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Gravity and Magnetic Studies of the Southern Rocky Mountain Crust: Basins to Basement

The Rocky Mountains have intrigued researchers and explorationists ever since the gold rush days. These mountains are a tectonic puzzle because of their complex history and their distance from plate margins that usually make driving mechanisms evident. From a petroleum exploration point of view, the formation of the ancestral Rocky Mountains, the Laramide orogeny, and late Cenozoic extension and uplift are of primary interest. There has been an increasing emphasis on gravity and magnetic data in studies of this region, and these data have been particularly effective when used in an integrated fashion with seismic and drilling data. Rifting during the late Precambrian and Cambrian affected large areas of the southwest and created sedimentary basins that have in many cases survived to the present. In at least some cases, these strata contain both source and reservoir rocks. Thus, there is frontier defined by stratigraphic depth. In addition, younger structures such as those associated with the ancestral Rocky Mountains have often been affected by older rift structures preserving Cambrian and older strata. Gravity and magnetic data have played a major role in studies that reveal the deep manifestation of ancestral Rocky Mountain structures, including the deep basin structure and anomalies structure of the uplifts, and these data show that the scale of these structures is impressive in a global context. The structures extending across Oklahoma and the Texas panhandle into New Mexico have been referred to as the Southern Oklahoma or Wichita aulacogen, which can be interpreted to extend along this trend as far northwest as the Uncompahgre uplift in Utah. 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. The Laramide orogeny also produced considerable crustal scale deformation in the form of large basement uplifts and deep productive basins. Finally, late Cenozoic uplift and extension formed a series of basins that gravity and magnetic data show are deep and complex.

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Biographical Sketch

G. Randy Keller holds the L.A. Nelson Professorship in the Department of Geological Sciences at the University of Texas at El Paso. He is also Chief Scientist and Co-Principal Investigator at UTEP's large NASA Earth Science research center. His research interests stress the geological applications of geophysics and span a variety of techniques at a variety of scales. He has conducted many studies of the structure and evolution of the lithosphere using gravity, magnetic and seismological measurements integrated with geological data. He has also regularly used geophysical methods to study issues such as ground water resources, earthquake hazards and site characterization. He has been very involved in the Geoinformatics initiative and is interested in the development of databases, techniques that foster data integration, software tools and Web services. In addition, he has helped organize numerous large cooperative research efforts and has regularly received funding from sources that include NSF, NASA, Department of Energy, U.S. Geological Survey, Department of Defense and industry. Dr. Keller has published over 200 scientific papers, reports and book chapters as well as many maps. He also has directed 22 doctoral dissertations and 62 master's theses and has mentored and advised many undergraduate students. He is a long-time member of the GSA, AGU, SEG, AAPG, RAS and EGU and has served numerous governmental agencies, professional societies and scientific bodies as an officer and committee member. In addition to his research interests he is particularly concerned with issues such as those involving information technology and data sharing, diversity, science education and professional development of students and those already in the work force.