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Patterns in Production: A Minimum Analytical Nodule Analysis (MANA) of a High Altitude Locality in the Medicine Bow Mountain Range, Larimer County, Colorado

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Introduction and Background

The works of James Benedict and Elizabeth Morris contributed substantial research and knowledge to high altitude archaeology in the mountain ranges of northern Colorado. However, there is still much to be gained from renewed investigation into high altitude sites in this region of the Rocky Mountains. Site 5LR174 is located on the West Branch of the Laramie River watershed in the Rawah Wilderness of the Medicine Bow Mountain Range. This environment contains multiple diverse ecological zones with evergreen forests and grassy meadows, and is characterized by the high altitude lakes that decorate the landscape.

The site sits at an elevation of 3,258 meters, and exhibits a high degree of heterogeneity of raw materials in the tools and lithic debitage that were collected from the surface. All of the sites in the study area were surface collections, making analysis of landscape use by hunter-gatherers in this region especially difficult. What is most fascinating about this wide range of raw materials is the fact that there are no apparent local raw material sources within the immediate area. This site provides a unique opportunity to utilize MANA to investigate constituent tool life histories, as well as technological organization and hunter-gatherer behavioral patterns related to tool production.

Figure 1: Map of Colorado counties with highlighted study area

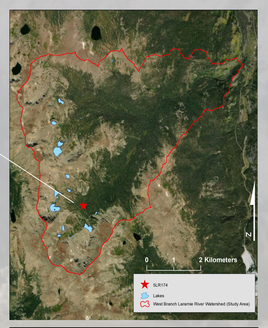


Figure 2: Map of complete study area in the West Branch of Laramie River watershed

Figure 3: Photo of the Rawah Wilderness within the study area

Methods

The first step in this research was to divide the assemblage into their proper minimum analytic nodules (MANs). This was done on the basis of:

- Color
- Texture
- Inclusions
- Cortex
- Short and long wave fluorescence using the Raytech Portable UV light

Figure 4: Photo depicting the author's use of the Raytech Portable UV light to confirm nodules

The use of the Raytech Portable UV Light allowed the author to confirm whether or not the artifacts truly belonged together in their prospective nodules by comparing their short and long wave fluorescence.

Once all of the artifacts were divided into their MANs, data was collected on the artifacts per their individual nodules. These measurements included:

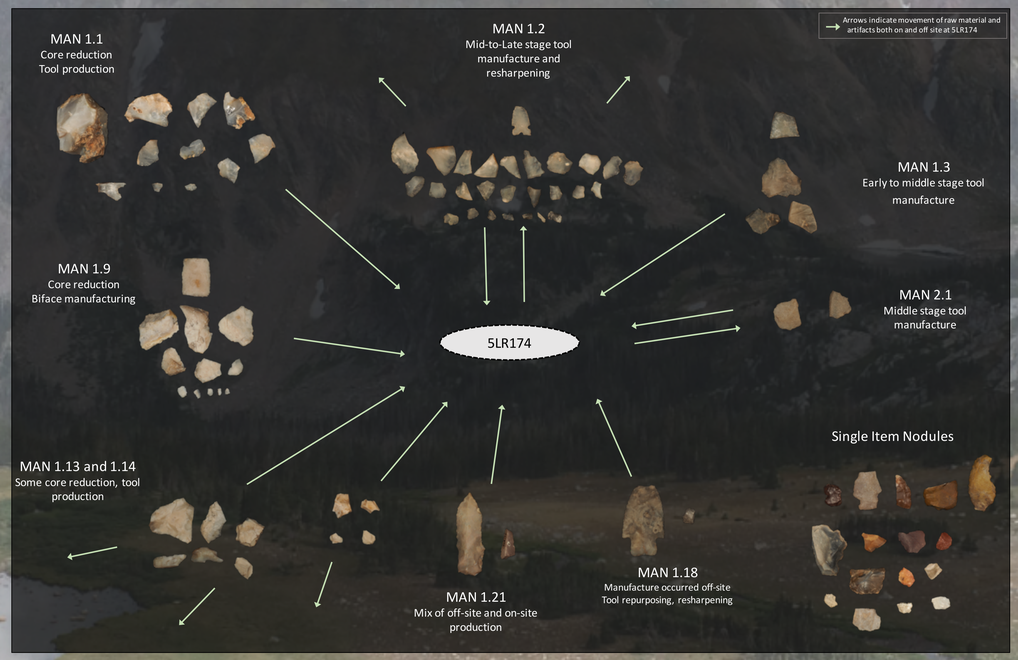
- Maximum length (mm)
- Weight (g)
- Presence of cortex
- Presence of platforms

Total Number of Nodules and Artifacts

The total number of artifacts in this assemblage is 151, with 11 of those being formal tools including projectile points and biface fragments.

Table 1: Total number of nodules that are represented at 5LR174

Raw Material	Multiple Artifact MAN	Single Artifact MAN	Total
Chert	22	13	35
Quartzite	1	7	8
Quartz	2	0	2
Petrified Wood	0	5	5
Obsidian	0	3	3



Brief Nodule Descriptions

Table 2: This table provides descriptions of nine of the nodules that were present at 5LR174. These nodules were chosen for this table on a basis of variety in both tool types, as well as raw material types to demonstrate the high degree of heterogeneity that is present in this assemblage

MAN #	Nodule Description	Raw Material Description
1.1	There are 11 total artifacts in this nodule, including one partial projectile point and a core. Three of the flakes still have some cortex, while the smaller flakes that I have placed in this nodule do not. This nodule likely represents the initial stage of tool manufacture, and the projectile point I have associated with this nodule is simply due to the fact that they are clearly of the same raw material. The two smallest pieces of debitage in this nodule have been placed in a sub-nodule that would be more likely directly related to the manufacturing of the projectile point. The behavioral interpretation related to this nodule is core reduction for the purpose of tool manufacturing.	Gray chert with a subtle yellow tint; cortex is rough, and ranges from gray to a rusty orange color. Some darker gray/black dendrites and white inclusions are present in this material. Compares well to lab samples of Troublesome Formation Chert.
1.2	There are 27 total artifacts in this nodule, including one nearly complete side-notched projectile point. 41% of the debitage in this nodule is smaller than 10 mm, and the average maximum length is 12.3 mm. Due to the average size of the debitage, the interpretation of this nodule is mid-to-late stage tool manufacturing and tool repurposing. The nearly complete projectile point measures 17.4 mm in maximum length.	Gray to white chert with a very subtle yellow tint. This material is mostly opaque with off-yellow inclusions that can be observed when held to a light source. No cortex observed in this nodule. Compares well to lab samples of Troublesome Formation Chert.
1.3	There are 4 total artifacts in this nodule, including one biface fragment. The three flakes represent the earlier stages of tool manufacturing that were likely removed from the same core that the biface was created from, however no evidence of the later stages of tool manufacturing are represented in this assemblage.	Slightly gray chert, deep yellow tint. No cortex observed in this nodule.
1.9	There are 12 total artifacts in this nodule, including one biface fragment. Three of the larger flakes have a small amount of cortex, representing core reduction, while the smaller flakes likely represent biface manufacturing.	Off-white chert with pale yellow banding and inclusions; compares well to lab samples of Kremmling chert.
1.13	This nodule consists of 6 flakes that are relatively small in size, two of which exhibit a small amount of cortex. This represents later removal of flakes from a core, and the broken pieces of debitage from the core reduction process.	White, waxy chert with some yellow coloration.
1.14	This nodule consists of 4 small flakes, representing later stages of tool production or resharpening. The tool was likely manufactured off-site, resharpened or repurposed on-site, and discarded off-site once completed.	White chert with yellow banding and coloration; opaque.
1.18	There are 2 total artifacts in this nodule: one very small flake and an archaic, broad-stemmed projectile point. The small flake associated with this tool is likely attributed to one of the latest stages in the production of this point, such as thinning. This point is nearly complete, missing the tip.	Gray opaque chert with round white inclusions.
1.21	This nodule contains a piece of angular debris in association with a thick bifacial tool. This tool is steeply flaked along the obverse side of the tool along a distinct central ridge and displays parallel flaking.	Beige and purple grainy chert with small black inclusions.
2.1	This nodule contains two small flakes of quartzite, and is the only nodule that represents this particular raw material.	Light gray quartzite; compares well to lab samples of orthoquartize, similar to samples from the Windy Ridge quarry.

Analysis

This graph demonstrates the range of maximum lengths between six nodules, which were chosen for this portion of analysis based on their wide range of tool and debitage type. MAN 1.1 and 1.9 contain reduction debitage, which explains why they contain both the largest flakes and the widest range of maximum lengths. MAN 1.2 represents the later stages of tool production, which is reflected in the higher quantity of smaller flakes. MAN 1.13 has also been interpreted to have some level of core reduction, and 1.3 has been interpreted to represent the earlier stages of tool manufacture due to the larger sizes of the flakes, which can be observed in this graph. Finally, MAN 1.14 is interpreted to represent the later stages of tool production, which is reflected in the relatively small size of the flakes that are present in this nodule.

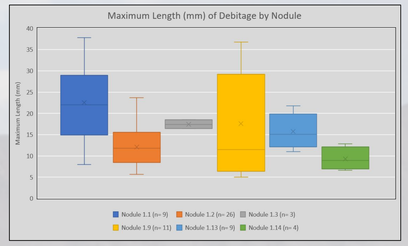


Figure 5: Graph demonstrating the range of maximum lengths (mm) of four nodules

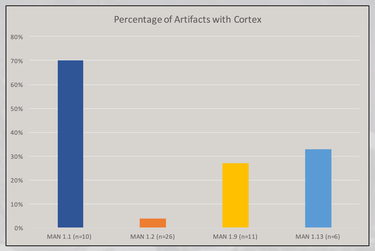


Figure 6: Graph demonstrating the range of cortex percentage of four nodules

This graph displays the percentage of four nodules where at least some of the artifacts contained cortex. As MAN 1.1 contains a core and is representative of core reduction, this nodule has the highest percentage of artifacts with cortex. MAN 1.2 has very little cortex present in the large amount of artifacts due to the fact that this nodule is representative of the later stages of tool manufacturing. MAN 1.9 had numerous smaller flakes that are indicative of the later stages of biface manufacturing, however the larger flakes in this nodule all contained cortex from the earliest stages of tool production. Approximately 1/3 of the artifacts in MAN 1.13 exhibited a small amount of cortex.

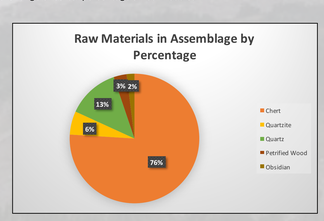


Figure 7: Graph demonstrating the total raw material percentage in the assemblage, with chert being the most highly represented raw material

Results and Interpretations

Minimum Analytical Nodule Analysis (MANA) is a complicated process that requires in-depth analysis of raw material types as well as debitage analysis. However, it can be quite useful in interpreting sites that exhibit a high degree of heterogeneity in both debitage and raw material types. While the interpretations of the behavioral patterns of hunter-gatherer groups at 5LR174 using this method can be quite theoretical, the method itself allows researchers to gain insight into patterns that may arise through analysis of archaeological assemblages. Site 5LR174 was especially difficult to interpret as all of the artifacts were surface finds. This alone reduces the ability to denote chronological time in a site, especially if there is a lack of diagnostic artifacts. Even if there were more abundant diagnostic artifacts at 5LR174, there is no stratigraphic evidence to assist in confirming the time at which a tool was discarded.

While it is not unusual for there to be tools without coinciding debitage, as this is representative of off-site manufacturing and the discard of said tools on-site, it is more unusual for there to be a single flake with no tools associated with them. While this could simply be due to the fact that these artifacts were collected from the surface, and the rest of the flakes could potentially be found upon excavation, the quantity of these single item nodules is fascinating in itself. Despite the overall smaller sample size in terms of total artifacts that are present in this assemblage, there were a much higher quantity of Multiple Item Nodules and Single Item Nodules than was initially expected. This indicates that 5LR174 could have been an important spot within this landscape. It is situated in the subalpine ecological zone near the transition to the Alpine. Being in proximity to multiple ecological zones could have granted easier access to various important resources, making this a desirable location to stop to prepare oneself before moving on through the landscape.

It is clear that the hunter-gatherer groups that passed through this site were highly mobile, as there is a wide range of raw materials utilized in the manufacturing of tools. Raw materials ranged from those that compare well with lab samples from the Troublesome Chert Formation as well as Kremmling chert, to orthoquartzite that compared well with samples from the Windy Ridge quarry. An obsidian core from an unknown source and two obsidian flakes that were sourced to obsidian sources in Idaho (Dr. Jason La Belle, personal communication) were also present in this assemblage. It was surprising to find such a low quantity of Windy Ridge quartzite, as many of the other surface sites in the study area contained a higher quantity of this particular raw material.

Acknowledgements

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