about 2 kilometers of dextral offset between 18.6 and 18.0 Ma. Extension to the southwest of this segment of the boundary, in the Goldfield Mountains, was moderate to extreme. South of the cauldron, the boundary zone turns sharply to the east and extends into the Globe-Miami area. Extension to the south of this boundary was weak to moderate but distributed over a larger area than in the Goldfield Mountains.

The sharp turn in the boundary zone at the Superstition cauldron coincides regionally with the hypothetical southwesterly continuation of the Jemez Lineament, a prominent northwest-trending zone of Neogene magmatism that extends across New Mexico and eastern Arizona. The turn also coincides with an abrupt change in the dip of the detachment faults that bound the core-complexes in the Basin and Range province. To the west, detachment faults dip to the northeast, and to the south they dip to the southwest. Directly southwest of the Superstition volcanic field the absence of core-complexes is conspicuous.

The nearest core complex, in the South Mountains directly to the west, had a long-lived history (~25-17 Ma) of exhumation involving Tertiary granitoids significantly older than the volcanics of the Superstition volcanic field. Along strike to the southeast from the South Mountains a low-angle, northeast-dipping normal fault in the Santan Mountains, which lie directly southwest of the Superstition volcanic field, is overlapped by a flat-lying outlier of the Apache Leap Tuff.

FINSTICK, SUE A.,

Determining the influence of surface water on Six Mile Spring, Parawan, Utah.

Six Mile Spring has historically been the main source of culinary water for the City of Parowan, Utah, providing about 900 gpm year-round. Routine water sampling indicated a possible link with surface water. Tests were undertaken to determine the influence of surface water on the spring. The results of additional water sampling, as well as the results of a Hydrolab Datasonde 3 logger, a MicroParticulate Analysis (MPA) test, and a calcium chloride tracer test, were inconclusive. A dye tracer test (Fluorescent FWT Red) proved conclusively that Six Mile Spring is under the direct influence of surface water. Geologic mapping indicates that the spring is fault-controlled. However the surface water influence is likely a result of solution channels within the Tertiary (Eocene and Paleocene?) Claron Formation limestone. Future plans call for similar testing on other springs in the area.

HACKER, DAVID B.

Geologic evolution of the Pine Valley Mountains, Basin and Range – Colorado Plateau transition zone, southwest Utah.

Tertiary volcanic and hypabyssal intrusive rocks cover most of the Pine Valley Mountains in Washington and Iron Counties, Utah. The older (Oligocene and Miocene) part of the volcanic sequence consists mostly of regional calc-alkaline ash-flow tuffs derived from caldera sources (Indian Peak and Caliente caldera complexes) outside the area. These volcanic rocks rest on, or are interbedded near the top of, fluvial and lacustrine rocks of the Paleocene-Oligocene Claron Fm. The Claron rests unconformably on fluvial rocks of the Upper Cretaceous Iron Springs Fm. Beginning in the latest Cretaceous and ending in the Paleocene, the Iron Springs and underlying older Mesozoic rocks were folded during the Sevier orogeny, producing a NE-trending open fold, named here the Big Hollow syncline. The axial trend of the syncline is aligned parallel to the Virgin anticline to the east. The Virgin-Big Hollow fold system is interpreted to be younger than thrusting in the Iron Springs district to the north and therefore may represent the youngest structural feature of the orogenic belt in this part of southwest Utah.

During the early Miocene (22 to 20 Ma), an episode of igneous activity in the Pine Valley Mountains produced a series of shallow, calc-alkaline laccolithic intrusions with associated volcanics and gravity-slide structures. The intrusions of the Pine Valley Mountains are part of the larger (140 km long) NE-trending Iron Axis magmatic province, which includes more than a dozen-exposed intrusions consisting mostly of quartz monzonite. The gigantic 30 km long by 11 km wide Pine Valley laccolith (20.5 Ma) caps a large portion of the Pine Valley Mountains and has a remaining thickness of as much as 900 meters. The laccolith intruded beneath a thin cover (<200m of Claron and Tertiary volcanics) and most likely occupied an area of 600+km2, as delineated by erosional outliers to the south and subsurface extensions beneath domed country rocks to the north. Gravity-slide structures associated with intrusive doming of several laccoliths consist of allochthonous masses of brecciated Tertiary volcanic and sedimentary strata detached along low-angle faults from the growing uplifted flanks of the Pinto Peak, Stoddard Mountain, and Pine Valley intrusions as well as the Bull Valley-Big Mountain (BV-BM) intrusion to the west. The largest slide mass (from BV-BM) covers 170 km2, is as much as 670 m thick, and extends more than 20 km from its intrusive arch. Immediately following each sliding episode, each intrusion erupted ash flows and (or) lava flows that partially or totally covered the slide masses. Thus, the laccoliths of the Pine Valley Mountains each show continuous growth stages from (1) initial rapid sill emplacement to its full lateral extent within the Iron Springs or Claron Fms, (2) vertical growth and bending of the overburden as the sill thickened into a laccolith, (3) gravity sliding from the upturned roof as the intrusion continued its vertical growth, and (4) eruption of ash flows and (or) lava flows as a result of pressure release due to gravity sliding.

Following intrusive activity (post-20 Ma), the area again received regional ash-flow deposits from the Caliente caldera complex (Racer Canyon Tuff) followed by local bimodal magmatism that produced abundant basalt lava flows and minor dacitic domes. Numerous post-8 Ma NS-trending high-angle normal faults produced an overall extensional related fragmentation of the Pine Valley Mountains at this time related to Basin and Range tectonism. The location and alignment of the youngest volcanic centers are highly controlled by the presence of these faults.

HARRIS, R., NELSON, S., DORIAS, M., KOWALIS, B., HARRIS, D., AND HEIZLER, M.

Tectonic evolution of the northern-most basement of the Colorado Plateau: Petrology and Thermochronology of the Santaquin metamorphic complex, southern Wasatch Range, Utah.

Petrologic and thermochronological analysis of the Santaquin metamorphic complex (SMC) reveal that it differs in composition and age from Archean basement exposed 50 km to the north and may represent the northern most exposure of Colorado Plateau basement. The SMC consists of mildly strained garnet amphibolite and schists intruded by granitoid bodies, which are mildly deformed by mostly non-rotational shear. Hornblende separates yield 40Ar/39Ar plateau cooling ages of 1657 +/- 2 Ma for the host amphibolite and 1623 +/- 2 Ma for a mafic syenite intrusion. K-feldspar from the syenite indicates the SMC cooled to <100fC at around 750 Ma, which is near the age of the unconformably overlying Big Cottonwood Formation. Reheating to 325 +/- 30fC occurred from around 500-350 Ma. This event was most likely caused by burial of up to 10 km of sedimentary successions during passive margin and Oquirrh Basin development. The feldspar reached its closure temperature (~200fC) at around 180 Ma, most likely as a result of basin inversion associated with the Sevier orogen. The time/temperature history after this event is currently being explored by analysis of apatite fission tracks.

HEATH, S.H. Southern Utah University

Herbert E. Gregory, Pioneer Geologist of the Colorado Plateau

Herbert E. Gregory, Yale Geologist, spent over four decades studying the geology of the Colorado Plateau. He began his studies in the southwest in 1907 on the Navajo Indian Reservation in northern Arizona and ended it with his studies of Zion and Bryce Canyon National Parks in 1951, less than a year before his death. Between these two studies he spent considerable time in southeastern Utah and on the Kaiparowits Plateau in southern Utah. He produced five classic United States Geological Survey Professional Papers: #93, Geology of the Navajo Country: A Reconnaissance of Parts of Arizona, New Mexico, and Utah, 1917; #164, with Raymond C. Moore, The Kaiparowits: A Geographic Reconnaissance of Parts of Utah and Arizona, 1931; #188, The San Juan Country: A Geographic and Geologic Reconnaissance of Southeastern Utah, 1938; #220, Geology and Geography of the Zion Park Region: Utah and Arizona, 1950; and # 226, The Geology and Geography of the Paunsagunt Region, Utah: A Survey of Parts of Garfield and Kane Counties, 1951. With such expertise, it is little wonder that the International Geological Congress which was held in the United States in 1933, invited Gregory to write the guidebook for the excursions in the Colorado Plateau region. The guide is still an important first course for geologists new to the Colorado Plateau. In 1919, Gregory wrote his wife about the plateau country: "Gee! How I love those red rocks and sands and dry heat."

Gregory's greatest contribution to geology came with his studies of the Kaiparowits region. He gave the world there first view of this remote and isolated region. This poster presentation will outline Gregory's pioneering effort into this relatively unstudied region of the Colorado Plateau. He made his first reconnaissance into the Kaiparowits in 1915. This survey study was followed by extensive fieldwork in 1918 and 1922, and another short expedition to the region in 1924. Today the Kaiparowits Plateau is the centerpiece of the Grand Staircase-Escalante National Monument. For the student of the monument, a knowledge of the work of Gregory is necessary. Gregory felt the Kaiparowits was the centerpiece of the geology of the Colorado Plateau. At the Fifty Mile Point on the Kaiparowits he wrote in his field notes: "profound straight walled meandering canyons, and Navajo Mountain is a gorgeous spectacle." To his wife he exclaimed: "For scenery, the Grand Canyon must take second place."

In addition to featuring Gregory's work in the Kaiparowits, a chronology of his life and work and a short bibliography will be presented. Herbert E. Gregory was one of the great pioneers of geology on the Colorado Plateau and his story needs to be told.

HINTZE, LEHI F. and AXEN, GARY J.

The Lime Mountain area, an unusually informative window into the Mesozoic – Cenozoic structural complexities of southeastern Nevada.

The Tule Spring Hills are a Basin and Range horst that exposes a structural complex produced by Mesozoic southeastward thrusting and Cenozoic east-west extension. The Tule Spring Hills thrust, eastern kin to the Las Vegas area Keystone thrust, places a 1000-foot- thick (300m) sheet of brittlely fractured, pervasively faulted, Cambrian carbonate strata over less faulted Jurassic Kayenta redbeds and, locally, a mélange of Triassic strata. Sandwiched locally between the overthrust Cambrian carbonates and the Mesozoic redbeds are remnant blocks of mélanges several thousand feet (m) long, which have been dragged along beneath the thrust plate.

The Lime Mountain thrust places Cambrian and Ordovician strata over Mississippian limestone, a different subthrust stratum than that of the Tule Spring Hills thrust. On the north end of Lime Mountain, the Mississippian limestone is cut by a dike of Miocene volcanic rock and has been locally marbleized. Miocene volcanic rocks, from sources north of the area, originally were laid unconformably across the area but have been removed by erosion, except in a few areas. They include 22 to 24 Ma ash-flow tuffs from the Caliente caldera complex and 10 to 14 Ma tuffs and basaltic rocks from the Clover Mountains just north of the Lime Mountain area.

The north end of the Tule Spring Hills are cut by east-southeasterly trending right-lateral strike-sli faults that appear to offset some of the volcanic rocks and, thus, may be of late Cenozoic age. the major Basin and Range normal faults that bound the Tule Spring Hills are not exposed but have been identified on seismic lines and separate the Tule Spring Hills from the Tule Desert Basin, on the northwest, and the Mesquite Deep Basin on the southeast. The Mesquite Deep Basin contains 32.000 feet (10km) of Tertiary valley-fill in its deepest part, including sediments derived from the Lime Mountain area.

HURLOW, H.A., LOWE, M., WALLACE, J.J., and BISHOP, C.E.

Geology, hydrogeology, and ground-water quality of Cedar Valley, Iron County, southwestern Utah.