Gallery of Geology - Sierra de Cristo Rey

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Courtesy of El Paso Public Library, Charles Binion Collection

The statue of Christ the King stands sentinel over the international border between the United States of America and Los Estados Unidos de México as the sun rises over the Franklin Mountains at El Paso, Texas. Perched atop a 4,675-ft (1,425-m) Tertiary andesitic pluton known today as Sierra de Cristo Rey, the statue of Christ looks eastward from New Mexico into the valley of the Rio Grande almost a thousand feet below, into the legendary El Paso del Norte portion of the Camino Real, the "royal road" from Mexico City to Santa Fe. On April 30, 1598, approximately 25 mi southeast of this site, Don Juan de Oñate took possession of the land (the kingdom of New Mexico) in the name of God and King Philip of Spain (Preston 1998, p. 22).

The statue is the result of Pope Pius XI's 1933 request to commemorate the 19th centennial of Christ's birth. Father Lourdes Costa, parish priest at Smeltertown, Texas, suggested that his parishioners put a cross on the peak. They raised first a wooden cross, then a metal cross, at which point Father Costa had the peak's name changed officially to Sierra de Cristo Rey in 1935 (Binion 1970, p. 19). Previously, it had been known as Cerro de Muleros (Muleteer or Mule Skinner's Peak) and Cerro Rodadero (Shifting Peak).

Soon after the Bishop of El Paso became enthusiastic about the project, and a statue to rival Rio de Janeiro's Monumento do Cristo Redentor was proposed. In 1938 the statue (33.5 ft high on a 9-ft base) was carved from 30 tons of Upper Cretaceous limestone from Austin, Texas, known as "Cordova cream" by Urbici Soler, a master sculptor from Spain who took 2 yrs to complete the statue (Binion 1970, p. 19). Lovejoy (1976, description of frontispiece) placed the cost of the Cristo Rey project at $500,000 and stated that the statue was made from Cordova cream "sandstone." The statue is physically in Doña Ana County, New Mexico, about a quarter of a mile north of the Mexican state of Chihuahua and about a mile west of El Paso County, Texas.

The bulk of the Sierra de Cristo Rey uplift is formed of the Eocene Muleros Andesite, a plagioclase and hornblende porphyry. This andesitic pluton is about 10,000 ft (3,000 m) in diameter and straddles the New Mexico–Mexico boundary with about two-thirds of the pluton exposed in New Mexico. The pluton has intruded and deformed about 1,000 ft (300 m) of Cretaceous marine strata of the uppermost Comanchean series (Buda Limestone through Del Norte Formation) and the lowermost Gulfian series (Boquillas Formation). The Cretaceous rocks are exceptionally well exposed in concentric outcrop belts around the pluton, where the shales have been mined for brick clay, the sandstones used as silica sources, and the limestones used in cement plants (Lovejoy 1976, p. 11).

Sierra de Cristo Rey is the one of the few places in New Mexico where strata of the uppermost Comanchean and the lowermost Gulfian strata are well exposed and fossiliferous. As a result, it is one of the featured outcrops in the lead article in this issue of *New Mexico Geology* (Cobban et al. 2008, fig. 2). The Comanchean (provincial) series, named for Comanche, Texas, and the (provincial) Gulf series have long been equated with Lower and Upper Cretaceous, respectively. Adkins (1933, p. 401) states that "the lower limit of the [Gulf] series is defined lithologically by the presence of the underlying Grayson [Formation] or Buda [Limestone] at most places." However, the unconformity between the Gulfian formations and the Buda Limestone falls within the Cenomanian Stage,

not at the Albian–Cenomanian boundary (Cobban et al. 2008, fig. 2, this volume).

At Sierra de Cristo Rey both the calcarenites at the base of the Gulfian Boquillas Formation and the upper limestones of the Comanchean Buda Limestone are fossiliferous allowing the Gulfian–Comanchean unconformity to be dated. The base of the Boquillas lies in the upper middle Cenomanian *Acanthoceras amphibolum* Zone, whereas, the upper Buda lies in the lower Cenomanian *Neophlycticeras* (*Budaiceras*) *hyatti* Zone (Cobban et al. 2008, fig. 2, this volume). The missing two lower Cenomanian zones may have been removed from the rock record by erosion; strata containing the lower middle Cenomanian *Acanthoceras bellense* fauna may not have been deposited.

Proceeding northwestward from Cristo Rey, the magnitude of the Gulfian–Comanchean unconformity increases dramatically. In the Cookes Range, the top of the Comanchean equivalent Sarten Sandstone is eroded and lies in the lower Cenomanian *Neophlycticeras* (*Budaiceras*) *hyatti* Zone; however, the base of the Mancos Shale is in the upper Cenomanian *Calycoceras* (*Proeucalycoceras*) *canitaurinum* Zone, two ammonite zones higher than at Cristo Rey, 80 mi to the southeast. In the Big Burro Mountains, 57 mi to the northwest of the Cooke's Range, the base of the Mancos lies in the upper Cenomanian *Calycoceras* (*Proeucalycoceras*) *canitaurinum* Zone, but the underlying Beartooth Quartzite does not contain marine megafossils. At Virden, 19 mi to the west of the Big Burros, the base of the Mancos Shale is at least two ammonite zones higher in the upper Cenomanian *Metoicoceras mosbyense* Zone but is in contact with Precambrian granite. (See Cobban et al. 2008, p. 86, this volume.) The stratigraphic rise at the base of the Mancos Shale reflects the waning influence of the Burro uplift in middle and late Cenomanian time as the Late Cretaceous seaway transgressed across southwest New Mexico (Hook and Cobban 2007, pp. 90–91).

Proceeding southeastward along the Rio Grande from Sierra de Cristo Rey to Del Rio, Texas, (375 mi southeast), the Gulfian–Comanchean unconformity does not appear to change much, if at all, in magnitude. Where there are fossil collections at or near the bases of the Gulfian rocks (Boquillas, Chispa Summit, and Ojinaga Formations), they are in the lower Cenomanian *Acompsoceras inconstans* Zone or the overlying *Forbesiceras brundrettei* Zone, although fossils from these zones are occasionally found in depressions in the top of the underlying Buda Limestone (Cobban et al. 2008, p. 76, this volume). The top of the Buda Limestone generally contains a fauna from the underlying lower Cenomanian *Neophlycticeras* (*Budaiceras*) *hyatti* Zone. The top of the Buda Limestone usually shows evidence of erosion; Cooper et al. (2008, fig. 12) show microkarst features at the Boquillas–Buda unconformable contact in Big Bend National Park, 230 mi southeast of Cristo Rey. The microkarst features include shallow solution hollows in the Buda filled with Boquillas shale.

The story of the Sierra de Cristo Rey extends back in geologic time more than 100 million years and includes deposition of marine Cretaceous rocks, formation of a major unconformity, and the intrusion of an andesitic pluton. This story extends back in historic time to 1598 when Oñate claimed New Mexico for the King of Spain. The peak that holds the statue of Christ the King has had several names including Cerro de Muleros and Cerro Rodadero. Today it is often called, informally and on tourist brochures "Christ of the Rockies." Its official name, Sierra de Cristo Rey, dates back to 1935. Additional photographs of the peak and its beautiful statue as well as stations of the cross can be found in Binion (1970, pp. 19–25) and Lovejoy (1976). A complete account of the geology of Cristo Rey can be found in Lovejoy (1976.)

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The Southern Extension of the Western Interior Seaway: Geology of Big Bend National Park and Trans-Pecos, Texas

A premeeting field trip to Big Bend National Park will be held from Monday, September 29, through Saturday, October 4, in conjunction with the Geological Society of America's annual meeting in Houston. Big Bend is cosponsoring the field trip, which will be led by Roger Cooper, Lamar University; Dee Ann Cooper, University of Texas at Austin; Brian Lock, University of Louisiana at Lafayette, and Thomas Lehman, Texas Tech University.

Big Bend National Park in Trans-Pecos Texas (that part of Texas west of the Pecos River) is bounded on three sides by the Rio Grande and Mexico. This high desert is the southernmost expression of the Rocky Mountains within the United States and the least-studied part of the Western Interior Seaway. Between Del Rio and Alpine, Texas, the field trip includes stops at outcrops of the Del Rio and Buda (Cenomanian), Boquillas (Ernst Member), and Atco Chalk (Coniacian) Formations, followed by two days examining the Buda, Boquillas (Eagle Ford and Austin equivalent), Aguja, and Javelina Formations in Big Bend National Park, and the Cenomanian–Turonian and Turonian–Coniacian Stage boundaries.

More information on "The Western Interior Seaway" will be available at a technical poster session (T37) hosted by Roger and Dee Ann Cooper on Tuesday, October 7, at the GSA meeting in Houston. This is a multidisciplinary session specifically devoted to studies of the Western Interior Seaway and its global correlatives. Presenters will be an eclectic mix of paleontologists, stratigraphers, sedimentologists, geophysicists, and geochemists.