

EARLY PLEISTOCENE (LATE BLANCAN) VERTEBRATES FROM SIMON CANYON, SOCORRO COUNTY, CENTRAL NEW MEXICO

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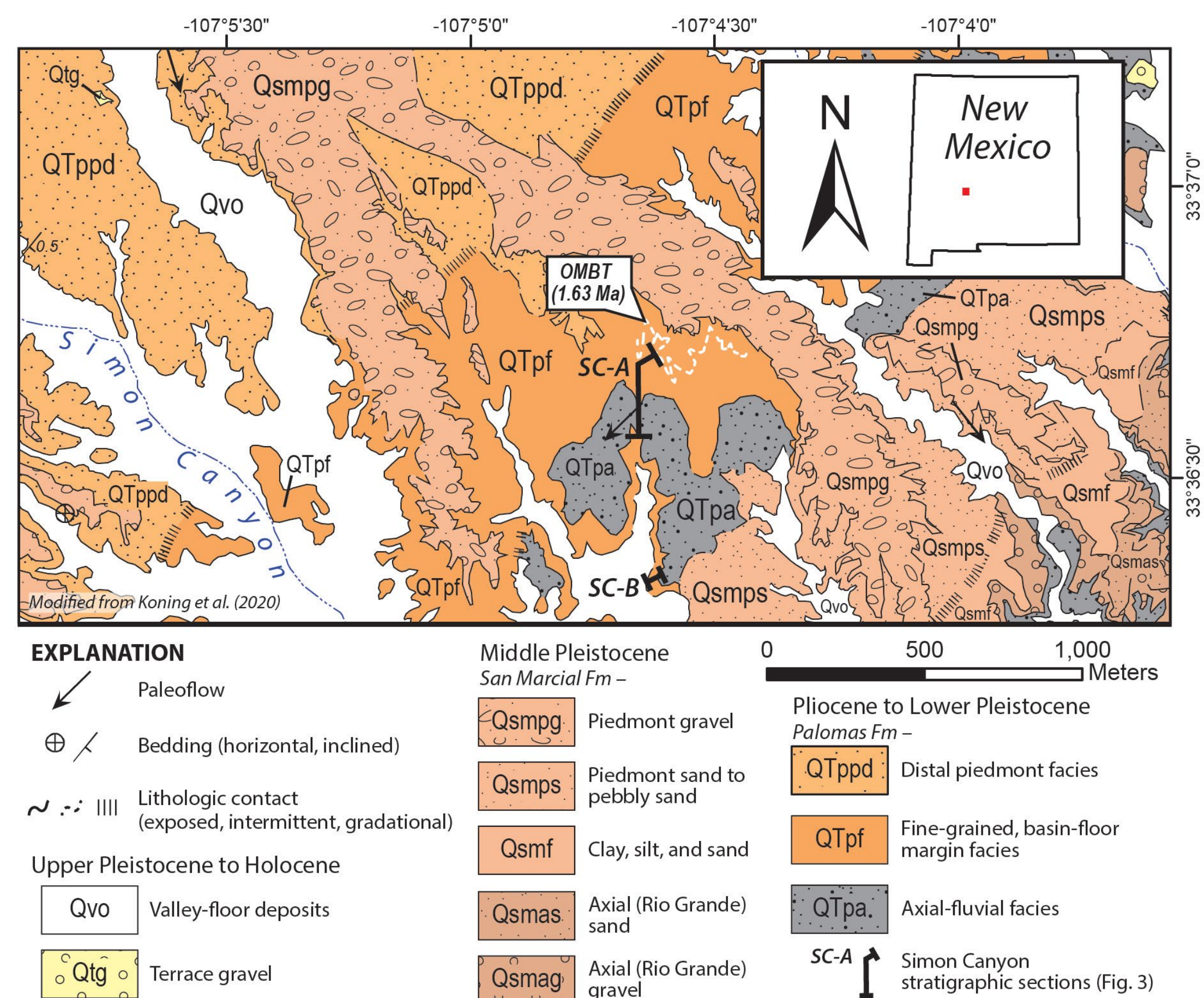


FIGURE 1. Geologic map showing stratigraphic units of the Palomas Formation near the Simon Canyon Local Fauna, within a few hundred meters of stratigraphic sections SC-A and SC-B in Figure 2. Geology is from Koning et al. (2020). The white, dashed line represents the bed of Otowi Member of the Banderlier Tuff (OMBT) pumice (1.628 Ma) present at the top of stratigraphic section SC-A.

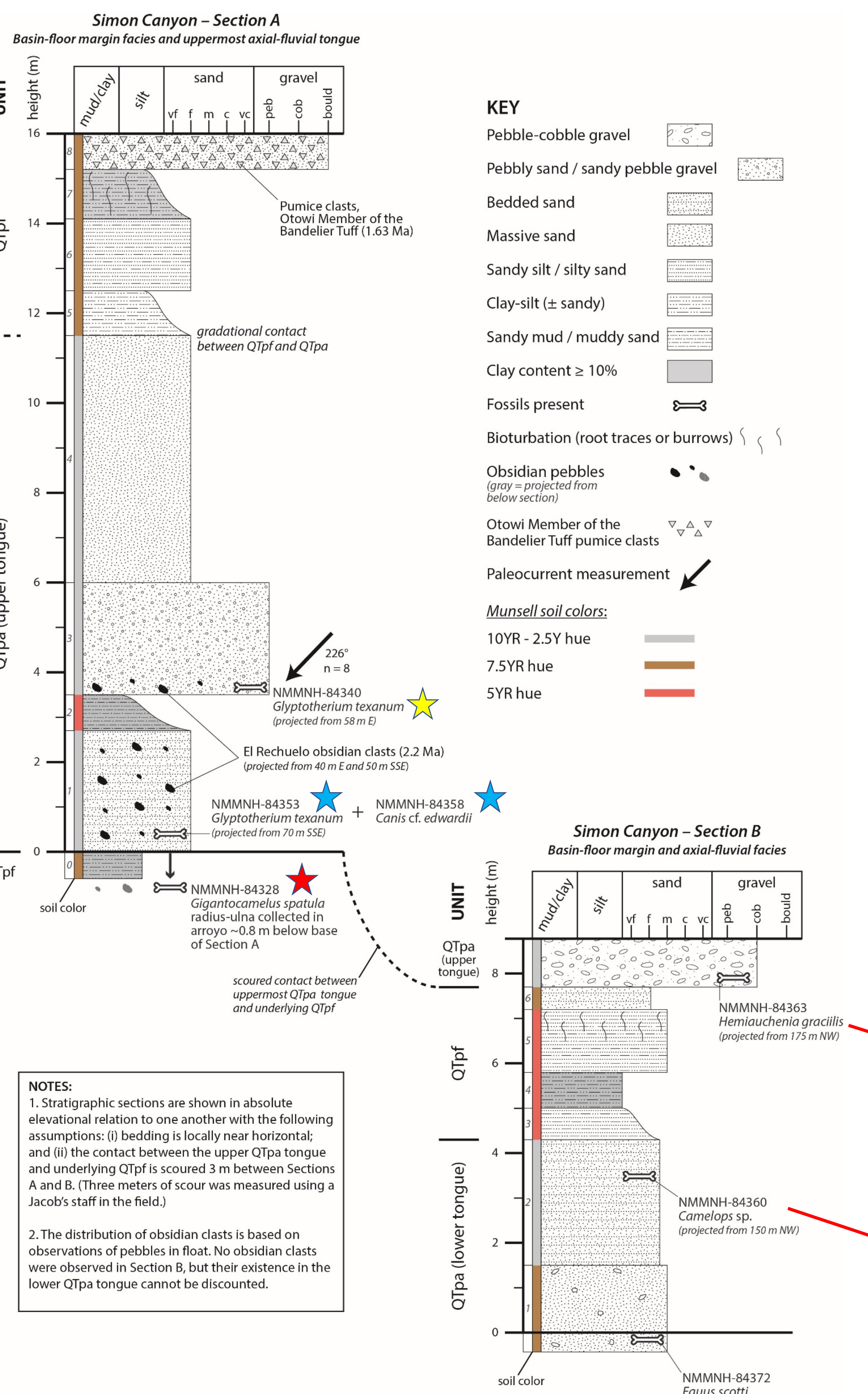


FIGURE 2. Simon Canyon stratigraphic sections A and B (SC-A and SC-B in Figure 1). Palomas Formation stratigraphic units are listed on the left. QTPf = fine-grained transitional unit; QTPa = axial-fluvial sand tongue. Note there is a lower (section SC-B) and an upper (section SC-A) axial-fluvial sand tongue, with the upper tongue yielding the most fossils. The age of the upper tongue is tightly constrained between 1.63 and 2.4 Ma because of the confirmed presence of El Rechuelos Rhyolite obsidian clasts (2.23 ± 0.15 Ma—maximum age) and the Otowi Member of the Banderlier Tuff (OMBT) pumice bed (1.628 ± 0.008 Ma—minimum age).

ABSTRACT

A recently discovered assemblage of vertebrate fossils 53 km south-southwest of Socorro, here named the Simon Canyon Local Fauna (LF), is one of the most precisely dated early Pleistocene (late Blancan North American Land Mammal Age – NALMA) faunas in New Mexico. The site is located near the lower (eastern) end of Simon Canyon in the central San Marcial Basin, Socorro County, in central New Mexico. The fossils were collected primarily from two axial-fluvial sand tongues of the Palomas Formation. The lower 4 m of the 12 m-thick, upper sand tongue yielded most of the fossils and also contained pebbles of obsidian. Trace-element analysis of three obsidian clasts, using XRF methods, indicate a close match with the El Rechuelos Rhyolite obsidian (ERRO), dated at 2.23 ± 0.15 Ma. A 0.8 m-thick, coarsening-upward, pebble-boulder pumice bed is present 4 m above the top of the upper sand tongue. Its geochemistry supports a correlation with the Otowi Member of the Banderlier Tuff (OMBT), dated at 1.628 ± 0.008 Ma, assuming this bed is the same as the Fort Craig pumice. We interpret that this pumice was transported here via a dam-burst flood within thousands of years after the associated Toledo caldera eruption in northern New Mexico at 1.63 Ma. Thus, the age of the upper axial-fluvial sand tongue is bracketed between 2.4 and 1.6 Ma. The Simon Canyon LF consists of 15 species of vertebrates, including seven mammals known from Blancan NALMA vertebrate faunas in New Mexico and elsewhere in the southwestern US: *Glyptotherium texanum* (glyptodont), *Canis cf. edwardii* (wolf), *Equus scottii* (large horse), and four camels, *Camelops* sp., *Gigantocamelus spatulus*, *Hemiauchenia cf. blancoensis*, and *Hemiauchenia gracilis*. Except for *Equus scottii* and *Camelops* sp., these Blancan vertebrates were collected in the lower third of the upper axial-fluvial sand tongue or within 1 m below it. The most age-diagnostic of these species are *Glyptotherium texanum*, a mammal of South American origin and a participant in the Great American Biotic Interchange, that first arrived in New Mexico at the beginning of the late Blancan (~2.7 Ma) and became extinct at the end of the early Irvingtonian NALMA (~1.0 Ma), and *Hemiauchenia gracilis*, a small camel known only from the late Blancan (~1.6–2.5 Ma). Conspicuously absent are Blancan mammals that became extinct at ~2.2 Ma (e.g., *Borophagus*, *Nannippus*) as well as *Mammuthus*, a Eurasian immigrant whose first appearance in North America at ~1.6 Ma defines the beginning of the early Irvingtonian. Thus, the mammalian biochronology of the Simon Canyon LF indicates a latest Blancan age (~1.6–2.2 Ma) for the fauna collected in the upper axial-fluvial sand. This biochronologic age is remarkably consistent with the independent 1.6–2.4 Ma age provided by the overlying OMBT pumice bed and the ERRO clasts found in the lower part of the upper axial-fluvial sand tongue.

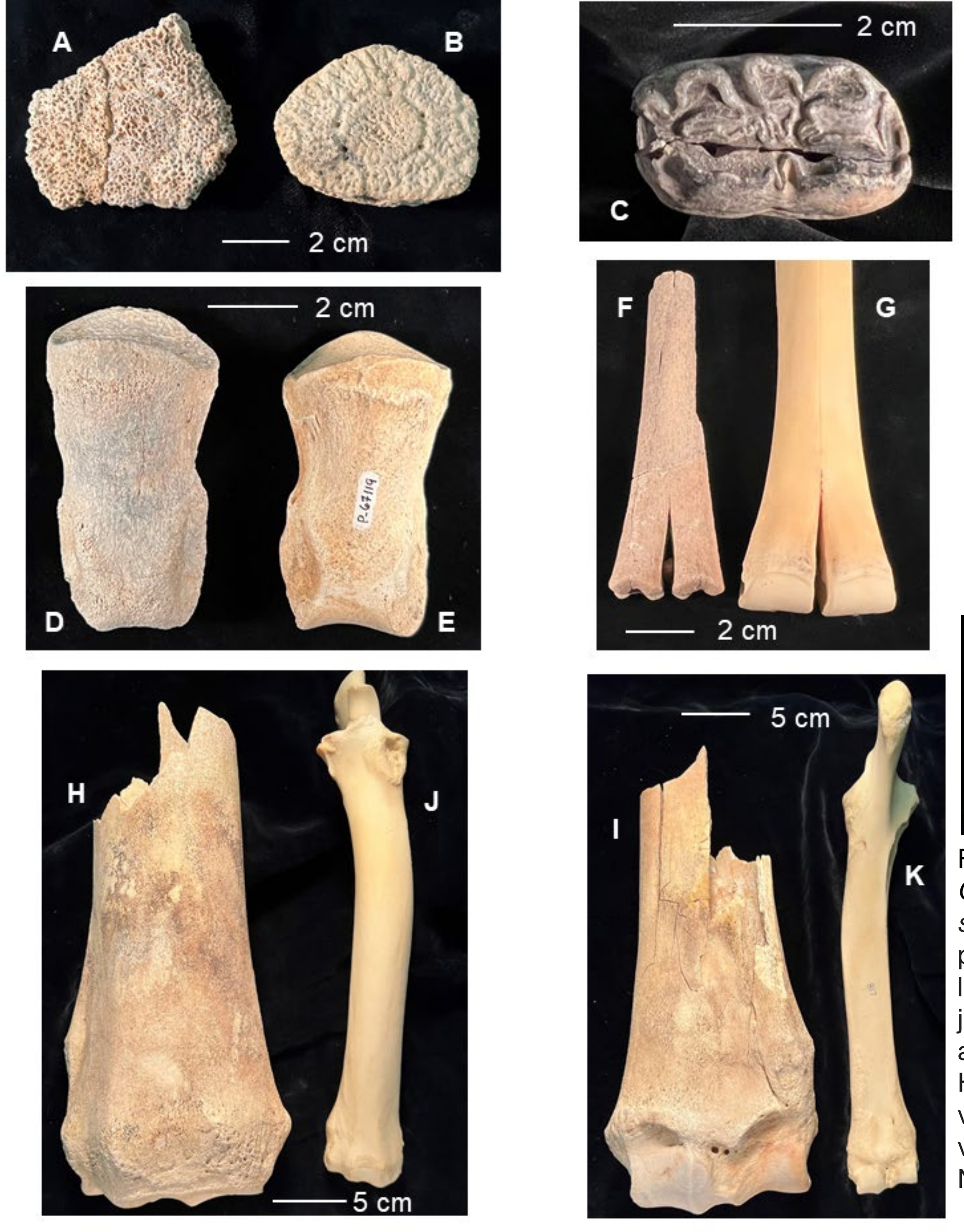


FIGURE 6. Early Pleistocene (late Blancan) vertebrate fossils from the Simon Canyon Local Fauna. A, B. *Glyptotherium texanum*, carapacial osteoderms, external view, A. NMMNH 84353, B. NMMNH 84340. C. *Equus scottii*, right third or fourth lower premolar, occlusal view, NMMNH 84372. D, E. Two species of *Camelops*, medial phalanx, anterior view, D. *Camelops* large species, Simon Canyon, NMMNH 84360, E. *Camelops hesternus*, late Pleistocene Canovas Creek LF, Catron County, New Mexico, NMMNH 67119. F. *Hemiauchenia gracilis*, juvenile distal metapodial, anterior view, Simon Canyon, NMMNH 84363. G. *Lama glama*, distal metacarpal, anterior view, modern. H, I. Distal right radius-ulna of *Gigantocamelus spatulus*, Simon Canyon, NMMNH 84328. H. Anterior view, I. Posterior view. J, K. Right radius-ulna of *Lama glama*, modern. J. Anterior view, K. Posterior view. L. *Canis cf. edwardii*, cervical vertebra, anterior view, NMMNH 84358. M. *Equus* small species, cervical vertebra, anterior view, NMMNH 84373. N. *Hemiauchenia cf. blancoensis*, lumbar vertebra, anterior view, NMMNH 84368. O. *Odocoileus* sp., antler fragment, NMMNH 84333.

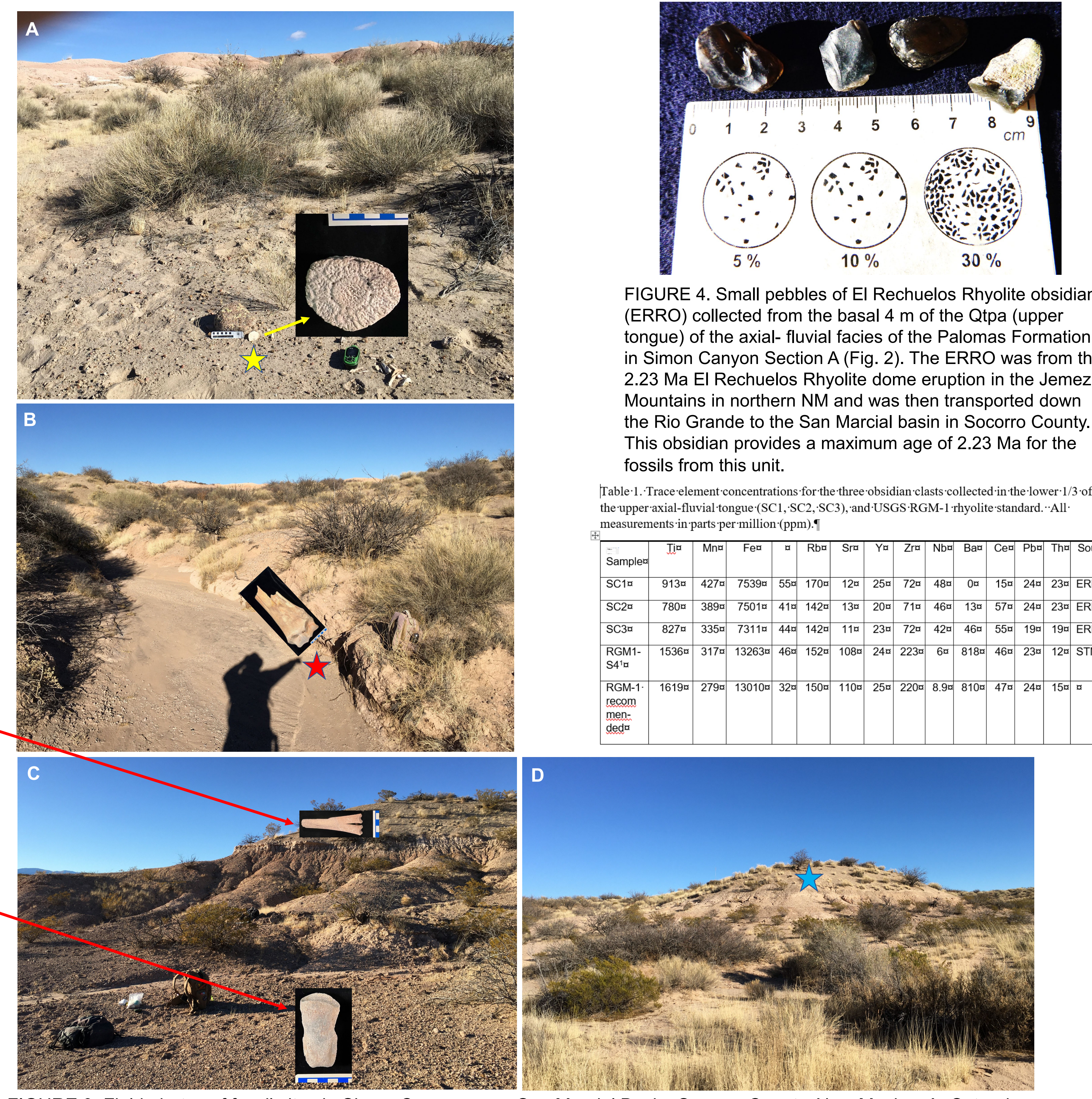


FIGURE 3. Field photos of fossil sites in Simon Canyon area, San Marcial Basin, Socorro County, New Mexico. A. Osteoderm of glyptodont (*Glyptotherium texanum*) indicated by yellow star and arrow. See yellow star on Fig. 2 for stratigraphic position—the highest fossil in the section. B. Person points to site where radius-ulna of giant camel (*Gigantocamelus spatulus*) was found. See red star on Fig. 2 for stratigraphic position. C. Site where two age-diagnostic camel fossils were found. At base of section is a toe of *Camelops* and 5 m higher in section is a metapodial of the dwarf llama *Hemiauchenia gracilis*. Stratigraphic position in Fig. 2 indicated by red arrows. D. Outcrop where Simon Canyon Section A was measured (see Fig. 2). Age-diagnostic fossils found at this site (blue star) were an osteoderm of *Glyptotherium texanum* and a vertebra of the extinct wolf *Canis edwardii*. See blue stars on Fig. 2 for stratigraphic position.

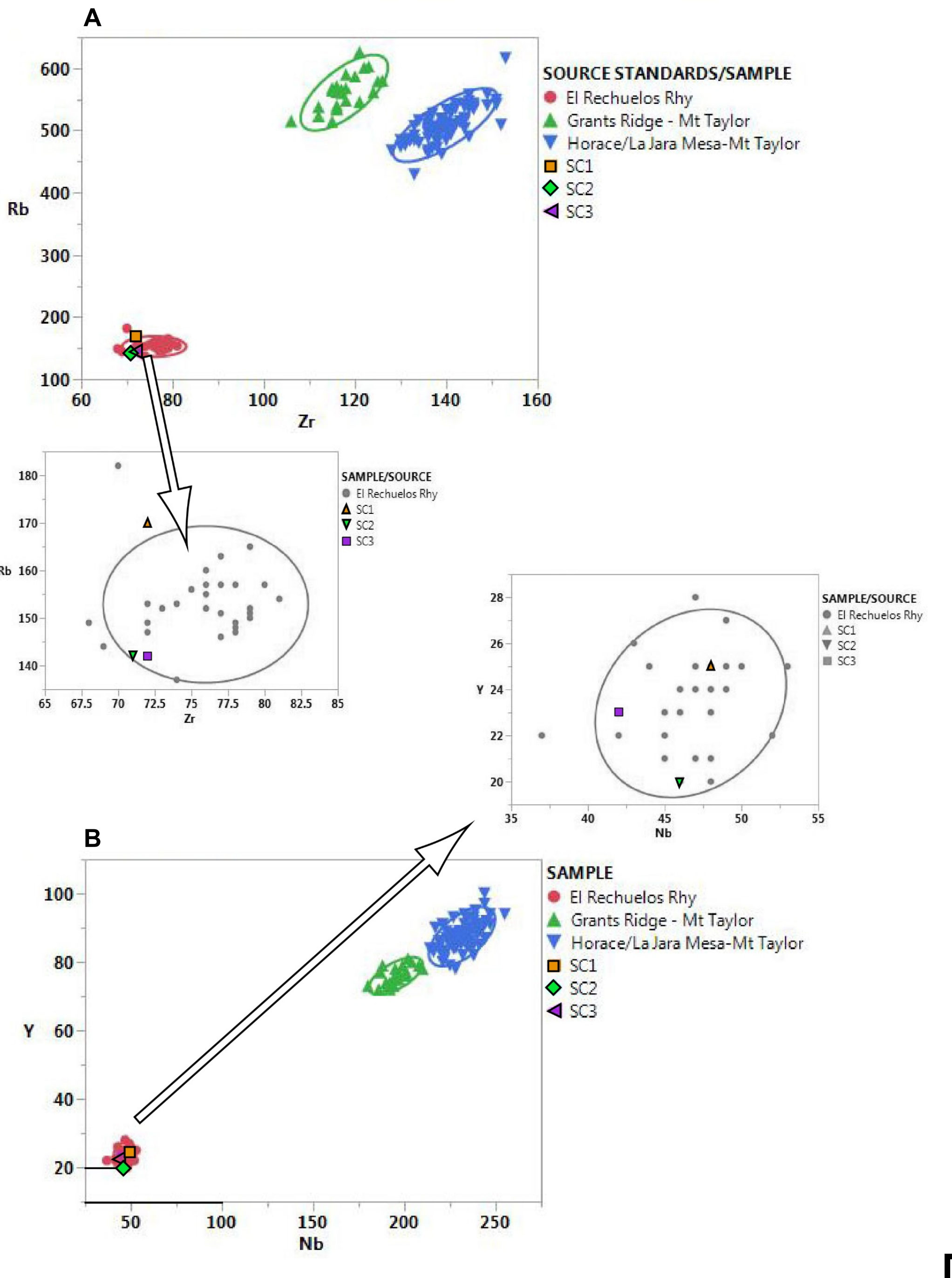


FIGURE 5. Zr/Rb (A) and Nb/Y (B) bivariate plots of Mount Taylor and El Rechuelos Rhyolite source standards and the three obsidian clasts (SC1, SC2, SC3) collected at the Simon Canyon LF. The three most likely upstream sources must predate 1.628 Ma and are the El Rechuelos Rhyolite, Grants Ridge (Mt. Taylor area), and Horace/La Jara Mesa (also in the Mount Taylor area). Note the close correspondence of the three Simon Canyon LF samples with the El Rechuelos Rhyolite. The two middle bivariate plots comparing the three Simon Canyon obsidian clasts and El Rechuelos Rhyolite standards provide increased clarity. All measurements are in ppm. Confidence ellipses at 90%.

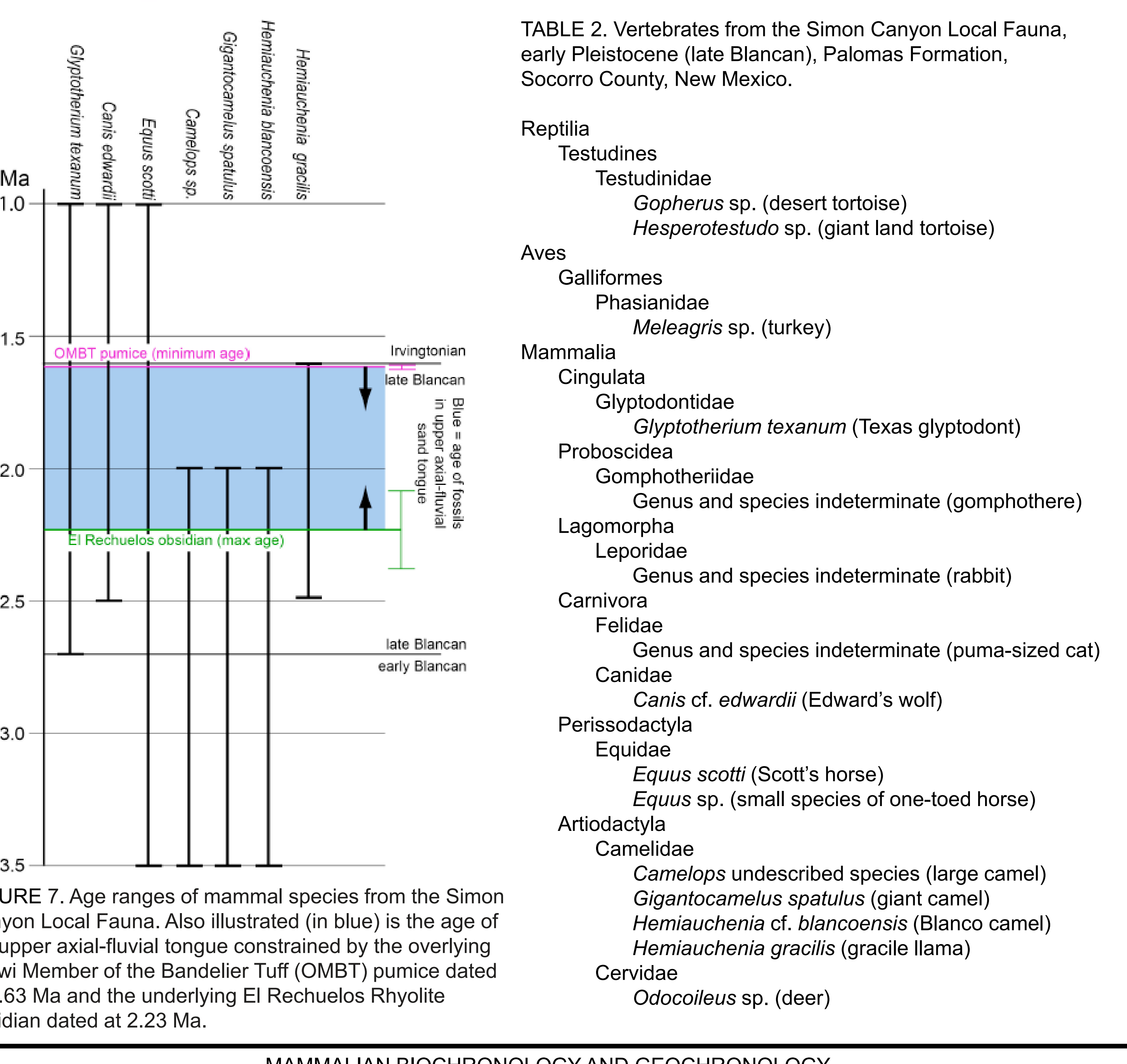


FIGURE 7. Age ranges of mammal species from the Simon Canyon Local Fauna. Also illustrated (in blue) is the age of the upper axial-fluvial tongue constrained by the overlying Otowi Member of the Banderlier Tuff (OMBT) pumice dated at 1.63 Ma and the underlying El Rechuelos Rhyolite obsidian dated at 2.23 Ma.

The biochronologic age control from the Simon Canyon LF agrees remarkably well with independent geochronologic data provided by the Otowi Member of the Banderlier Tuff (OMBT) pumice and El Rechuelos Rhyolite obsidian (ERRO). The occurrence of *Glyptotherium texanum*, *Canis edwardii*, and *Hemiauchenia gracilis* confirms that the Simon Canyon LF is younger than 2.5 Ma, whereas the presence of the camels *H. blancoensis*, *H. gracilis*, *Camelops* sp., and *Gigantocamelus spatulus* establishes an age older than 1.6 Ma. The absence of *Borophagus*, *Nannippus*, and *Equus simplicidens* further suggests an age younger than 2.2 Ma. Most of the age-diagnostic mammals were collected in the stratigraphic interval encompassing the lower 4 m of Section A (Fig. 2), located 11–15 m below the OMBT pumice bed. The overlying OMBT pumice is dated at 1.628 ± 0.008 Ma and therefore postdates the Simon Canyon LF. We collected several clasts of ERRO (Fig. 4), dated at 2.23 ± 0.15 Ma, on the surface of the same stratigraphic interval that produced many of the mammals mentioned above (i.e., the lower 4 m of the upper axial-fluvial tongue; Fig. 2). Since the obsidian provides a maximum age constraint and the pumice bed a minimum age constraint, the fossils in the basal 4 m of the upper axial-fluvial tongue (Section A of Fig. 2) are between 1.6 and 2.4 Ma. This is very similar to the age range indicated by the mammalian biochronology of 1.6 to 2.2 Ma.