tions and between the Evanston and lower Wasatch Formations show the
Ulamas to have risen in two distinct pulses. The earliest rise may have
begun by Maestrichtian time and the latest rise, forming the north flank
fault system, culminated in the Eocene.

BROOKS, WILLIAM E., U.S. Geol. Survey, Denver, CO
Possible Volcanogenic Origin of Uranium at Anderson Mine, Yavapai
County, Arizona

Uranium mineralization in Miocene sediments at the Anderson Mine,
70 km northwest of Wickenburg, Arizona, is interpreted to have been vol­
canogenic on the basis of geologic setting, absence of uranium-depleted
source rocks in the vicinity, and geologic similarities to the Aurora ura­
nium prospect in the McDermitt caldera, Nevada.

The Anderson deposit formed in most sediments within the McLendon
caldera. The caldera is identified by a sediment-filled basin coincident
with a circular, ~ 25 mgal gravity low centered 5 km (3 mi) south of
the mine. A thick apron of andesite, near-source lahar, and rhyodacite forms
a crescentic outcrop pattern that partially encircles the gravity low. Ash­
flow tuft, interpreted to have erupted during caldera collapse, crops out
approximately 30 km (18 mi) south of the mine.

Contrary to previous interpretations, the volcanic rocks of McLendon
caldera are unlike source rocks for uranium in the Anderson deposit.
The lavas and ash-flow tuft from the volcano have average Th/U ratios of
4.5 and 2.4, respectively. Both ratios are close to or within the magmatic
Th/U range of 2.5-5, indicating minimal uranium depletion. If the ura­
nium did not come from volcanic rocks, it could have been provided to
the sediments through hot-spring systems from a late-stage, uranium­
riched differentiated source.

The occurrence of the Anderson and Aurora deposits within caldera
moat sediments strongly suggests a genetically similar, volcanogenic
model. Other geologic similarities include silicified zones, fossil hot
springs, thin-laminar bedding, stacked ore bodies, association of anom­
alous manganese and molybdenum, and the presence of carnottite and cof­
finite.

BROWN, KARL W., Utah Geological and Mineral Survey, Salt Lake
City, UT
Overview of Petroleum Activities in Utah, 1972-1982

After a decade (1962-72) of relatively slow petroleum activity in Utah,
the past 10 years have seen a substantial increase. Although the produc­
tion of petroleum has steadily declined since 1975, the number of wells
drilled has generally increased from year to year.

The petroleum activity is centered mainly in four different areas within
the state: the Paradox basin (southeastern Utah); the Uncompahgre
uplift (central eastern Utah); the Uinta basin (northeastern Utah); and
the thrust belt area (northern central Utah).

The Paradox basin includes 43 oil and gas fields that primarily produce
from the Paradox Formation. The Uncompahgre uplift includes 23
fields, most of which produce gas from the Dakota-Cedar Mountain for­
mation. The Uinta basin includes 58 fields with over 95% of the produc­
tion coming from the Green River and Wasatch Formations. The thrust
belt area includes nine fields that produce condensate and gas almost
entirely from the Twin Creek and Nugget formations.

Drilling activity in the first three areas has been relatively constant,
with in-fill operations within known fields accounting for most of the
drilling. The thrust belt has been the center of increasing activity since the
initial Pineview discovery in 1975.

BRUHN, R. L., and R. B. SMITH, Univ. Utah, Salt Lake City, UT
Extensional Tectonics of Eastern Basin-Range/Overthrust Belt: Inference
ences on Structural Style from Reflection Data, Surface Geology, and
Rheologic Models

Interpretations of over 1,500 km (900 mi) of industry-related reflection
data in the Cordillera have revealed the following styles of late Cenozoic
deformation: (1) the widespread development of asymmetric eastward­
tilted basins that are bounded by low to moderate-angle planar and listric
faults, and (2) five eon echelon, low-angle reflections interpreted as
regional detachments. Some steeply dipping planar and listric normal
faults may be partly controlled by the presence of Mesozoic thrust struc­
tures, but this hypothesis is not applicable universally. In some cases, ends
of normal fault segments are apparently determined by the positions of
sidewall ramps and other cross-strike displacement transfer zones of
Mesozoic age. Alternatively, several major normal faults, particularly
those in Tertiary volcano-tectonic complexes, have no obvious relation­
ship to Mesozoic structures. The low-angle reflections interpreted as a set
of detachments extend east-west at least 200 km (125 mi) and dip gently
westward from 3 km (2 mi) beneath the western Colorado Plateau to over
10 km (6 mi) at the Utah-Nevada border. The structural style of low-angle
and listric faults cannot: be reconciled easily with classic brittle failure the­
ory, but the interpreted termination of normal faults at or above the
frictional/quasiplastic transition may occur as shallow as ~ 7 km (4 mi).
Rheologic models of an extending upper crust suggest a vertically strati­
fied model: brittle from the surface to as shallow as 7 km (4 mi), then vari­
rably ductile. The shallow depth of the upper ductile layer has important
implication for controlling fault geometry and therefore the locations of
fault-related basins.

BRYANT, W. ANTHONY, U.S. Geol. Survey, Denver, CO
Paleoenvironmental Interpretation Based on Foraminifera of Coal­
Bearing Almond Formation, Little Snake River Coalfield, Wyoming

The Upper Cretaceous Almond Formation (Mesaverde Group) in south­
central Wyoming represents deposition in a variety of marginal
marine environments. Foraminiferal assemblages recovered from cores
and outcrops of the Almond in the Cow Creek area reflect this environ­
mental diversity.

The Almond Formation is about 450 ft (135 m) thick and is divided into
2 informal members, both of which contain coal. Coals in the upper 100
ft (30 m) of the upper member are thin, but the lower member contains
several thick beds. The coal-bearing parts of both members are character­
ized by repetitive coarsening-upward bay-fill deposits of mudstone and
sandstone, commonly overlain by coal. A major coarsening-upward
sequence in the lower part of the upper member is capped by sandstone
interpreted to be a marine shoreface deposit. Fine-grained rocks in both
members contain foraminifera.

Three foraminiferal assemblages are defined on the basis of faunal
density, diversity, dominance, and taxonomic composition. A low­
diversity agglutinated benthic assemblage interpreted as a hyposaline salt­
marsh fauna occurs in the fine-grained rocks of the lower member. A
high-diversity mixed agglutinated and calcareous benthic assemblage
interpreted as a hyposaline bay to lagoon fauna occurs in shales in the
lower part of the upper member. A moderate-diversity agglutinated ben­
thic assemblage that occurs in fine-grained rocks in the upper part of
the upper member is interpreted as an intermediate hyposaline salt marsh to
interdistributary bay fauna.

These variations in benthic foraminifera populations provide signifi­
cant insight into water characteristics in otherwise homogeneous sedi­
ments. The combination of lithologic and faunal studies provides
improved palenevironmental interpretation over either method used
independently.

BUNNELL, MARK, Utah Fuel Co., Helper, UT, CHRIS KRAVITS,
Coastal States Energy Co., Houston, TX, and JOSEPH REESE, Okla­
homa State Univ., Stillwater, OK
Marine Sandstone “Rolls” in a Coal Mine in Northern Wasatch Plateau,
Utah

Coal seam undulations, locally called rolls, are a common but poorly
understood geologic feature in underground coal mines of the Wasatch
Plateau coal field of central Utah. Rolls may detract from coal mineabil­
ity by: (1) creating steep grades that are difficult for mining machinery to
negotiate, (2) providing low areas where mine water pools, and (3) adding
diluting material which decreases coal quality. Rolls found in Skyline
Mine 3 involve local, abrupt changes in elevation of the top and base of
the lower O’Conner A coal seam. The change in elevation ranges from 5
to 30 ft (1.5 to 9 m) along a horizontal distance of 30-150 ft (9-46 m) and
may exceed 3,000 ft (915 m) along strike. Mapping indicates the rolls are