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Geophysical Expressions of Ancestral Rocky Mountain Structures

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Considerable geophysical data that reveal the deep manifestation of Ancestral Rocky Mountain structures have recently come to light. These data show that the scale and complexity of these structures is impressive. The Wichita and Uncomphagre uplifts are the largest of these features, and the structural relief across the northern margin of the Wichita uplift along is border with the Anadarko basin is about 15 km. This feature is one of the largest structures in North America. For example, the Anadarko basin contains more than 12km of Cambrian through Permian sedimentary rocks. The structures extending across Oklahoma and the Texas panhandle have been referred to as the Southern Oklahoma or Wichita aulacogen. This set of structures extends from the early Paleozoic continental margin in northeasternmost Texas ands can be interpreted to extend along this trend as far northwest as the Uncomphagre uplift. The rifting that initiated the formation of these features formed as a result of a major continental breakup in latest Precambrian/earliest Paleozoic time. We can only infer the presence of rift structures from indirect geologic evidence. However, geophysical data document that the amount of modification of the crust is impressive. In fact, little if any of the original upper continental crust remains beneath the Wichita uplift and thrust faults extent at least to mid-crustal depths. The deformation that formed the Ancestral Rocky Mountains is a massive inversion of these rift structures and is due to a plate collision in the late Paleozoic. These structures form one of North America's major petroleum provinces.

Many other Ancestral Rocky Mountain structures are very large. The Central basin platform in the Permian basin is also underlain by a rift structure that was inverted. In this case, the rifting occurred at ~1.1 Ga during another period of widespread rifting in North America. Recent studies in New Mexico have revealed that the formation of the Ancestral Rockies was accompanied by strike-slip movements. A number of steep-sided troughs filled primarily with Pennsylvanian strata have been discovered. These structures appear to be most easily interpreted as pull-apart basins. In central New Mexico, these basins trend N-S, but in northeastern New Mexico, there are a number of inferred orientations that are not well constrained by existing data.