End Pleistocene and Younger Dryas Stadial Advance and Effects on Fauna and Humans

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Abstract

The end of the Pleistocene and onset of the Younger Dryas marked an abrupt climatic reversal coincident with major faunal losses and disruption to human populations. Extinctions of numerous megafaunal genera were unusually severe compared to earlier glacial–interglacial transitions. A recently completed fifty-year study of fluted points in the Carolinas documents parallel cultural changes among Paleoamerican groups. Analysis of Clovis and Redstone typologies shows a marked decline in post-Clovis Redstone forms, suggesting population contraction. A preliminary analysis of the newly updated 2026 Paleoindian Database of the Americas (PIDBA) likewise suggests a post-Clovis decline in the Great Plains: although raw Clovis and Folsom totals are now similar, time-normalized point frequencies remain lower for Folsom, consistent with population decline and/or settlement reorganization following Clovis. Archaeological evidence from Iberia, however, also indicates population bottlenecks, consistent with a widespread environmental or possibly extraterrestrial trigger. In the eastern United States, technological shifts accompany these demographic changes. Redstone points appear optimized for bayonet-like stabbing and repeated withdrawal during close-range dispatching of animals with handheld lances, rather than the earlier emphasis on spearing. ArcGIS mapping of county-level distributions in the Carolinas shows that Redstone points made from suspected North Carolina metavolcanic stone cluster near major Fall Line localities. Following severe population loss, these areas may have served as enduring natural landmarks, where scattered kin groups continued to interact.

Introduction

- The Sudden end of the Pleistocene and onset of Younger Dryas climatic reversal coincided with major changes in fauna and human populations in the SEUS (Anderson et al. 2011; Smallwood et al. 2015; Smallwood et al. 2018; .
- Here we explore potential connections between YD climatic reversal and declines in Clovis and post-Clovis Redstone point types in the SEUS and differences in geographic spatial patterning and changes in spearing technologies.
- Evidence suggests a post-Clovis population contraction and settlement shift in the SEUS, perhaps similar to declines elsewhere in North America (Ballenger et al. 2011; Prasciunas et al. 2016). Archaeological evidence from Iberia suggest broader global demographic impacts at this time (Fernández-López de Pablo et al. 2019).

Fluted Points in the Carolinas

- Three fluted points in NC are believed to bracket the Younger Dryas: Clovis, Redstone, and Cumberland (Daniel 2021).
- Data from private and institutional collections gathered over the last 50 years examined the typological classification and spatial distributions of 375 fluted points in NC (Daniel et al 2025).
- NC Clovis points are characterized by a lanceolate shape, straight-sided fluted base, and shallow basal concavity similar in form to Clovis points elsewhere in North America (Figure 1), albeit with some variation as indicated by an LGM analysis (Daniel et al 2025).
- Redstone points recognized in the mid-South (Cambron and Hulse 1975) and are similar to Gainey points found in the Great Lakes regions and Midwest (Morrow 2015). Redstone points exhibit a relatively deep basal concavity and single flute that approaches full facial fluting on resharpened points (Figure 2).
- North Carolina Clovis and Redstone points were typologically characterized and differentiated by Landmark Geometric Morphometric (LGM) which supported a typological distinction between the two types. Clovis and Redstone points are statistically significantly different in their entire shape, and shapes of their hafts and blades. North Carolina points exhibit allometry in point shape while Redstone points do not. That is, both Redstone blades and hafts were isometric in shape (Daniel et al. 2025).



Figure 1. North Carolina Clovis Points: (a) NC186; (b) NC18; (c) NC208; (d) NC364; (e) NC361; (f) NC146; (g) NC271; (h) NC363; (i) NC339.



Figure 2. North Carolina Redstone Points: (a) NC217; (b) NC119; (c) NC215; (d) NC2; (e) NC123; (f) NC345 and Cumberland Points: (g) NC191.

Instrument-assisted Fluting Method

- A fundamental change in fluting distinguishes Clovis and Redstone points.
  - Clovis points (Figure 3, left) exhibit a shallow basal concavity compared to most Redstone points (Figure 3, right).
  - Redstones show they were fluted by an intervening instrument placed up in the concavity (akin to Folsom fluting).
- Based on the LGM results, we also infer that reduction strategies for Clovis and Redstone points were significantly different. For whatever reason, it was important for the Redstone point makes to maintain the "Redstone shape" throughout their use-lives, perhaps necessitating points being removed from the hafts for resharpening (Daniel et al. 2025).

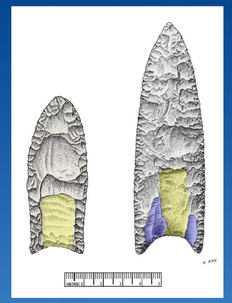


Figure 3. Clovis points (left) exhibit a shallow basal concavity compared to most Redstone points (right). Redstones show they were fluted by an intervening instrument placed up in the concavity shown by the force lines emanating from the concavity such that the flutes were initiated from that edge not from the base of the biface preform using a percussion method like Clovis. Repeated platform creation meant that more of the concavity had to be rechipped causing the concavity to be deeper. The shorter lateral flake scars (highlighted in blue) parallel to the main flute (highlighted in yellow) are more likely the scars related to creating the raised platform.

Chronology

- Clovis is assumed to represent the earliest established point type in the state but the dating of Clovis and other fluted types in North Carolina is unknown.
- Regardless of the date ranges for North Carolina fluted points, we think the cultural-historical sequence of Clovis, Redstone, and Hardaway-Dalton (a manifestation of the Dalton horizon elsewhere in the Southeast) (Coe 1964; Goodyear 1999) is accurate.
- The shared technological traits of Clovis and Dalton including overall lanceolate shape, edge grinding, and flaking qualities suggest a historical relationship with Redstone being an intervening type.
  - Redstones exhibit fluted faces like Clovis points but display deeper basal concavities and steeple-shaped blades like Hardaway-Daltons.
  - The fuller facial fluting of Redstone is reminiscent of the full facial fluting on Folsom points in the Great Plains which are known to post-date Clovis (Flennikan 1978).

Point Function

- Assuming the cultural-historical sequence of Clovis, Redstone, and Hardaway-Dalton is accurate, we speculate that the morphological distinction between Clovis and Redstone points is a functional one related to proboscidean extinction.
- Clovis blades tend to be more excurvate on the margins and nearly rounded on the tips. Redstone tips are more pointed and the blade margins straighter. This suggests that Clovis points were better suited for piercing and cutting while Redstones were more effective for piercing and penetrating.
  - This distinction is consistent with Buchanan & Hamilton (2021) study that examined tradeoffs between penetration and robustness (i.e., durability) in a sample of Paleoindian point types found that "Eastern Clovis" tended to sacrifice penetration ability for durability while the Redstone type emphasized penetration versus durability.
- Hunting armature changes likely tied to human demographic shifts and altered animal ecology (the extinction of several dozen animal genera including proboscideans, horses and Bison antiquus). Clovis points known to be associated with these larger species.
- Atlatl-thrown (Clovis) spears may have declined versus handheld (Redstone) lances that were repeatedly thrust and withdrawn from prey, akin to modern bayonet stabbing.
- Redstone point morphology with straight blade margins and minimal basal ears suggests an adaptation to close-up thrusting such as needed for bison herds and caribou herds further north, since proboscideans were extinct by Redstone times.
- LGM analysis suggest the maintenance of the Redstone form during resharpening differs from Clovis (Daniel et al. 2025).

Spatial Distribution

- *Raw Material Sources.* One archaeological manifestation of cultural adaptation ca. 13,000 years ago can be seen in the point raw material distribution maps in the Carolinas. Artifact tool stone types were identified relative to our understanding of the geologic occurrence of stone in both states.
- For the purposes of this poster, we concentrate on the raw material distributions of metavolcanic (including metasedimentary) stone and chert Clovis and Redstone points.
- The best known respective sources of this stone lie in the Uwharrie Mountain region of the Carolina Terrane (formerly Carolina Slate Belt) in the eastern Piedmont of NC and the the Allendale sources along the Savannah River in the SC Coastal Plain (Figure 5).
- Spatial distributions of these point types across the state, when combined with similar point distributions across South Carolina, reveal distinct geographic patterns. Notably, metavolcanic Clovis points in North Carolina are centered on Uwharrie rhyolite sources in the Piedmont, while Coastal Plain chert Clovis points focus on Allendale chert sources along the Savannah.
- *Clovis Raw Material Distributions.* Metavolcanic Clovis points (Figure 6) in both states show a heavy Piedmont and Fall Line focus centered on the Uwharrie rhyolite sources in North Carolina and perhaps some metavolcanic sources along the northern Wateree River in York and Lancaster counties, South Carolina.
- Lesser frequencies of metavolcanic Clovis points do occur in portions of the upper Coastal Plain that tend to parallel some of the major river valleys in the region. It may be the case that when occupation of the Coastal Plain occurred, it happened via movement from the Piedmont along river valleys or along interstream divides between major drainages.
- Allandale chert Clovis points (Figure 7) show a distribution centered on the Allendale quarries along the Savannah River with a broad distribution that extends over most of the South Carolina Coastal Plain south of the Congaree and Santee Rivers.

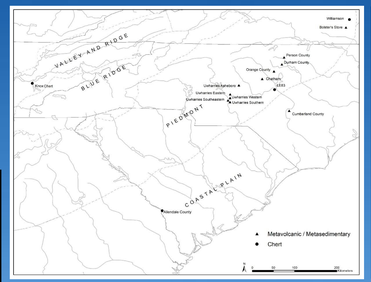


Figure 5. Stone raw material sources in and around the Carolinas.

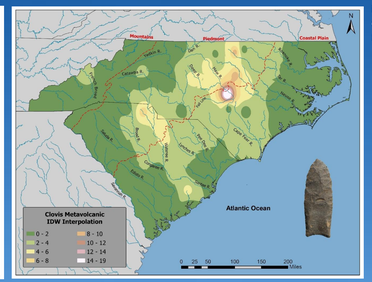


Figure 6. Distribution of metavolcanic Clovis points based on inverse distance weighted (IDW) interpolation using county centroids as spatial locations. Map made using ESRI ArcGIS Pro© Version 3.1.3.

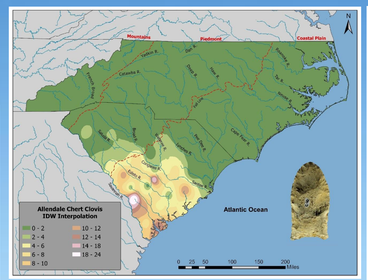


Figure 7. Distribution of Allendale chert Clovis points based on inverse distance weighted (IDW) interpolation using county centroids as spatial locations. Map made using ESRI ArcGIS Pro© Version 3.1.3.

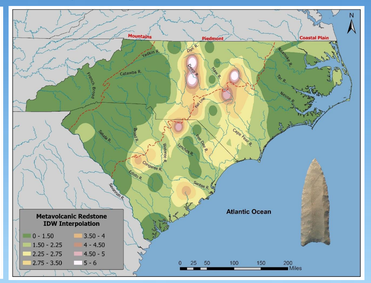


Figure 8. Distribution of metavolcanic Redstone points based on inverse distance weighted (IDW) interpolation using county centroids as spatial locations. Map created using ESRI ArcGIS Pro© Version 3.1.3.

Spatial Distribution (cont.)

- *Redstone Raw Material Distributions*. Turning to the Redstone distribution, both metavolcanic and Allendale chert Redstone distributions exhibit a geographic footprint similar to Clovis points (Figures 8 and 9) albeit in reduced frequencies.
- Metavolcanic Redstone points exhibit several small clusters along the Fall Line in both states suggesting a significant geographic constriction of the range previously occupied by Clovis, although the distribution of metavolcanic points crosses the Congaree and Santee Rivers, unlike the Clovis metavolcanic pattern.
- Ratios of Clovis to Redstone points in North and South Carolina indicate ~3-4 Clovis points for every 1 Redstone.

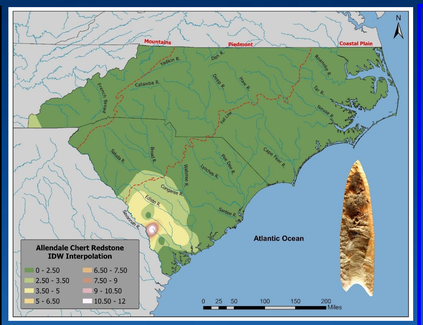


Figure 9. Distribution of Allendale chert Redstone points based on inverse distance weighted (IDW) interpolation using county centroids as spatial locations. Map created using ESRI ArcGIS Pro© Version 3.1.3.

Interpretations

- The two Clovis distributions clearly reflect the influence of the respective raw material sources in each state.
- This pattern might represent the geographic ranges of two macrobands centered on their respective toolstone sources: the Uwharrie Mountains metavolcanic stone sources to the north ("Uwharrie Clovis Marcoband") and the Allendale Coastal Plain chert sources to the south ("Allendale Clovis Macroband") (e.g., Daniel and Goodyear 2015;2018).
- We suggest this pattern represents two contemporary and adjacent macrobands centered on distinct major toolstone sources spanning a distance of some 300 km.
- The areas where these macrobands converge along the Congaree and Saluda Rivers are hypothesized as an aggregation area between these groups that would have facilitated trade and exchange of mates necessary for social alliances and maintenance of genetic diversity.
- Similarly, we speculate that the Redstone distributions represent a settlement pattern in the Carolinas focused primarily on the Fall Line ecotone.
- This may represent a cultural adaptive response to the environmental pressures of YD climate change, the extinction/extirpation of regional megafauna and a decline or demographic shift in human population.

Discussion and Conclusions

- The point types discussed here span climatic and environmental changes associated with the Younger Dryas (YD) stadial, the magnitude and human consequences of which remain debated (Holliday and Meltzer 2010; Ballenger et al. 2011).
- In the Southeastern United States, projectile-point data indicate substantial post-Clovis demographic and settlement changes, including a marked decline and geographic constriction of Redstone points in the Carolinas (Daniel et al. 2025), followed by a strong increase in point frequencies during the Dalton horizon.
- Anderson et al. (2011) similarly identified declines in projectile-point frequencies, quarry use, and cultural radiocarbon dates consistent with population decline and/or settlement reorganization during the early YD.
- A preliminary analysis of the greatly expanded 2026 PIDBA dataset suggests that the Great Plains pattern identified by Anderson et al. (2011) also persists. Although raw Clovis and Folsom totals are now similar, normalizing point frequencies for their different estimated durations indicates that Folsom abundance per unit time remains substantially lower than Clovis, consistent with a post-Clovis population decline and/or settlement shift.
- Comparable changes in land use have been identified in the Southwest (Ballenger et al. 2011; Prasciunas et al. 2016), while demographic contraction across the Pleistocene-Holocene transition has also been documented in Iberia (Fernández-López de Pablo et al. 2019).
- Together, these patterns warrant further investigation of regional demographic responses to environmental change during the YD.

References

Other than the references listed below, all other cited references can be found in Daniel et al. 2025.

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