

Seriation in Rock Art Analysis

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Seriation has been an important tool for archeological analysis in America for nearly 100 years, but it has not been used in rock art studies as much as with other kinds of artifacts. Although rock art figures have characteristics similar to ceramics, for which usefulness of seriation was recognized early, rock art was not easily attained for laboratory analysis and was not perceived as having a long cultural time depth compared with potsherds. Therefore, it was not subjected to seriation analysis during the heyday of the method in the 1950s. By the 1980s and 90s, when rock art analysis was becoming more scientifically oriented, seriation was usually passed over for more computer-based statistical methods of ordering analytical units. The purpose of this paper is to show the benefits of the seriation method to rock art research. It can be applied to any geographical area, without commanding a detailed knowledge of statistics, to produce an inferred chronology when absolute dating is not possible due to money or cultural constraints, such as Indian or landowner opposition to sample collection. Examples of seriation analysis in central Montana from sites in the Smith River area (Figure 1) demonstrate how the method is applied to rock art and the kinds of results it can yield.

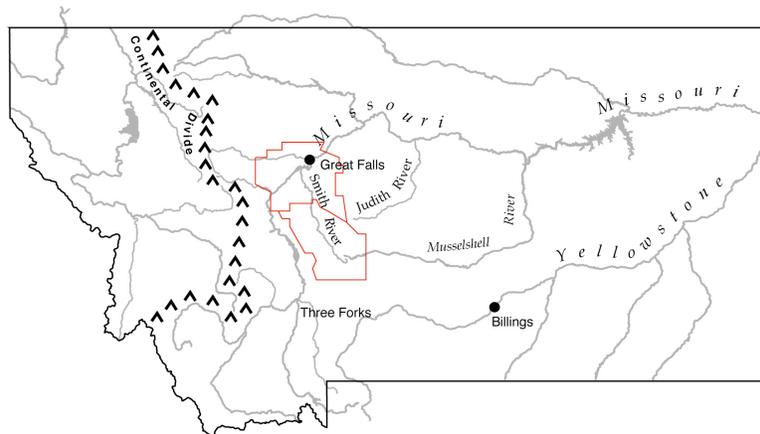


Figure 1. Central Montana study area, with Cascade (north) and Meagher (south) counties outlined.

The first comprehensive examination of the applicability of seriation studies to rock art was published in 1982 by David Whitley. At the time of Whitley's study, seriation had been used in only one other rock art analysis. Since Whitley's work, seriation has not become commonplace, but it has been successfully applied in more diverse regions.

Seriation is a descriptive method that is scientifically testable. It involves the manipulation of problem-defined types for the purpose of determining their relative age based on physical changes through time. This method produces the most consistent patterning of types from which a chronology can be inferred.

Types for the Montana study are based on attributes of the rock art figure, which is considered here as an individual completed illustration on the rock surface. It may be as simple as a handprint or as complex as an intricate geometric design, but it is recognizable as an item in and of itself and separable from other marks around it. The persistence of any rock art figure form (including technological attributes) is dependent upon humans transmitting form information within a given area during a particular time. Based on this assumption, the rock art figure is an artifact that is stylistically or adaptively neutral, which makes it an ideal candidate for seriation, since these kinds of artifacts have a low probability of reinvention, which is necessary for chronological inference. It is important to remember that seriation studies treat style in a traditional archeological manner where the analytical technique is used to analyze style rather than using style as the technique, which is often done in rock art research as a result of borrowing that approach from art history.

Two main methods of seriation are Occurrence and Frequency. In Occurrence Seriation type frequency is irrelevant, and types are considered only in terms of presence or absence in an assemblage. This kind of seriation is based on the assumption that types are distributed continuously through time. Frequency Seriation is also based on an assumption of continuous distribution, but unlike Occurrence, Frequency Seriation requires the arrangement for each type to form a continuous line and to form a unimodal frequency distribution.

The initial seriation analysis of Smith River sites in central Montana attempted both Frequency and Occurrence seriation. Frequency did not work in this area because this kind of analysis needs a large database in order to establish a unimodal distribution. For the Smith River, this meant using only sites with over 30 figures, an impossibility because most sites here do not have that many figures, and such results would be nonrepresentative. Therefore, Occurrence Seriation was selected as a better method because it is based on presence-absence data rather than counts. This allows the variety of paints and figures in the region to be used regardless of whether or not they occur in a site with many paintings.

Accurate results from Occurrence or Frequency seriation necessitate compliance with basic seriation assumptions presented by Ford in the early 1950s. The first assumption is that populations producing these cultural remains are relatively stable geographically. Most Smith River paintings appear to have been made by pre-horse hunters and gatherers who were not widely nomadic. In order to insure that defined types were limited in space, figures from sites

in Cascade County, the downstream northern portion of the Smith River, were not combined with figure types from Meagher County, the upstream southern part of the river.

The next assumption is that most sites were used for a short time relative to overall temporal use of the area. Therefore, to ensure each defined type did not span a long period, sites were omitted if determined to be multi-component based on the presence of superpositioning or the presence of more than three different kinds of paint when any two were known to be widely separated in time based on regional superpositioning information. Few Smith River sites are multi-component in this sense, so this limitation did not greatly impact sample size.

The third assumption is that analytical types gradually change through time. From general archeological evidence, the study area appears to have been almost continuously occupied since the Archaic Period beginning about 6000 B.C. However, further supporting gradual change over time is the absence of an abrupt break in the rock art sequence such that units immediately following the break bear no resemblance to units before the break.

The fourth assumption is that each artifact type reflects and can be used to measure cultural change through time and distribution across space, and the last assumption pertinent to Occurrence Seriation is that site and artifact samples are representative. For this study area, the site sample includes all major geographical areas within the main drainage and its tributaries. As already mentioned, in order to obtain a representative sample of artifacts (that is, rock art figures) in the Smith River area, it was necessary to use the Occurrence method rather than Frequency.

Smith River analysis types were defined relative to five seriation problems designed to determine the sequence of paint use and the sequence of figure types. Because such types need to be limited in time, attributes were chosen that previous studies of superpositioning and cross-dating had shown to demonstrate changes through time. After initial type definition it was still necessary to adjust selected attributes, based on experimental trial and error, to define types that produced continuous distributions.

Paint types in the study area were defined based on color and whether the paint was liquid or solid (that is, crayon). Figure types were based on form. Graphs were then generated that plotted paint or figure forms by the sites in which they occurred. This resulted in columns showing which types were located in which sites. Columns were then ordered to produce a continuous distribution. Overlapping types are assumed to indicate a closer relationship than those that do not overlap. Ideally, there is only one overlap per type, which suggests a neat and tidy evolution of paints and figures from time 1 to time 2, but seldom can this be accomplished during the first analysis attempt, if at all. It may take several tries to find types that are time sensitive. However, once the graph reflects the best continuum, it does not by itself reveal

which end of the distribution is oldest or youngest. Comparing the resulting information with other relative or absolute dating methods usually results in temporal ordering, sometimes with datable occurrences that better place chronological periods within absolute or archeological association.

Superpositioning at ten sites in the study area has demonstrated that paint kinds and colors changed through time. Therefore, seriation analysis began with paints. Results were expected to reflect superpositioning if paint characteristics accurately serve as chronological markers. Seriation additionally was expected to provide more details on the relative positions of paints, such as those that occur only at the top of superpositioning layers and could not be temporally separated through overpainting alone. Paints in the analysis provide a continuous seriation

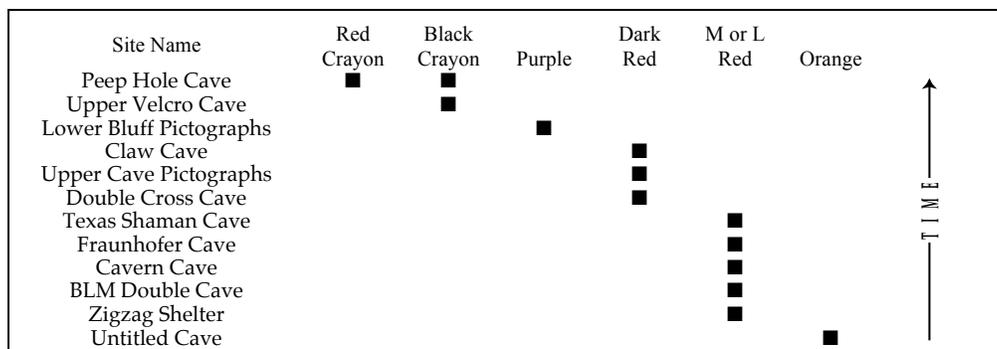


Figure 2. Occurrence Seriation graph of paint types in Cascade County (north)■

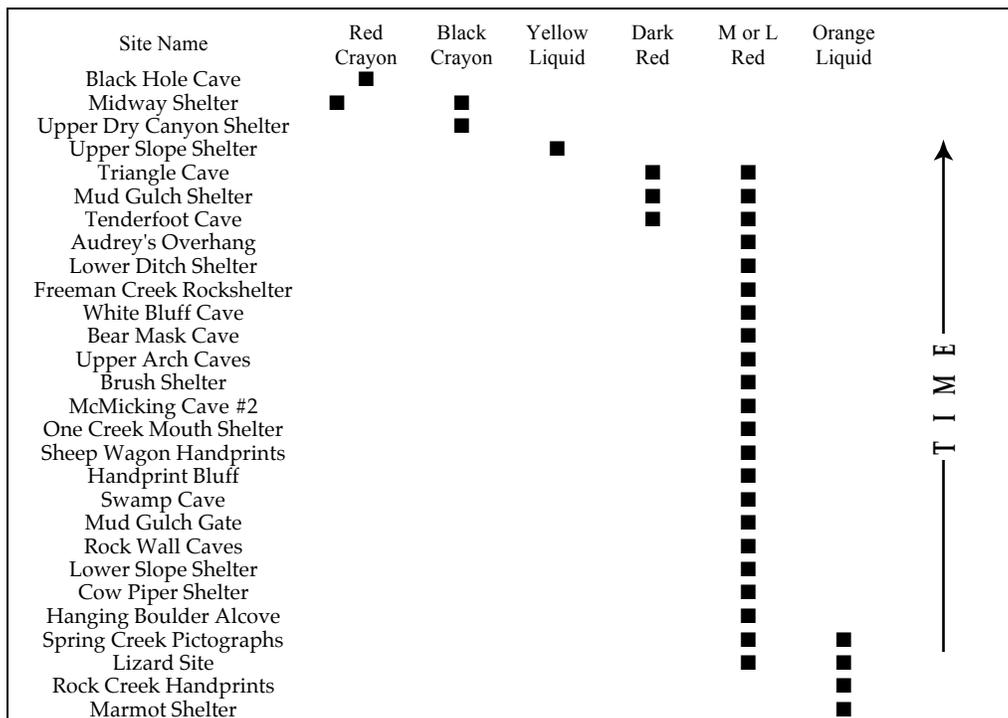


Figure 3. Occurrence Seriation graph of paint types in Meagher County (south).

pattern in which crayon is latest, based on superpositioning data. Therefore, orange liquid paint was determined to be oldest, and the resulting seriation order concurs with superpositioning. Orange liquid was followed by medium to light red, and then dark red. Relations among the other liquid paint colors and between red and black crayon could not be conclusively determined by this analysis.

Experiments found that generic figure classes such as anthropomorphs, zoomorphs, and geometrics are not sufficiently time sensitive in this area to sort with seriation. Although superpositioning and cross-dating indicate that nonrepresentational figures dominate early paintings and representational figures dominate later paintings, both occur throughout the sequence, (as Figures 4 and 5 demonstrate) and a continuous seriation pattern confirming a shift from the more abstract to the more realistic was not possible.

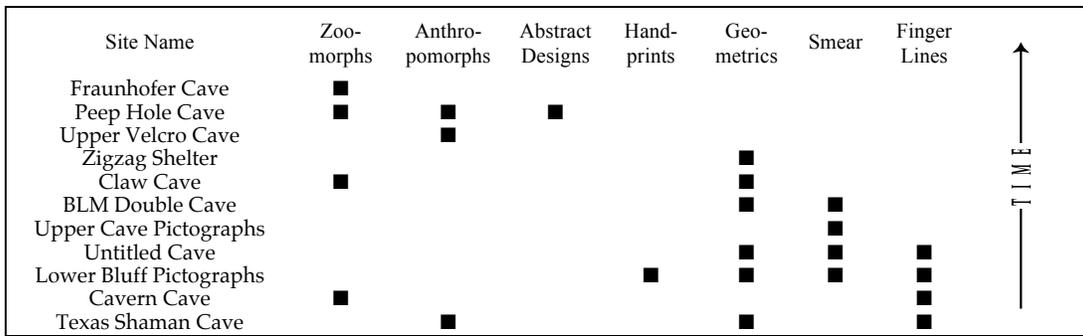


Figure 4. Occurrence Seriation graph of general figure types in Cascade County (north).

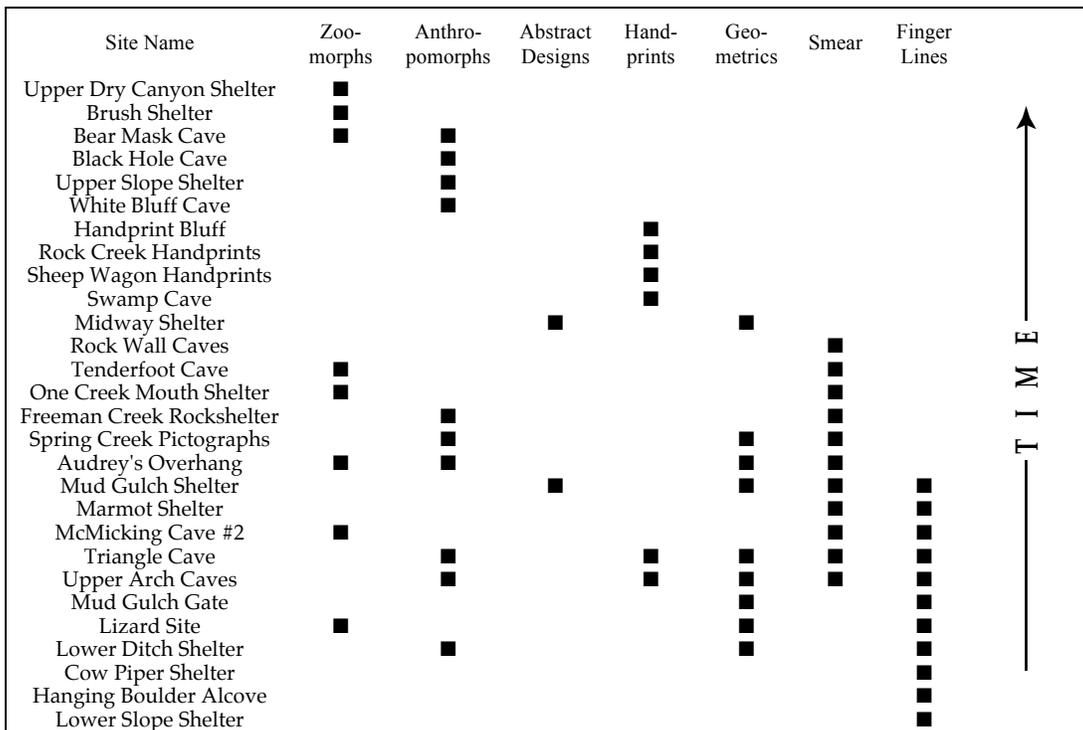


Figure 5. Occurrence Seriation graph of general figure types in Meagher County (south).

Because of unsatisfactory results using generic figure classes, more specific types were defined and seriated. Results show that the more detailed the type definition, the better the result. For example, when the cross, bear, and a motif of three fingerlines are seriated, a continuous pattern results, and based on paint data, the order indicates that the fingerline pattern is the oldest, as shown in Figure 6. A continuous seriation pattern also occurs when five more specific figure types are included with the southern sites, as indicated in Figure 7. Once again using paint data for ordering, the three-fingerline motif is the oldest.

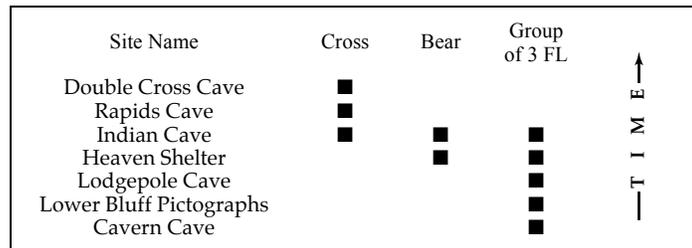


Figure 6. Occurrence Seriation graph of figure types in Cascade County (north).

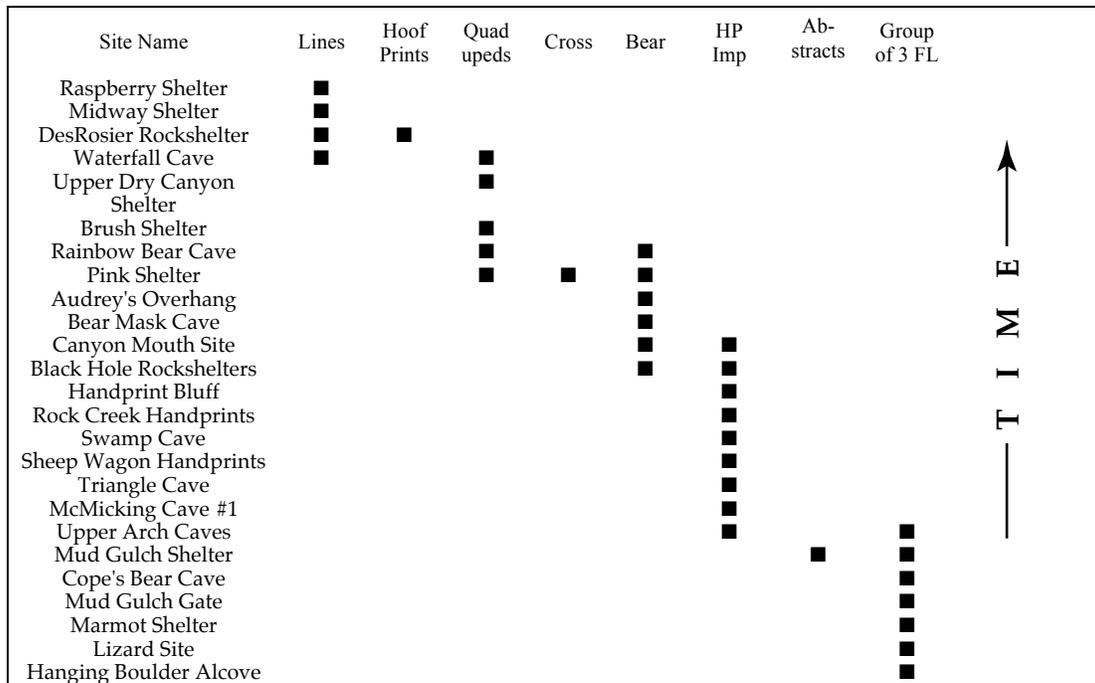


Figure 7. Occurrence Seriation graph of figure types in Meagher County (south).

Since initial attempts with figure types showed the advantage of using more specific attributes to refine large groupings, anthropomorphs were reexamined based on body shape, arm position, and presence or absence of digits. Graphs generated with these more specific types produce continuous seriation patterns. Specific anthropomorph seriation for the northern

part of the river (Figure 8) shows that humans with headdresses began early and continued until near the middle of the sequence, shield bodies and humans with digits were next, then armless humans, which overlapped with stick figures, are most recent. Upraised arms did not play a prominent role at these sites, and black crayon anthropomorphs were included only as a time reference for the latest paintings. However, in the southern part of the study area, (Figure 9) the sequence went from upraised-arm humans, to shield bodies, to armless bodies, to humans with headdresses, to those with digits, and finally to stick figures. Differences in specific anthropomorph type distribution between the two areas appeared upon closer examination to be the result of function rather than time. If ceremonial attributes of armlessness, upraised arms, and headdresses were removed from the analysis, general changes in anthropomorphic form follow the same pattern in both the northern and southern areas, with shield bodies preceding humans with digits, and then stick figures.

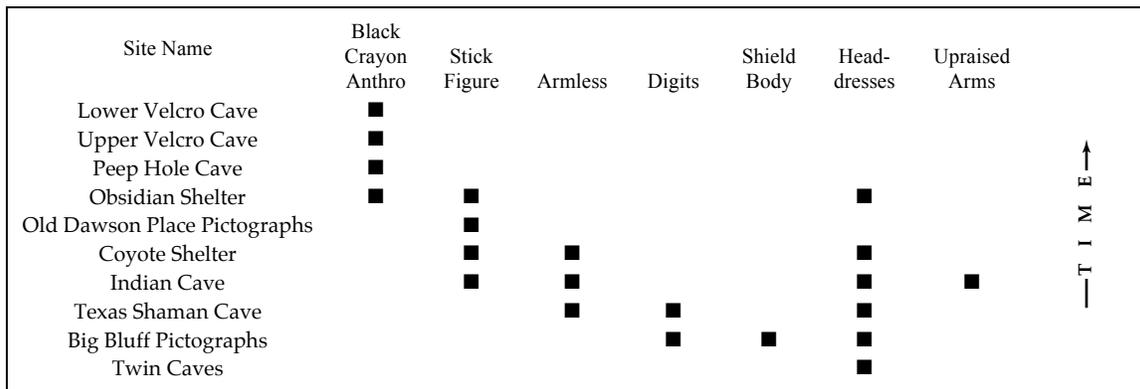


Figure 8. Occurrence Seriation graph of anthropomorph types in Cascade County (north).

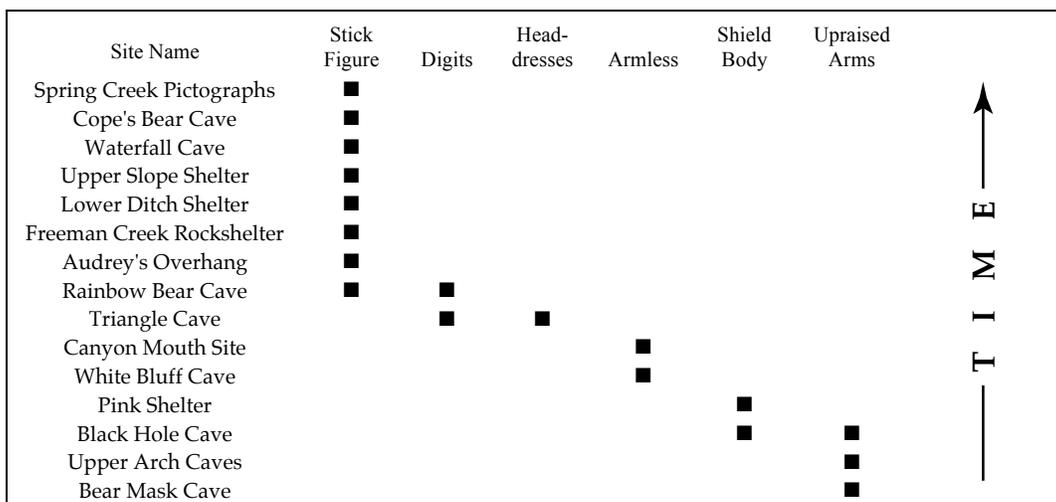


Figure 9. Occurrence Seriation graph of anthropomorph types in Meagher County (south).

New more specific body shape types were subsequently defined to test the validity of relative positions in time of shield and stick anthropomorphs (Figures 10 and 11). The Occurrence Seriation graph patterns for the new types confirm the lateness of the stick figure body relative to shield bodies in central Montana. Rectangular bodies occur between these two types in both counties. Small sample size for other body shapes prevent conclusive pattern definition but demonstrates the usefulness of examining body attributes for chronological studies.

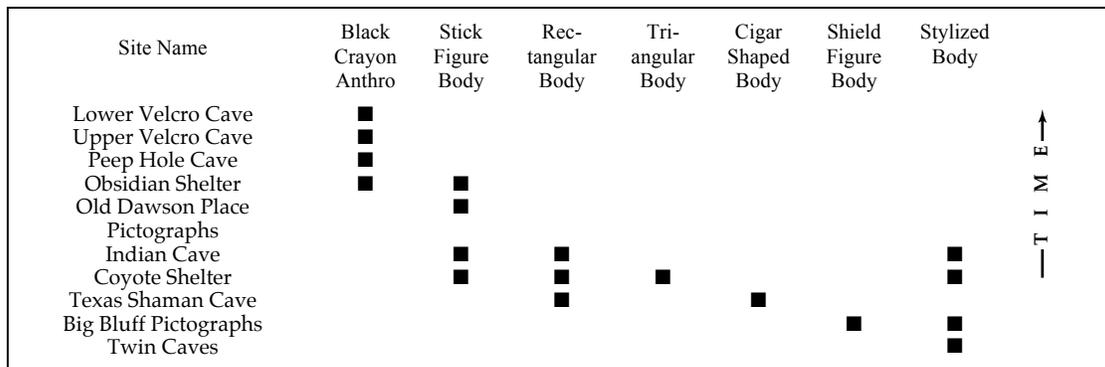


Figure 10. Occurrence Seriation graph of anthropomorph body types in Cascade County (north).

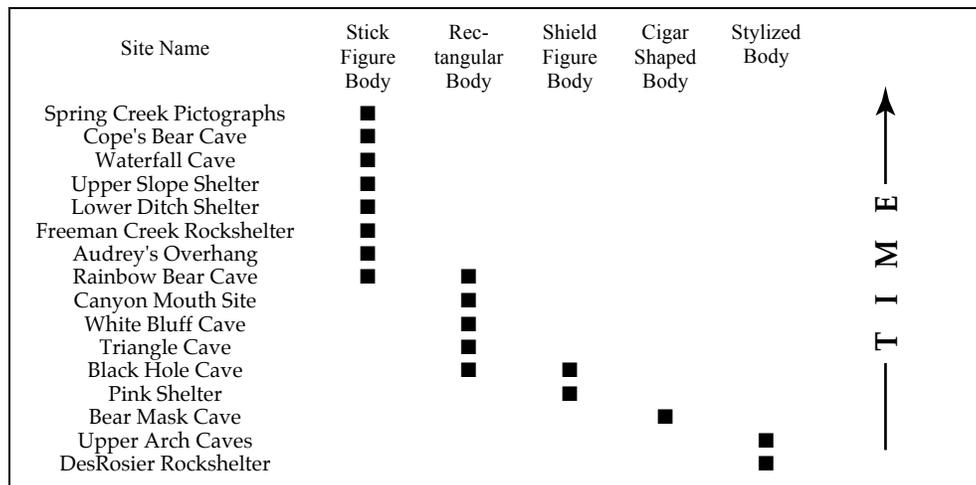


Figure 11. Occurrence Seriation graph of anthropomorph body types in Meagher County (south).

In conclusion, Smith River seriation supports other relative time sequences suggested by superimposition and cross-dating. Liquid paint was found to precede dry crayon drawings, and although seriation indicates that general figure classes, such as anthropomorphs, alone are not time sensitive in this area, more specific figure types display a consistent pattern. Focused examination of anthropomorph attributes show that body shape and other details of figure

composition are more time sensitive than the overall figure class. This shows that time-consuming definition of specific attributes can result in more informative seriation graphs. Seriation analysis has helped develop an inferred rock art chronology for central Montana. The method is not costly and does not require a detailed knowledge of statistics, but it is time consuming. In order to use seriation successfully, it is necessary to have accurate recordings of figures and to have a representative sample from the region under investigation. The advantage of seriation is that it can be used to infer chronology for an area when there are no other means of identifying time sensitive attributes.