Revisiting & Integrating
Compositional Ceramic Datasets
on the Northern Great Plains

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Brief history of studies
Archaeological Pottery

- Dunn and Kay
  - Extended Middle Missouri
  - Riggs Ware
  - n = 29

- Speakman
  - Terminal Middle Missouri & Coalescent
  - Knife River & LeBeau Wares
  - n = 230

- Nepstad-Thornberry
  - Late Plains Woodland & Initial Middle Missouri
  - Scalp, Ellis, Great Oasis, Sanford, Stuart, Riggs, and Foreman Wares
  - n = 106

- Hollenback et al. (ongoing)
  - Middle–Late Plains Woodland, Northeast Plains Village
  - n = 45

- Roper, Cobry, and Hoard
  - Central Plains materials

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Geological Clays

- **Dunn and Kay**¹
  - Clay-rich sediments from alluvial contexts between KRIV and Clay County, SD (n = 9)

- **Speakman**²,³
  - Clay and clay-rich sediments from alluvial (valley) and residual (upland) contexts between Corner Butte and KRIV (n = 30)

- **Mitchell**⁴
  - Clay-rich sediments from alluvial contexts from near Double Ditch and Shermer (n = 10)

- **Hollenback et al. (ongoing)**
  - Clay-rich sediments from alluvial and lacustrine contexts from locations around Devils Lake and near KRIV (n = 11)

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Archaeological Clays

- **Mitchell**
  - Middle Missouri
    - South Cannonball (n = 2)
    - Paul Brave (n = 1)
    - Shermer (n = 3)
    - Huff (n = 2)
  - Coalescent
    - On-a-Slant (n = 1)
    - Upper Sanger (n = 1)
    - Double Ditch (n = 9)

Summary of findings
• Helb
  • A single compositional group
  • Affinities with alluvial clayey sediment from Burleigh County, proximate to Huff
    • But—similarities with clayey sediment from nearby Helb
- Central North Dakota
- Two broad compositional groups
- Distinguished primarily by differences in transition-metal ratios
- Each appears to be broadly associated with clays of distinct geological origins
  - Alluvial (M/H-1)
  - Residual (M/H-2)
- Little correlation with wares, villages, etc.
• South Dakota
  • Crow Creek & Scalp Creek
  • Big Sioux River
  • Some pieces similar to Central Plains
  • All distinct from central North Dakota materials
• Archaeological clays
  • Two groups defined on the basis of Hf and U
  • No comparison to archaeological pottery
    • Archaeological clays grouped together
    • Geological clays grouped together

Modeling Ceramic Compositions

\[ S_i = (P \times T_i) + ([1 - P] \times C_i) \]

Wherein

- \( i \) is the abundance of a particular element
- \( S \) is the modeled ceramic
- \( P \) is the proportion of temper (by mass)
- \( T \) is the temper
- \( C \) is the clay


Modeling Ceramic Compositions

\[(0.25 \times 500) + (0.75 \times 1000) = 875\]

- Temper:clay ratio of 1:3 (25% temper)
- Temper: 500 ppm; Clay: 1000 ppm
  - Results in 875 ppm pottery
- Point estimates between end-members
  - Assumes uniformity in temper:clay ratio
  - Does not consider variation in both components
  - Does not consider analytical uncertainty
Modeling Ceramic Compositions

\[ S_i = (P \times T_i) + ([1 - P] \times C_i) \]

- \( P \) is sampled from a truncated normal distribution defined by
  - \( \mu \) (average amount of temper added)
  - \( \sigma \) (variation in temper:clay consistency)
Modeling Ceramic Compositions

\[ S_i = (P \times T_i) + ([1 - P] \times C_i) \]

- Means and covariation matrices are determined from analyses of multiple clay and temper specimens
- Multivariate-normal distributions are produced for each component
Modeling Ceramic Compositions

\[ S_i = (P \times T_i) + ([1 - P] \times C_i) \]

- Simulated tempers and clays within these distributions are generated producing possible compositions for each
Modeling Ceramic Compositions

\[ S_i = (P \times T_i) + ([1 - P] \times C_i) \]

- \( P, T, C \) are sampled from the respective distributions to produce \( n \) possible ceramic compositions
Recommendations

• Pottery from Middle Missouri Tradition sites to complement extant Coalescent ceramic data

• Clay sampling
  • Archaeological clays
  • Consider and record geological context
  • Workability and textural studies: is it usable?

• Temper sampling
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