A Combined Rare Earth Element and Sedimentologic Approach to Taphonomic Interpretations of the Early Cretaceous Crystal Geyser Dinosaur Quarry, Utah

Depositional Environment
The stratigraphy within the quarry consists of a basal carbonate or pisolithic horizon with chert pebbles, claystone clasts, dinosaur bones, and travertine fragments. Overlying this unit is a bone-bearing mudstone with pisoliths, claystone clasts, chert pebbles, carbonate nodules and concretions, and green motes. Carbonate accumulation increases toward the top of the bone-bearing units. The top of the bone-bearing unit is marked by truncated roots and vertically oriented bones. This is overlain by interbedded sandy mudstones and limestones. The caprock is a silicified limestone that has spring-like features (see below). Comparison of macroscopic and microscopic features within the quarry with modern spring deposits suggest that the dinosaur bones were preserved in spring deposits influenced by fluvial activity.

Modern Spring Features
- Modern Crystal Geyser, Utah
- Calcite feather dendrites, modern springs, flume (Evens and Renaut, 1995)
- Modern Crystal Geyser, Utah
- Positively in spring-fed pools, Bohme/Flacher and Bugens, 1979

Macroscopic and Microscopic Features
- Macrocrystalline calcite
- Cavity wall calcite
- Calcite spar and microspar
- Wavy laminae of carbonate or pisoliths (C.A. Olszewski, 2003)
- Macrocrystalline calcite
- Cavity wall calcite
- Calcite spar and microspar
- Wavy laminae of carbonate or pisoliths

Taphonomy

Unit 1
- 1.0 to 1.3 m above Morrison Formation
- Bone matrix:
  - Bone fragments
  - Bone splinters
  - Bone fragments in matrix of carbonate or pisoliths
  - Bone fragments in matrix of pisoliths
  - Bone fragments in matrix of carbonate

Unit 2
- 1.5 to 1.7 m above Morrison Formation
- Bone matrix:
  - Bone fragments
  - Bone splinters
  - Bone fragments in matrix of carbonate or pisoliths
  - Bone fragments in matrix of pisoliths
  - Bone fragments in matrix of carbonate

Unit 3
- 1.3 to 1.5 m above Morrison Formation
- Bone matrix:
  - Bone fragments
  - Bone splinters
  - Bone fragments in matrix of carbonate or pisoliths
  - Bone fragments in matrix of pisoliths
  - Bone fragments in matrix of carbonate

Waves show taphonomic variations based on stratigraphic location.

Weathering
- Mechanical
  - Attrition
  - Abrasion
  - Fracture
  - Other Traces

Lateral Changes in Orientation

LEGEND
- Dinosaur bones
- Carbonate nodules
- Sandstone
- Limestone
- shale
- slate
- muddy sandstone
- fish bone
- plant debris
- pisolith
- carbonate nodules
- metal matrix
- matrix
- bone fragment
- bone splinter
- bone matrix
- bone fragment in matrix of carbonate or pisoliths
- bone fragment in matrix of pisoliths
- bone fragment in matrix of carbonate
- bone fragment in matrix of carbonaceous material
- bone fragment in matrix of metal matrix
- bone fragment in matrix of matrix
- bone fragment
- bone splinter
- bone fragment in matrix of carbonate or pisoliths
- bone fragment in matrix of pisoliths
- bone fragment in matrix of carbonate