGV including:

164 Projectile Points from collection of Nick Morales: 90 from Nuevo Leon, Mexico; 43 from San Ysidro, Texas; 31 from Zapata, Texas

16 Projectile Points from the collection of Don Kumpe

Data Analysis:

Null Hypothesis: There is no statistically significant relationship between elements of cryptocrystalline minerals such as chert that can distinguish geographic deposition.

Alternative Hypothesis: There is a significant relationship between elements of El Sauz chert that can distinguish geographic deposition.

In order to examine the relationships between the elements in our samples, we exported the quantified net counts into Excel and examined the data set for patterns and relationships. Because the Zr & Ti peaks are the most consistent characteristics of El Sauz chert spectra, we sorted the data set by Zr concentrations. Then we separated the samples with the least 10% of Zr into one spreadsheet, and the most 10% of Zr into another. This gave us 30 samples in each set, and we assumed that the top 10% set was predominantly El Sauz chert while the least 10% was most likely NOT El Sauz. We focused our investigations on the HFS elements Cr, Mo, Np, P, Th, Ti, U, V & Y; and the LIL elements Sr, K & Rb, because these elements provide insight into the depositional history of minerals. Then we used the data analysis toolpak in Excel to run regression analyses on each element's relationship and compared the resulting data. The results appear below.

Lowest % Zr Samples R^2 Values

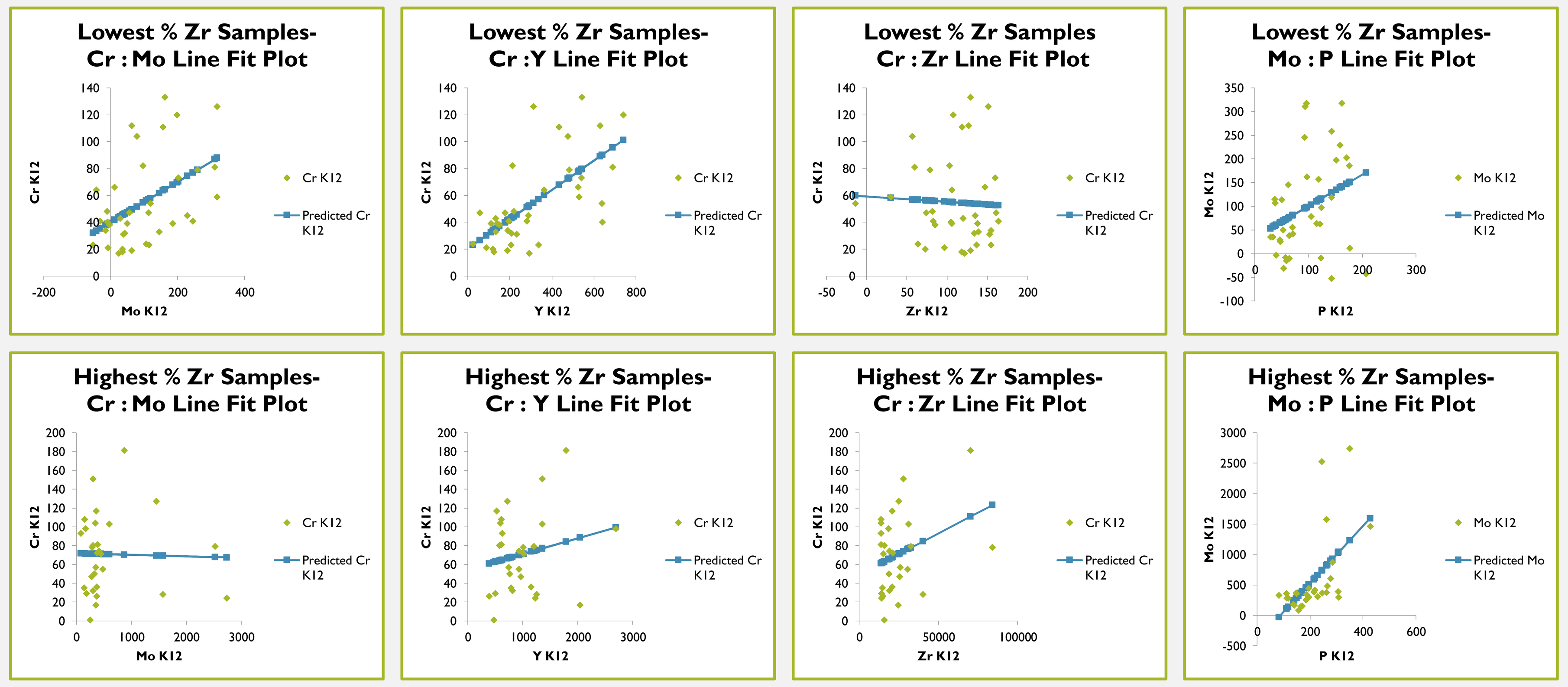
	Cr	Mo	Nb	P	Th	Ti	U	V	Y
Mo	0.21								
Nb	0.08	0.06							
P	0.23	0.07	0.04						
Th	0.04	-0.03	-0.02	0.10					
Ti	0.47	0.23	0.01	0.48	0.20				
U	0.13	0.24	0.18	0.27	-0.01	0.36			
V	0.06	0.03	0.03	0.06	-0.03	0.08	0.04		
Y	0.42	0.11	0.16	0.31	-0.03	0.21	0.27	0.11	
Zr	-0.03	0.05	0.02	-0.03	-0.03	-0.03	0.00	-0.02	0.02

Highest % Zr Samples R^2 Values

	Cr	Mo	Nb	P	Th	Ti	U	V	Y
Mo	-0.04								
Nb	-0.04	-0.04							
P	0.08	0.30	-0.04						
Th	-0.01	-0.04	0.06	-0.04					
Ti	0.07	0.17	0.06	0.48	0.14				
U	0.04	0.02	0.02	0.23	0.07	0.49			
V	-0.01	0.01	-0.03	0.12	-0.03	0.15	-0.02		
Y	0.00	-0.01	0.00	-0.04	0.24	0.00	-0.04	-0.03	
Zr	0.08	-0.02	-0.02	-0.04	-0.04	0.00	-0.04	-0.04	0.07

We noticed that in the set with high Zr, the 5 strongest relationships were between: Ti:U, P:Ti, Mo:P, Th:Y & P:U. In the set with low Zr, the 5 strongest relationships were between P:Ti, Cr:Ti, Cr:Y, Ti:U & P:Y. There is a clear difference between the strength of the relationship of Cr with Mo, Y & Zr in both sets: the set with low Zr showed a good relationship with Cr, Mo & Y and a negative relationship with Zr; while the set with high Zr showed a negative relationship between Cr, Mo & Y and a positive relationship with Zr. Additionally, Mo & P are more strongly associated in the samples with high Zr than in samples with low Zr.

Therefore, in lithic materials from the RGV with Zr concentrations similar to El Sauz chert, there are statistically significant relationships between the HFS elements Cr, Mo, P, Y & Zr. See fit plots below:



Conclusion

The HFS elements Cr, Mo, P, Y & Zr all display distinctly different relationships between themselves when comparing samples with differing levels of Zr.

Therefore, because samples of materials similar to El Sauz chert display strong elemental ratios that differ significantly from unrelated samples, we reject the null hypothesis.

Further research:

- When we placed the charts side by side on this poster for presentation, we noticed that one outlier in every plot stood out, and it was the same sample in every relationship. More samples from El Sauz chert should be analyzed to see if the relationship between Zr and Nb holds true despite greater variation
- Investigate gravel beds and projectile points in the RGV for their geochemical characteristics and variability
- Establish a database of lithic materials and projectile points to be used for comparison, identification, and to quantify the utilization of El Sauz and other local materials by prehistoric peoples.

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