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 <100*f*C at around 750 Ma, which is near the age of the unconformably overlying Big Cottonwood Formation. Reheating to 325 +/- 30*f*C 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 (~200*f*C) 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.

Cedar Valley is a N-NE-trending topographic depression on the southeastern margin of the Basin and Range Province. From 1980 to 1998, the valley's population increased by 75% and water use by public-supply systems increased by 110%. Continued rapid growth and development are creating potential water-supply and water-quality problems.

Cedar Valley's principal aquifer is in Tertiary sedimentary basin-fill deposits, composed of interbedded sand, gravel, silt, and clay deposited in stream, alluvial-fan, and lacustrine environments. Most recharge is from infiltration of Coal Creek, which drains the Markagunt Plateau east of Cedar Valley, into alluvial-fan deposits near Cedar City. The drainage basin is closed to surface outflow except during extreme precipitation events, but minor underflow occurs through topographic gaps along the valley's NW and S margins. Interpretation of seismic-reflection data collected by Mobil EPS, Inc. reveals that the Tertiary basin fill is up to 3,800 feet thick, contains three unconformity-bounded units, and has a complicated subsurface structure including two major sub-basins and several smaller intrabasin highs and lows.

Transmissivity of the basin-fill aquifer is greatest in alluvial-fan deposits along the SE and SW valley margins, and decreases toward the valley center as sedimentary deposits become progressively finer grained. Cedar Valley formerly contained flowing wells in its center and springs along its eastern margin, but pumping has lowered the potentiometric surface below the land surface and dried the springs since 1975. Bedrock units are of secondary importance for water supply, but are hydrologically connected to the basin-fill aquifer and may locally accommodate underflow across the basin-bounding fault system into the basin-fill aquifer.

Ground-water quality in the Cedar Valley basin fill is generally good, with total-dissolved-solids concentrations of 150 to 3,750 mg/L, but nitrate concentrations range from 0 to 59 mg/L. Most of the wells yielding high-nitrate ground water are near Enoch; nitrate sources likely include septic-tank systems, fertilizer, and nitrogen-bearing strata in the Cretaceous Straight Cliffs Formation. Evidence for the Straight Cliffs Formation as a possible nitrate source includes: (1) negligible changes in nitrate concentrations both historically and seasonally, despite implementation of a sanitary sewer system in the Enoch area in 1995, (2) high nitrate concentrations in ground water tapped by both deep and shallow wells, (3) high nitrate concentration in water from a well on the Fiddlers Canyon alluvial fan, upgradient from any septic-tank systems, and (4) high nitrate concentrations in some organic layers in the formation.

We applied a mass-balance equation to three areas in Cedar Valley, using site-specific ground-water flow available for mixing and site-specific ground-water-quality data, to estimate recommended septic-system density/lot size. Allowing for degradation of 1 mg/L with respect to nitrate, the mass balance approach yields average minimum lot sizes of 5.6 acres per system near Hamiltons Fort, a primary recharge area for the basin-fill aquifer, and 54 acres/system near Bauers Knoll, a secondary recharge area. The mass-balance approach is not the best land-use management tool for Mid Valley Estates, a possible ground-water discharge area, where the amount of water from septic-tank effluent is three times greater than the ground-water flow available for mixing. A public sewer system is a better alternative for domestic wastewater disposal in most areas in arid Cedar Valley, especially the Mid Valley Estates area.

HYLLAND, MICHAEL D.

Suggested Revisions to Lithostratigraphic Boundaries of the Upper Cretaceous Dakota Formation on the Kolob Terrace, Southwest Utah

The lithostratigraphic boundaries of the Upper Cretaceous Dakota Formation in southwestern Utah have long been problematic. Detailed studies in recent years have helped characterize the sedimentology and stratigraphy of the Dakota Formation in the Kaiparowits Plateau region, but outcrops to the west on the Markagunt Plateau remain relatively little studied. Recent geologic mapping on the Kolob Terrace adjacent to Zion National Park indicates that the stratigraphic positions of both the lower and upper contacts of the Dakota Formation should be revised. This reinterpretation will likely lead to improved understanding of lateral facies changes within basal Cretaceous strata across southern Utah, which in turn should provide new insights into the nature, timing, and interplay of tectonic and eustatic depositional events in the Cretaceous foreland basin of the Sevier orogen.

In southern Utah, the lower contact of the Dakota Formation has traditionally been placed at the base of a laterally persistent unit of quartzite- and chert-pebble conglomerate and conglomeratic sandstone, coincident with the basal Cretaceous unconformity. Strata that overlie the conglomeratic unit consist of a relatively thin sequence of drab to variegated, bentonitic mudstone locally containing carbonate nodules and barite crystals, interbedded with minor sandstone, organic shale, and volcanic ash. Recent pollen analyses indicate an Albian or older age for these strata; radiometric dating results from an ash layer are pending. Age and lithologic similarities suggest that these strata and the underlying conglomeratic unit are correlative with the Lower Cretaceous Cedar Mountain Formation. Thus, the basal Dakota contact should be placed above the mudstones, at the base of the overlying coal-bearing sequence dominated by fluvial (overbank) sandstone and siltstone.

On the Markagunt Plateau, the upper contact of the Dakota Formation has traditionally been placed just above the upper of two laterally continuous, relatively thick coal zones within the Dakota. However, this convention places a ledgy sequence of interbedded sandstone, siltstone, organic shale, and thin coal within the lower part of the Tropic Shale, below more typical Tropic outcrops characterized by slope-forming, septarian nodule- and ammonite-bearing, fine-grained sandstone and shale. Invertebrate faunal assemblages that include Crassostrea and Inoceramus pictus, as well as palynomorph assemblages, indicate that the ledgy sequence includes shallow marine, brackish, and fresh-water deposits of Cenomanian age. This sequence is therefore more appropriately considered to be an upper member of the Dakota rather than basal Tropic Formation, and the contact should be placed at the base of the slope-forming marine shale and sandstone above the highest coal and ledge-forming sandstone. In the vicinity of Zion National Park, the upper Dakota-Tropic interval re-