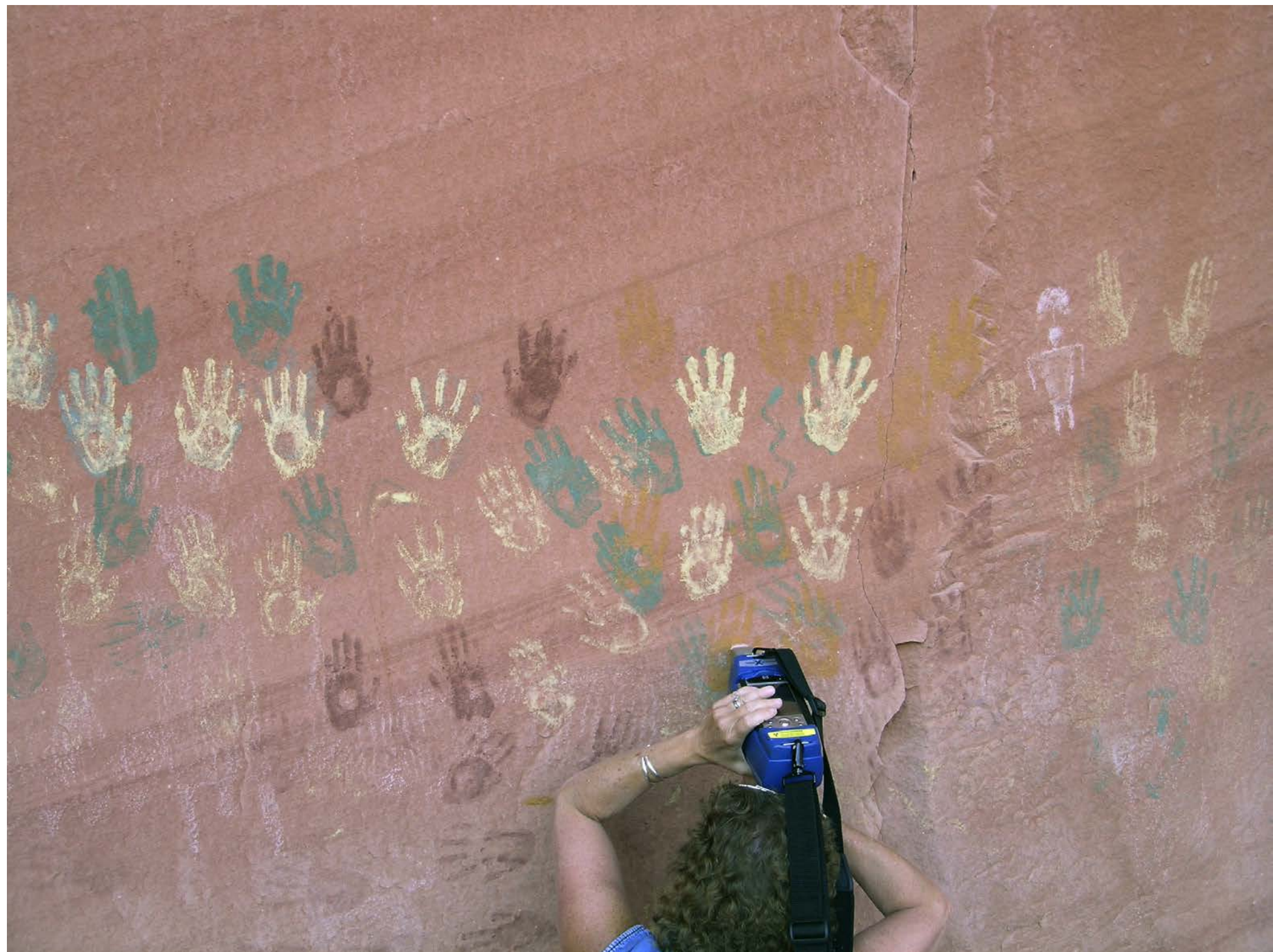


# pXRF in Pictograph Studies

## Robert Mark, Marvin Rowe, and Bonnie Newman

### Qualitative Analysis, or “Is the blue-green pigment a copper-bearing mineral?”



Basketmaker site in northeastern Arizona.

Fe	Bkg	Blue	Lt Green	Dk Green	Orange	Red	White
	5364	15850	5158	10564	16291	9295	4738
	10363	19551	5912		22200	9417	8935
	6146	19472	5962				17729
	6027	8552	4553				
	5773	17647	5575				
	5051	24536	4700				
	4721	12393	6120				
	5106	13986					
	5663	10719					
	5314	16746					
		11897					
		6599					
		15697					
		6934					
		12691					
		15350					
		7725					
		6157					
		7552					
		13233					
		13495					
		9889					
Mean	5953	13030	5426	10564	19246	9356	10467
SD	1613	4851	631		4178	87	6630

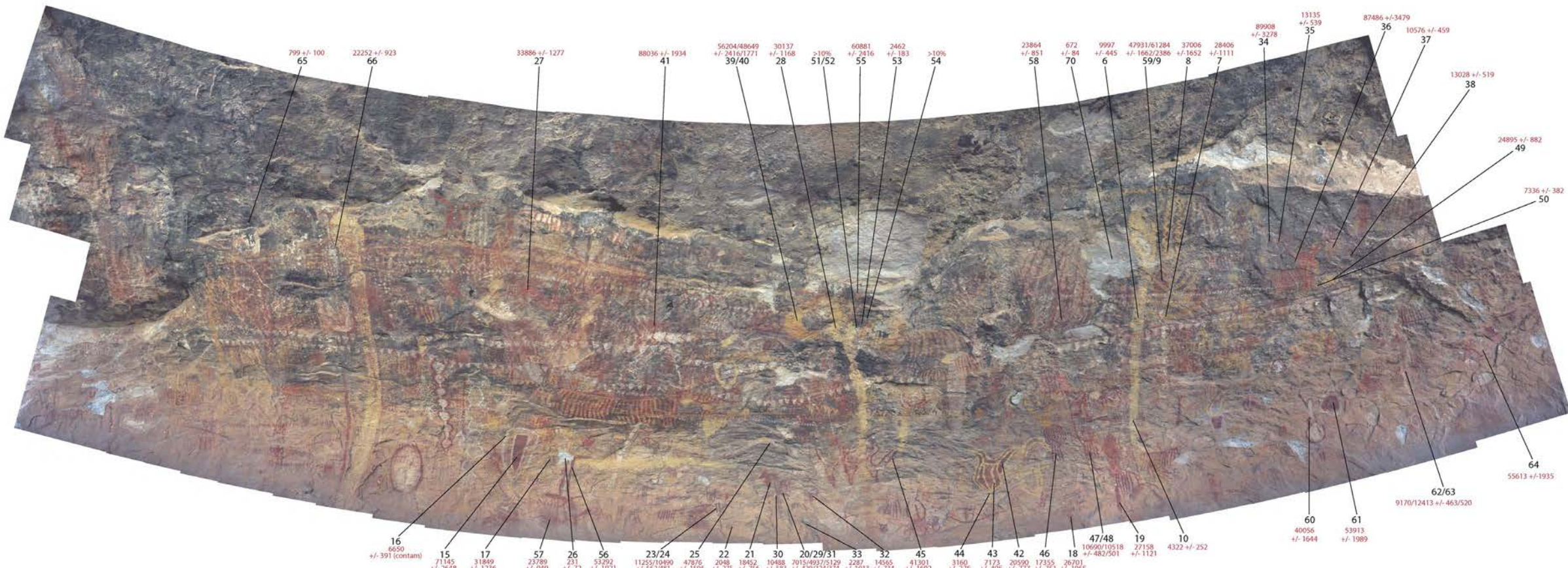
### Iron

However, the copper measurements showed no variation from the background (Bkg). We have concluded that the blue/green pigments are most likely produced from iron containing clays in formations such as the Brushy Basin Member of the Morrison Formation and in the Chinle Formation.

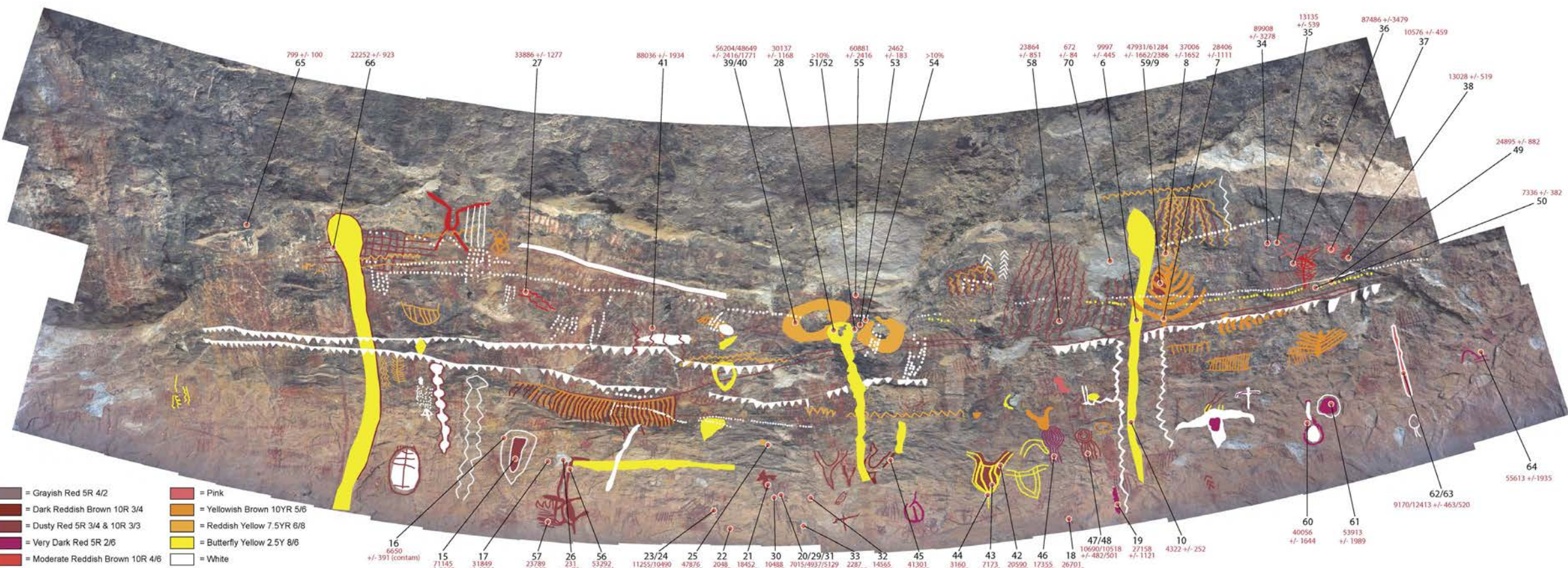


Outcrop of Brushy Basin Member, Morrison Formation, near Moab, UT.

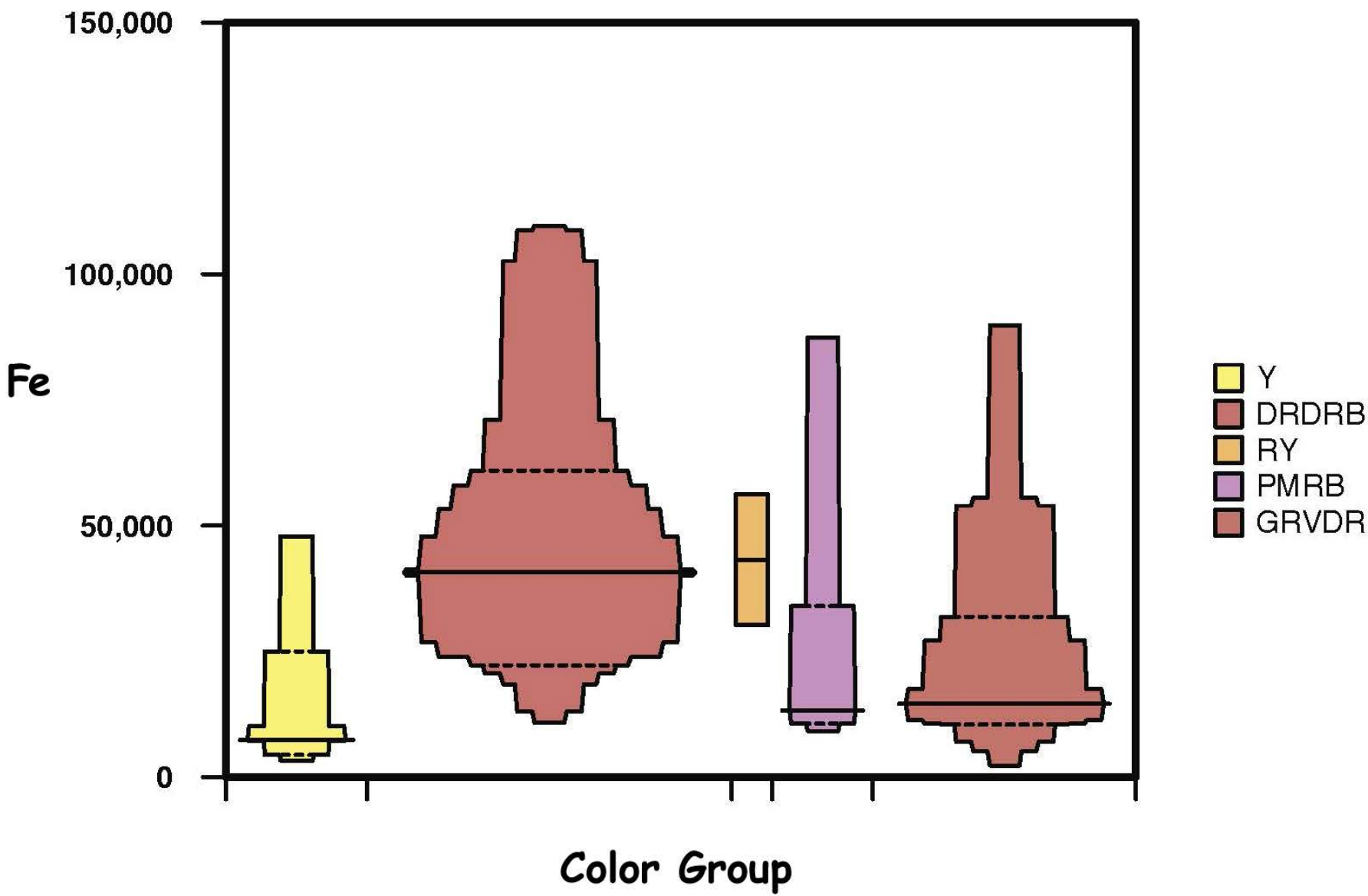
### Can we differentiate pigments in a complex panel?



Large panel in the Guadalupe Mountains of southeastern New Mexico. pXRF Fe values measured at indicated points. The image is digitally enhanced.



Glyph color classification from field measurements of Munsell values, and from the photographs.



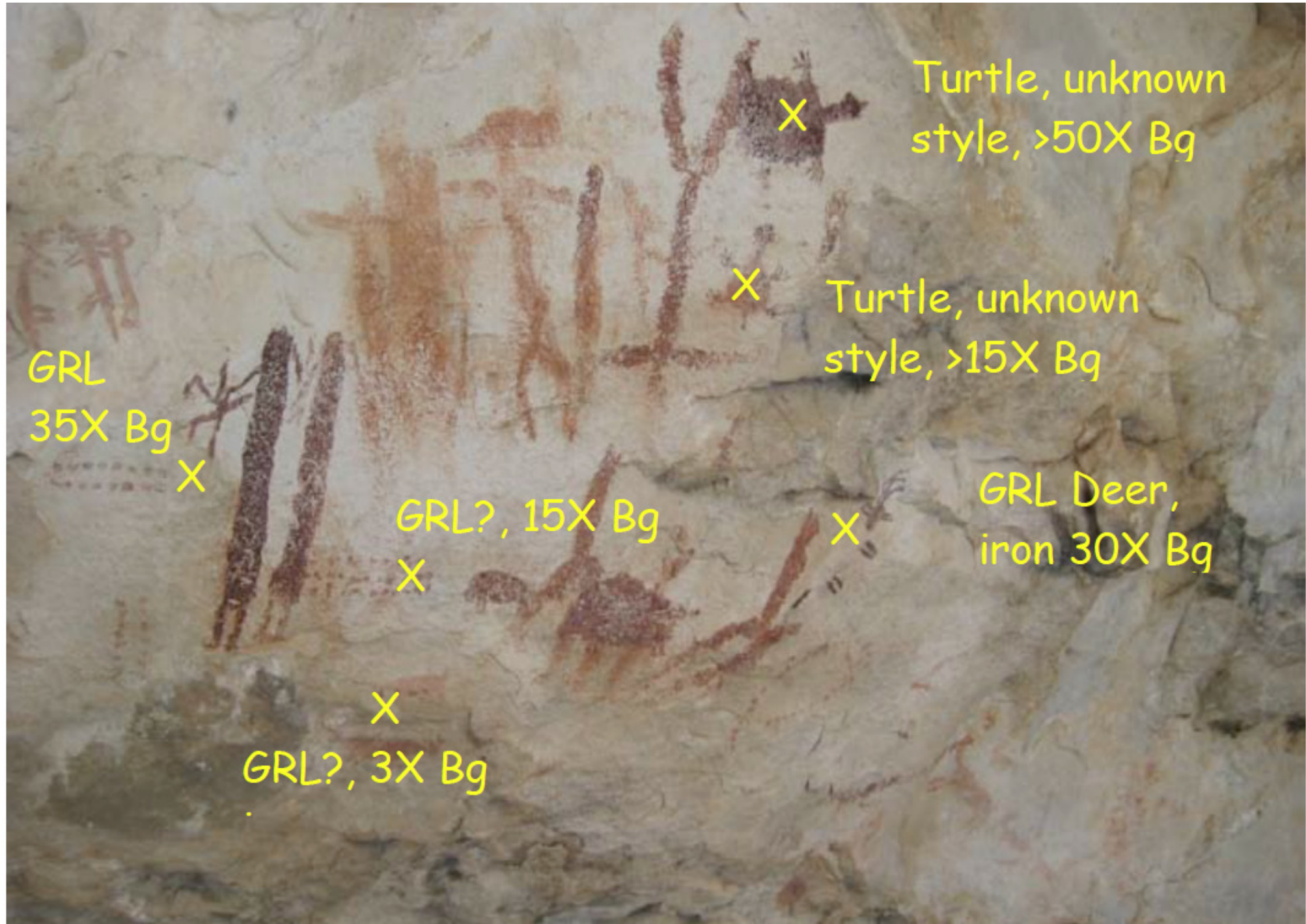
	Y	DRDRB	RY	PMRB	GRVDR
Mean:	14965.6	47385.2	43170.5	30850.6	25907.2
Median:	7336	40678.5	43170.5	13135	14565
Std. Dev.:	16217.1	32467.3	18432.2	33210.4	25896.4
Std. Err.:	6129.49	7652.61	13033.5	14852.2	7182.36
Minimum:	3160	10690	30137	9170	2287
Maximum:	47876	109654	56204	87486	89908
N:	7	18	2	5	13

The only significant component of the various reds, oranges, and yellows is iron. While Fe does vary with color, there is significant overlap among the pigments. Thus, the pXRF data did not help us to distinguish pigments at this site.

### Can pXRF help us select samples for AMS dating?



Detail of a panel in the Guadalupe Mountains. pXRF enables us to differentiate charcoal from manganese in the field and without taking samples. The black glyphs in this shelter are charcoal.



A portion of the painted surface in Lost Again shelter, in the Guadalupe Mountains, is about 1 m wide. There are a number of pictographs shown with widely varying iron signals. Therefore, we expect that at least four different paint recipes were used, implying different artists and potentially different ages. Bg is the background signal of iron from unpainted rock.

## Discussion

pXRF has considerable potential in the analysis of pictograph sites, however there are several issues that must be considered. For even semi-quantitative work these include the need for calibration in relevant settings, and to mitigate the lack of sample uniformity. Pigment applied to a rock surface varies in continuity, thickness, and line width. This leads to samples that include background rock as well as the pigment. Our experience suggests that even when the sample appears to cover the instrument aperture, considerable variation occurs. It is hoped that improvements in hardware, software, and procedures will ameliorate these problems, but much more research is needed.

For assistance with photographs, illustrations and/or field work, we thank Marglyph Berrier, Evelyn Billo, Raegan Buckley, Eric Dillingham, Angel Johnson, Jack Johnson, and Karen Steelman.