

Pleistocene vertebrates from the Pecos River valley near Roswell, Chaves County, New Mexico

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Abstract

River gravels in the Pecos Valley just north of Roswell, Chaves County, New Mexico, produced fossil vertebrates identified as *Gopherus* cf. *G. agassizii*, *Equus occidentalis*, *Equus* sp., *Camelops hesternus*, *Bison* sp., and *Mammuthus columbi*. These fossils indicate a Rancholabrean (late Pleistocene) age and represent the first Pleistocene megafauna described from river gravels in southeast New Mexico. The presence of the tortoise *Gopherus* suggests a local frost-free climate.

Introduction

Harris (1993) recently reviewed all occurrences of Quaternary vertebrates from New Mexico, the majority of which can be attributed to the middle to late Pleistocene Rancholabrean North American land-mammal "age" (between 300 and 10 Ka). Conspicuously absent from his review were any sites in Chaves County, which is located in the southeast part of the state. Here, we report a small collection consisting of six species of Rancholabrean vertebrates from Pecos River gravels northeast of Roswell (Fig. 1) and discuss their significance. These specimens were collected over the past ten years from commercial sand and gravels pits by Peggy Roberson, who generously donated them to the vertebrate paleontology collection of the New Mexico Museum of Natural History and Science (NMMNH).

The fossils from the Roswell gravel pits were derived from an approximately 5-meter-thick interval of poorly consolidated, coarse-grained sandstones and conglomerates that probably represent axial river gravels of the ancestral Pecos River (Kelley, 1971; Hawley et al., 1976). Most of the fossils consist of isolated, fragmentary remains of large mammals and of a small land tortoise. The coarse sands and gravels and fragmentary nature of the fossils suggest that the bones were transported by a high-energy stream prior to fossilization. The Roswell vertebrate fossil assemblage probably constitutes a biased sample because it represents a transported assemblage that has been hydrodynamically sorted. No screenwashing was attempted to obtain smaller vertebrates, although it is unlikely that a rich microvertebrate fauna was present considering the coarseness of the sediments.

Location

The Pleistocene fossils reported here come from commercial sand and gravel pits operated by the Beaver Sand and Gravel Company. These pits are located just west of the Pecos River and southeast of US-70 about 10 km northeast of Roswell, Chaves County, southeast New Mexico (Fig. 1). The fossils housed in the collections of the NMMNH are from six sites, one of which encompasses more than one gravel pit:

1. NMMNH locality 3004, NW¼ SE¼ sec. 3 T9S R25E, Melena 7.5-minute quadrangle (1982), Universal Transverse Mercator (UTM) grid coordinates 3713400N 557100E, zone 13. This site yielded an upper molar of *Mammuthus columbi*.

2. NMMNH locality 3005, NE¼ SE¼ sec. 3 T9S R25E, Melena 7.5-minute quadrangle (1982), UTM 3713500N 557200E, zone 13. This site yielded a jaw fragment of *Equus occidentalis*.

3. NMMNH locality 3006, NE¼ SW¼ sec. 3 T9S R25E, Melena 7.5-minute quadrangle (1982), UTM 3713200N 556500E, zone 13. This site yielded a right P2 of *Equus occidentalis*.

4. NMMNH locality 3007, SW¼ NW¼ sec. 10 T9S R25E, Melena 7.5-minute quadrangle (1982), UTM 3712400N 556200E, zone 13.

This site produced a lower molar of *Bison* sp.

5. NMMNH locality 3008, SE¼ sec. 35 T8S R25E, Acme 7.5-minute quadrangle (1962), UTM 3715000N 558600E, zone 13. This site produced several associated teeth of *Mammuthus columbi* from a skull that was destroyed during mining operations.

6. NMMNH locality 3009. This is an areal locality for all fossils collected in secs. 3 and 10 T9S R25E, Melena 7.5-minute quadrangle (1982), for which more-precise locality data are lacking. These include specimens of *Gopherus*, *Equus*, and *Mammuthus*.

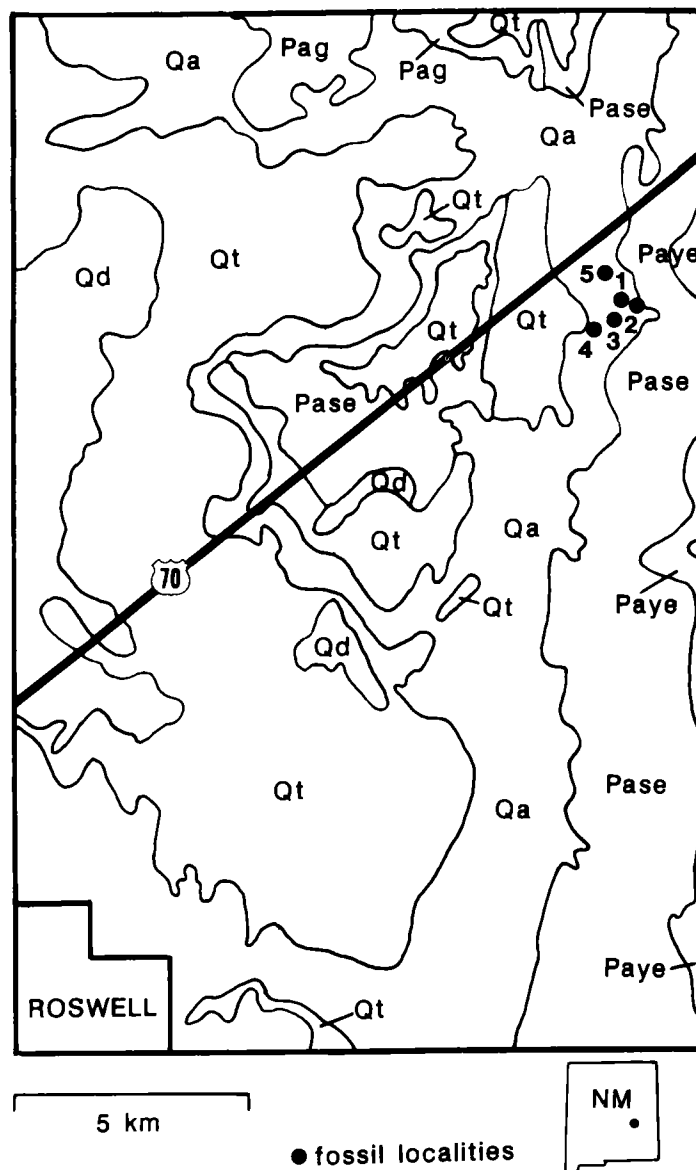


FIGURE 1—Map of the Pecos River valley northeast of Roswell, Chaves County, New Mexico, showing Pleistocene fossil localities. Geology modified from Kelley (1971). Stratigraphic unit acronyms are: Permian Artesia Group—Pag, Grayburg Formation, Pase, Seven Rivers Formation; Paye, Yates Formation; Quaternary deposits—Qa, alluvium; Qd, disturbed gravel; Qt, terrace gravel.

Paleontology

Gopherus cf. *G. agassizii*

The desert tortoise, *Gopherus agassizii*, is identified from two incomplete costals (NMMNH P-25515, Fig. 2A, B), a complete peripheral (NMMNH P-25514, Fig. 2D, E), and a complete humerus (NMMNH P-25518, Fig. 2C). This extant species no longer occurs in New Mexico, although it is known from at least six other RanchoLabrean localities in the south half of the state (Harris, 1993). The desert tortoise currently is restricted to the Mojave Desert in southeastern California, southernmost Nevada, and southwestern Utah, and the Sonoran Desert in western Arizona and northern Sonora in Mexico (e.g., McCord, 1994). The presence of fossil *G. agassizii* in southern New Mexico suggests this region experienced milder, possibly frost-free, winters during certain intervals of the Pleistocene.

Equus occidentalis

The only specimens of *Equus* that can be tentatively identified belong to *E. occidentalis*. NMMNH P-25510, a right dentary fragment with p4-m2 (Fig. 2F), and P-25511, a right P2 (Fig. 2G) are characteristic of *E. occidentalis*. The lower teeth of NMMNH P-25510 have relatively simple enamel patterns, wide, U-shaped metaconid-metastylid grooves, rounded metaconids, angular and postero-lingually directed metastylids, a lingually extended ectoflexid, and small and single pli-caballinids. These features and size (all measurements in mm: p4, length = 30.4, width = 22.5; m1, l = 28.6, w = 21.5; m2, l = 27.9, w = 19.6) justify assignment to *E. occidentalis* (Merriam, 1913; Kurtén and Anderson, 1980; Lucas and Logan, 1984). The P2 has a broad protocone and simple enamel pattern. These features and size (in mm: P2, l = 41.4, w = 29.4) also support identification as *E. occidentalis*. This species is reasonably common as a fossil in New Mexico, as it is known from 10 other RanchoLabrean sites from Bernalillo County in the north to Hidalgo County on the Mexican border (Harris, 1993).

Equus sp.

A species of *Equus* smaller than *E. occidentalis* is represented by isolated teeth in the collection, but the fossils are too fragmentary for identification to the species level.

Camelops hesternus

The large typical Pleistocene camel, *Camelops hesternus*, occurs in the Roswell gravel pits, but we did not have the opportunity to describe or photograph any of these specimens. One of us (SGL) examined a mandible of this species that is currently in a private collection.

Bison sp.

NMMNH P-22512 (Fig. 2J-K) is the right m1 or m2 of a bison. The current taxonomy of *Bison* is based on cranial features, especially the size and shape of the horn cores, not dental characters (McDonald, 1981), so we can only identify the tooth as *Bison* sp. The presence of *Bison* in the Roswell fauna is of particular importance because it is the defining genus for the RanchoLabrean land-mammal "age" (Lundelius et al., 1987). Effinger and Lucas (1990) reviewed the fossil record of *Bison* in New Mexico. They listed 30 localities for this genus, which are clustered in the east half of the state and in the northern Rio Grande valley.

Mammuthus columbi

The Columbian mammoth is the most common mammal in the collection, represented by one complete and about 10 partial teeth, several of which reportedly came from a skull that was destroyed

during mining operations. NMMNH P-25509, a right M3 (Fig. 2H, I) is characteristic. This tooth is 200+ mm in length and 100 mm in width; crown height is 250+ mm, total enamel plate number is 18+, lamellar frequency (enamel plates per 100 mm) is 6, and enamel thickness averages 3.3 mm. These measurements fall within the range of variation established for *M. columbi* by Dutrow (1980), Madden (1981), and Agenbroad (1994). The Columbian mammoth is known from more than 25 Pleistocene localities throughout New Mexico (Lucas and Effinger, 1991).

Discussion

The limited fauna of fossil vertebrates from river gravels in the Pecos Valley northeast of Roswell consists of *Gopherus* cf. *G. agassizii*, *Equus occidentalis*, *Equus* sp., *Camelops hesternus*, *Bison* sp., and *Mammuthus columbi*. These mammals, particularly *Bison*, indicate a RanchoLabrean age but do not allow a more-precise age determination (Lundelius et al., 1987). They provide, nevertheless, definite age indicators for the Quaternary gravels north of Roswell and the first mammal megafauna of Pleistocene age derived from river gravels in this part of the state. Furthermore, the occurrence of *Gopherus* indicates that deposition took place in a locally frost-free climate.

The fossil-vertebrate-bearing gravels north of Roswell are older than nearby latest Pleistocene-Holocene terrace deposits (Leonard and Frye, 1975; Leonard et al., 1975; Frye et al., 1982) and younger than the Miocene Ogallala Formation, as originally argued by Fielder and Nye (1933) and Morgan (1938). However, more field-work is needed to establish the precise stratigraphic and temporal relationships of these gravels to the complex terrace and valley-fill deposits described by these authors, and by Jelinek (1967) and Kelley (1971).

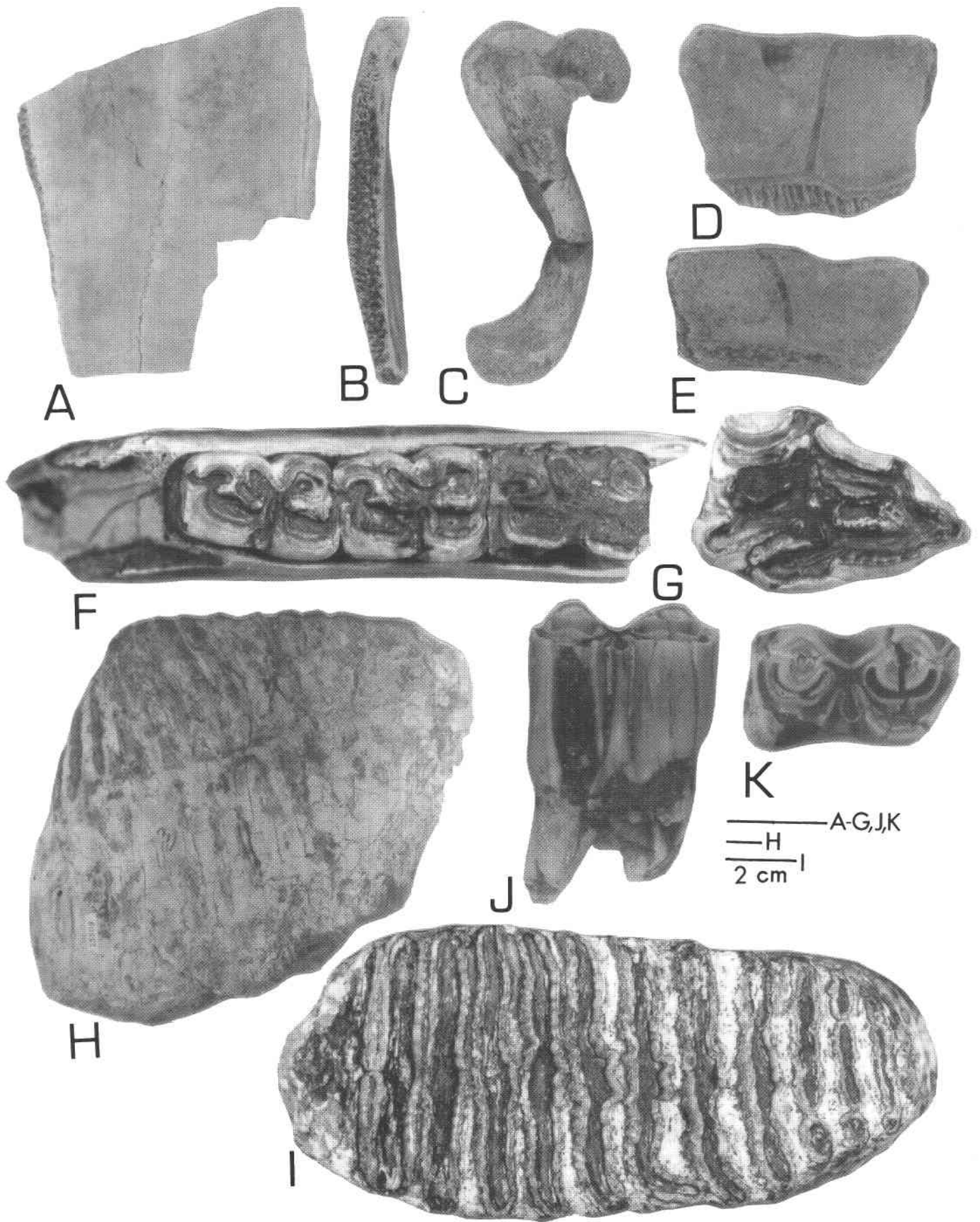
The fossil mammals from the Roswell pits constitute an assemblage very similar to the RanchoLabrean mammal fauna from gravel pits in the Edith Formation in the vicinity of Albuquerque, Bernalillo County (Lucas et al., 1988). The Edith Formation fossils also are derived from Quaternary river gravels. Four of the five mammals from the Roswell sites are shared with the fauna from the Albuquerque gravel pits, including *Equus occidentalis*, *Camelops hesternus*, *Bison* sp., and *Mammuthus columbi*. The recent discovery of *Bison* postcrania from a gravel pit near Socorro and the mandible of an American mastodon, *Mammuthus americanum*, from axial river gravels of the Rio Grande near Lemitar, both in Socorro County, suggest that RanchoLabrean vertebrates should be expected in similar deposits throughout New Mexico.

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FIGURE 2—Pleistocene vertebrates from the Pecos River valley northeast of Roswell, Chaves County, New Mexico. **A, B**, NMMNH P-25515, *Gopherus* cf. *G. agassizii*, dorsal (**A**) and edge (**B**) views of incomplete costals from NMMNH locality 3009. **C**, NMMNH P-25518, *Gopherus* cf. *G. agassizii*, anterior view of right humerus from locality 3009. **D, E**, NMMNH P-25514, *Gopherus* cf. *G. agassizii*, dorsal (**D**) and ventro-lateral (**E**) views of peripheral from NMMNH locality 3009. **F**, NMMNH P-25510, *Equus occidentalis*, occlusal view of right dentary fragment with p4-m2 from locality 3005. **G**, NMMNH P-25511, *Equus occidentalis*, occlusal view of right P2 from locality 3006. **H, I**, NMMNH P-25509, *Mammuthus columbi*, medial (**H**) and occlusal (**I**) views of right M3 from locality 3004. **J, K**, NMMNH P-25512, *Bison* sp., labial (**J**) and occlusal (**K**) views of right m1 or m2 from locality 3007.



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Geological Society of America Penrose Conference

Faults and Subsurface Fluid Flow: Fundamentals and Applications to Hydrogeology and Petroleum Geology

A Geological Society of America Penrose Conference, "Faults and Subsurface Fluid Flow: Fundamentals and Applications to Hydrogeology and Petroleum Geology", will be held September 10-15, 1997, in Albuquerque and Taos, New Mexico.

The conference will be a synopsis of state-of-the-art field, laboratory, and computer-modeling studies of the role of faults as barriers to and conduits for single and multi-phase fluid flow. Topics to be addressed will include deformation of rocks and sediments in fault zones; the influence of deformation on fluid flow and transport phenomena; diagenetic alterations and their feedback into hydrologic and structural processes; and geological and geophysical imaging of fault properties. We will emphasize both fundamental research and application to problems such as groundwater supply, groundwater contamination, petroleum migration, and petroleum production.

Participants will be picked up at the Albuquerque airport and spend the evening of September 10 in Albuquerque, and assemble the next morning for breakfast and a field trip to examine the relationship between faults and groundwater flow in the Albuquerque Basin. Planned stops will highlight the structure and stratigraphy of the Cenozoic basin-fill aquifer system; deformational features, paleoflow indicators, and zones of cementation along faults cutting unconsolidated basin-fill sediments; and the hydrogeology of basin-bounding faults. We will finish the trip by traveling to Taos, where we will devote the next three days to oral presentations, poster sessions, and discussions concerning current and future research on the interrelationship of faults and subsurface fluid flow. Participants will be returned to the Albuquerque airport before noon on September 15.

The conference will be limited to 70 participants, who will be selected to represent a broad range of disciplines and geographic areas of expertise. We encourage interested graduate students to apply, and will be able to offer some partial student subsidies. The registration fee, which will cover lodging, meals (except for first

night's dinner), transportation during the conference, the field trip, and all other costs except personal incidental expenses, is expected to be approximately \$600 to \$700. Participants will be responsible for transportation to and from the conference.

Convenors of the conference are:

William C. Haneberg, New Mexico Bureau of Mines & Mineral Resources, 2808 Central Avenue SE, Albuquerque, NM 87106, (505) 262-2774, fax (505) 255-5253, e-mail: haneberg@nmt.edu;
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 Laurel B. Goodwin, Department of Earth & Environmental Science, New Mexico Tech, Socorro, NM 87801, (505) 835-5178, e-mail: lgoodwin@nmt.edu; and
 Peter S. Mozley, Department of Earth & Environmental Science, New Mexico Tech, Socorro, NM 87801, (505) 835-5311, e-mail: mozley@nmt.edu.

The application deadline for this conference is **March 1, 1997**, and invitations will be mailed to participants by **April 1, 1997**. We will have a limited number of invited oral presentations, so that a significant part of the meeting can be devoted to poster presentations and informal discussions.

Potential participants should send a letter of application to William Haneberg at the address shown above, including a brief statement of interest, the relevance of the applicant's recent work to the themes of the meeting, and the subject of any proposed poster presentation. Although e-mail inquiries to any or all of the convenors are welcome, potential participants should submit 2 paper copies of their application. E-mail letters of application will not be considered.

A hypertext version of this announcement is linked to the New Mexico Tech Faults and Fluids Group website, located at <http://www.nmt.edu/~haneberg/Fluids.html>. □