SMOKY MOUNTAIN, UTAH–ARIZONA

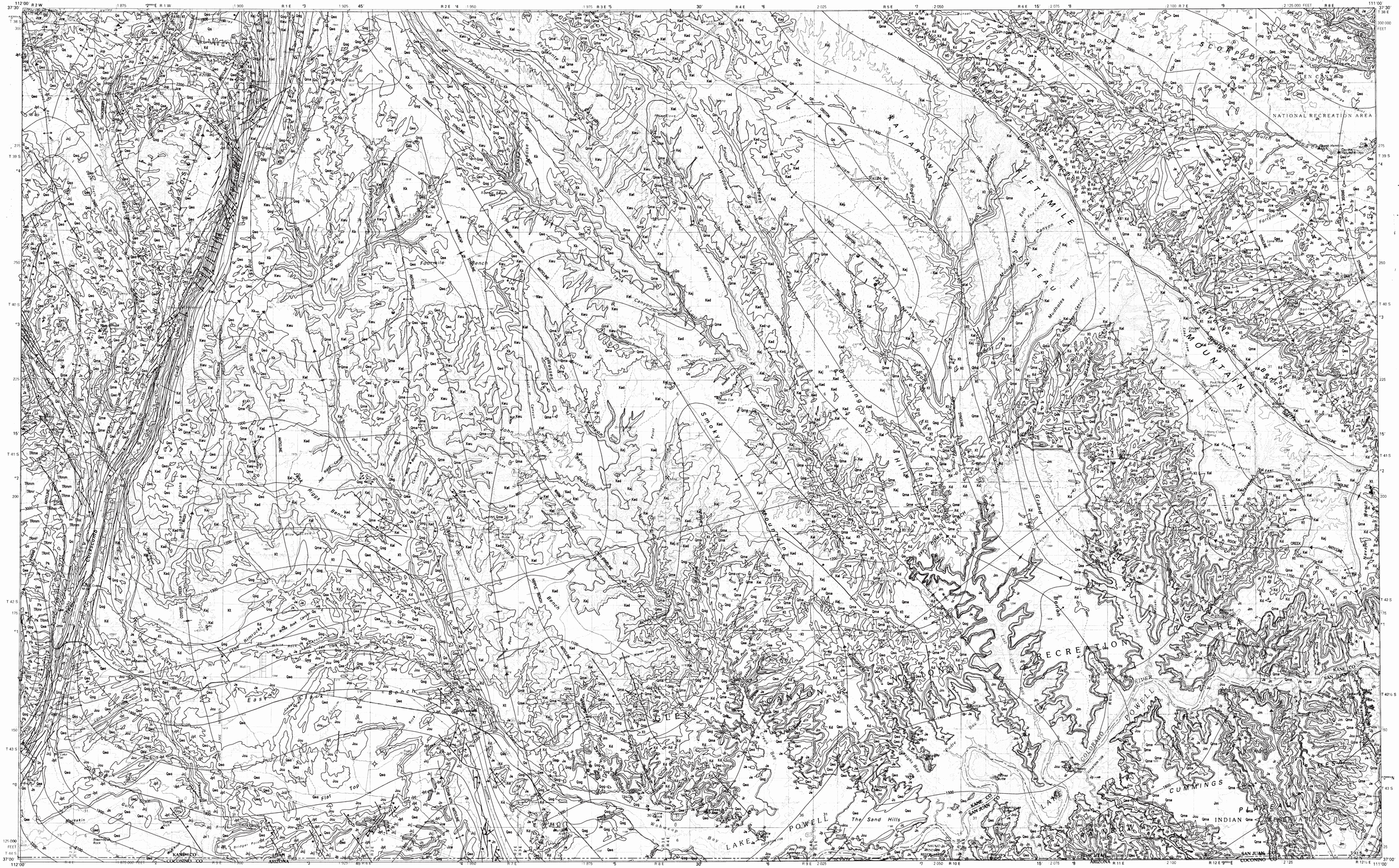

PLATE 1
Interim Geologic Map of the Smoky Mountain 30' x 60' Quadrangle
Kane and San Juan Counties, Utah and Coconino County, Arizona

SCALE 1:100 000
1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND
CONTOUR INTERVAL 50 METERS

SMOKY MOUNTAIN, UTAH–ARIZONA
37111-A1-TM-100
1985

Abstract

The Smoky Mountain 30' x 60' quadrangle is located in south-central Utah. It includes about half of the Grand Staircase - Escalante National Monument, designated in September 1996; and part of the Glen Canyon National Recreation Area, which includes a large part of Lake Powell. Bedrock strata are unusually well exposed, and range from the Permian Kaibab Formation to the Cretaceous Kaiparowits Formation. These strata are folded by a series of broad, generally northwest-trending anticlines, synclines, and monoclines, and are cut by several generally small-displacement faults. Various types of alluvial, eolian, and mass movement surficial deposits locally mantle the bedrock units.

Source Maps

This map was compiled primarily from the 1:100,000-scale geologic map of Kane County by Hellmut H. Doelling and Fitzhugh D. Davis (UGS Map 121), with small parts compiled from several large-scale maps of parts of San Juan County (the area southeast of Lake Powell) (see enclosed source index map). Minor modifications to resolve discrepancies were made by the compiler. Digitizing and production are commensurate with the 1:100,000 scale.

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UGS receptionist: 801-537-3300
UGS fax: 801-537-3400

The digital (GIS) version of this geologic map is in review at the time of release of this open-file report.

GEOLOGIC MAP SOURCES

(numbers refer to "Index to U.S. Geological Survey 7.5' quadrangles and sources of geologic mapping")

1. Blakey, R.C., 1970, Geology of the Paria NW (Fivemile Valley) quadrangle, Kane County, Utah: University of Utah, M.S. thesis, scale 1:24,000.
2. Bowers, W.E., 1983, Geologic map and coal sections of the Butler Valley quadrangle, Kane County, Utah: U. S. Geological Survey Map C-95, scale 1:24,000.
3. Doelling, H.H., and Davis, F.D., 1988, Geologic map of the Calico Peak quadrangle, Kane County, Utah: Utah Geological and Mineral Survey Map 123, scale 1:24,000.
4. Doelling, H.H., and Davis, F.D., 1989, Geologic map of Kane County, Utah: Utah Geological and Mineral Survey Map 121, plates 2 and 3, scale 1:100,000.
5. Doelling, H.H., and Graham, R.L., 1972, Kaiparowits Plateau coal field, in Southwestern Utah coal fields: Utah Geological and Mineral Survey Monograph 1 (Petes Cove, Collet Top, Basin Canyon, Needle Eye Point, East of the Navajo, and Ship Mountain Point quadrangles), scale 1:42,240.
6. McQueen, Kathleen, 1958a, Photogeologic map of the Paria NE (Lower Coyote Spring) quadrangle, Kane County, Utah: U.S. Geological Survey Map I-266, scale 1:24,000.
7. McQueen, Kathleen, 1958b, Photogeologic map of the Paria SE (Bridger Point) quadrangle, Kane County, Utah: U.S. Geological Survey Map I-265, scale 1:24,000.
8. Olson, A.B., 1957, Photogeologic map of the Paria SW (West Clark Bench) quadrangle, Kane County, Utah: U.S. Geological Survey Map I-263, scale 1:24,000.
9. Peterson, Fred, 1967, Preliminary geologic map and coal deposits of the northwest quarter of the Gunsight Butte (Smoky Hollow) quadrangle, Kane County, Utah: Utah Geological and Mineral Survey Map 24-E, scale 1:31,680.
10. Peterson, Fred, 1973, Geologic map of the southwest quarter of the Gunsight Butte (Warm Creek Bay) quadrangle, Kane and San Juan Counties, Utah, and Coconino County, Arizona: U.S. Geological Survey Map MF-306, scale 1:24,000.
11. Peterson, Fred, 1975, Geologic map of the Sooner Bench quadrangle, Kane County, Utah: U.S. Geological Survey Map I-874, scale 1:24,000.
12. Peterson, Fred, and Barnum, B.E., 1973a, Geologic map and coal resources of the northeast quarter of the Cummings Mesa (Navajo Point) quadrangle, Kane County, Utah: U.S. Geological Survey Map C-63, scale 1:24,000.
13. Peterson, Fred, and Barnum, B.E., 1973b, Geologic map and coal resources of the northwest quarter of the Cummings Mesa (Muzuki Point) quadrangle, Kane County, Utah: U.S. Geological Survey Map C-64, scale 1:24,000.
14. Peterson, Fred, and Barnum, B.E., 1973c, Geologic map of the southeast quarter of the Cummings Mesa (Cathedral Canyon) quadrangle, Kane and San Juan Counties, Utah, and Coconino County, Arizona: U.S. Geological Survey Map I-758, scale 1:24,000.
15. Peterson, Fred, and Barnum, B.E., 1973d, Geologic map of the southwest quarter of the Cummings Mesa (Gregory Butte) quadrangle, Kane and San Juan Counties, Utah, and Coconino County, Arizona: U.S. Geological Survey Map I-759, scale 1:24,000.
16. Peterson, Fred, and Horton, G.W., 1967, Preliminary geology map and coal deposits of the northeast quarter of the Gunsight Butte (Sit Down Bench) quadrangle, Kane County, Utah: Utah Geological and Mineral Survey Map 24-F, scale 1:31,680.
17. Peterson, Fred, and Waldrop, H.A., 1967,.Preliminary geologic map of the southeast quarter of the Gunsight Butte (Gunsight Butte) quadrangle, Kane and San Juan Counties, Utah, and Coconino County, Arizona: Utah Geological and Mineral Survey Map 24-G, scale 1:31,680.
18. Waldrop, H.A., and Peterson, Fred, 1967, Preliminary geologic map of the southeast quarter of the Nipple Butte (Lone Rock) quadrangle, Kane County, Utah, and Coconino County, Arizona: Utah Geological and Mineral Survey Map 24-C, scale 1:31,680.
19. Waldrop H.A., and Sutton, R.L., 1967a, Preliminary geologic map and coal deposits of the northeast quarter of the Nipple Butte (Tibbet Bench) quadrangle, Kane County, Utah: Utah Geological and Mineral Survey Map 24-B, scale 1:31,680.
20. Waldrop, H.A., and Sutton, R.L., 1967b, Preliminary geologic map and coal deposits of the northwest quarter of the Nipple Butte (Nipple Butte) quadrangle, Kane County, Utah: Utah Geological and Mineral Survey Map 24-A, scale 1:31,680.
21. Waldrop, H.A., and Sutton, R.L., 1967c, Preliminary geologic map and coal deposits of the southwest quarter of the Nipple Butte (Glen Canyon City) quadrangle, Kane County, Utah: Utah Geological and Mineral Survey Map 24-D, scale 1:31,680.

DESCRIPTION OF MAP UNITS

Qa **Alluvium** -- Mostly sand with lenses of silty clay, sandy silt, and gravel deposited in stream beds and adjacent floodplains; 0 to 37 meters (0-120 ft) thick.

Qes **Eolian sand** -- Sand in active dunes and sheets, mostly fine to medium grained, mostly of quartz; 0 to 30 meters (0-100 ft) thick.

Qea **Mixed eolian and alluvial sand** -- Mostly sand with minor amounts of clay, silt, or gravel; 0 to 30 meters (0-100 ft) thick.

Qag **Alluvial gravel** -- Poorly to well-sorted gravel and sand with interlayered silt and mud in pediments and river terraces; 0 to 18 meters (0-60 ft) thick.

Qms **Mass movements** -- Includes rock-fall deposits, colluvium, talus, detrital material, toreva blocks, landslides of all types, and landslide complexes; 0 to 76 meters (0-250 ft) thick.

Kk **Kaiparowits Formation** -- Drab gray mostly slope-forming arkosic sandstone; as much as 670 meters (2,200 ft) thick.

Wahweap Formation

Kwu **Upper member** -- Light-gray, gray-orange, and yellow-brown, fine- to medium-grained sandstone; forms cliffs and ledges; 46 to 244 meters (150-800 ft) thick.

Kwl **Lower member** -- Interbedded yellow-gray and yellow-brown sandstone, shale, and siltstone; mostly slope former; 76 to 274 meters (250-900 ft) thick.

Straight Cliffs Formation

Ksd **Drip Tank Member** -- Yellow-gray and yellow-brown, fine- to medium-grained, lenticular sandstone; 43 to 168 meters (140-550 ft) thick.

Ksj **John Henry Member** -- Yellow-gray, slope- and ledge-forming sandstone, mudstone, carbonaceous mudstone, and coal; contains the major coal resources of the Kaiparowits Plateau; 180 to 335 meters (590-1,100 ft) thick.

Ksl **Lower unit** -- Interbedded white and gray sandstone, mudstone, carbonaceous mudstone and coal (Smoky Hollow Member), 7 to 71 meters (24-234 ft) thick; underlain by yellow-gray to brown, cliff-forming sandstone (Tibbet Canyon Member), 21 to 56 meters (70-185 ft) thick.

Kt **Tropic Shale** -- Dark-gray, drab marine shale with subordinate gray sandstone, 152 to 229 meters (500-750 ft) thick.

Kd **Dakota Formation** -- Interbedded sandy shale, carbonaceous shale, shaly sandstone, conglomerate and coal; basal conglomerate may be Early Cretaceous in age; 1 to 46 meters (3-150 ft) thick.

Jm **Morrison Formation** -- Gray, yellow, and brown cliff-forming lenticular conglomeratic sandstone and sandstone, subordinate green, gray, or purple mudstone (mostly Salt Wash Member); present only in eastern half of quadrangle; 0 to 213 meters (0-700 ft) thick.

Jh **Henrieville Sandstone** -- White and yellow-white unit divisible into an upper massive, cross-bedded, fine- to medium-grained eolian sandstone and a lower white and yellow-white tabular-bedded sandstone, siltstone, claystone, and shale; forms steep slopes and cliffs; exposed only along northwest margin of the Kaiparowits Plateau; 0 to 71 meters (0-234 ft) thick.

Jr **Romana Mesa Sandstone** -- Gray-yellow-green, yellow-gray, or light-tan, very fine- to fine-grained, cliff-forming sandstone; present only in eastern half of quadrangle; 0 to 44 meters (0-145 ft) thick.

Js **Summerville? Formation** -- Brown with some white, alternating thin to medium planar beds of siltstone, shale, mudstone, and fine-grained sandstone; cliff forming; present only along the northeast margin of the Kaiparowits Plateau; 10 to 26 meters (35-85 ft) thick.

Je **Entrada Sandstone** -- Upper part (Escalante and Cannonville Members) is mostly red-brown, fine-grained, earthy-weathering sandstone, cliffy in the upper half and non-resistant and commonly covered with sandy alluvium in the lower half; lower part (Gunsight Butte Member) is fine-grained sandstone weathering into smooth "slickrim" erosional forms and cliffs; lower part is orange-brown to the north, yellow-gray to the south; 91 to 290 meters (300 to 950 ft) thick, thickening northeastward.

Carmel Formation

Jcw **Winsor and Wiggler Wash Members** -- Red or yellow slope-forming and earthy-weathering silty sandstone that locally include gypsum beds; 40 to 68 meters (130-225 ft) thick where mapped in the north part of the quadrangle; thins eastward.

Jcp **Paria River Member** -- Gypsum, red siltstone and sandstone, with a white chippy limestone at the top; 23 to 70 meters (75-230 ft) thick where mapped in the north part of the quadrangle; thins eastward.

Jcu **Upper unit** -- Combined Paria River, Winsor, and Wiggler Wash Members of the Carmel as mapped in the south and east parts of the quadrangle and along the Cockscomb; upper part mostly red or brown slope-forming and earthy-weathering silty sandstone or siltstone intercalated with sporadic irregular beds of white calcareous fine-grained sandstone that is locally gypsiferous; lower part is mostly dark-red siltstone or silty sandstone with a few tan or brown fine-grained sandstone beds capped by silty or sandy white or pink, chippy-weathering limestone; upper part is 18 to 46 meters (60-150 ft) thick, lower part is 15 to 21 meters (50-70 ft) thick.

Jpt **Thousand Pockets Tongue of the Page Sandstone**--Yellow, white, or brown, massive, cross-bedded sandstone, often with thin red siltstone partings; may join with the Page Sandstone in the subsurface beneath the Kaiparowits Plateau; 27 to 61 meters (90-200 ft) thick.

Jp **Page Sandstone** -- Mostly fine- to medium-grained quartzose, cross-bedded eolian sandstone; dark-red basal siltstone or silty sandstone locally present; unconformably overlies the similar-appearing Navajo Sandstone; present in the east half of the quadrangle; mapped with Navajo Sandstone in northeast part of the quadrangle; may join with the Thousand Pockets Tongue to the west; 10 to 76 meters (30-250 ft) thick.

Jcj **Judd Hollow Tongue of the Carmel Formation** -- Interbedded sandstone, siltstone, and minor red and lavender limestone; composed of thin equivalents of the Crystal Creek and Co-op Creek Limestone Members of the Carmel Formation as exposed in western Kane County; present in western half of quadrangle, pinches out eastward between Thousand Pockets Tongue and Navajo Sandstone near west end of Lake Powell; 0 to 70 meters (0-230 ft) thick.

Jn **Navajo Sandstone** -- White, pink, and brown, highly cross-bedded sandstone that forms cliffs, domes and bare-rock outcrops; excellent aquifer; 290 to 520 meters (950-1,700 ft) thick.

Jk **Kayenta Formation** -- Ledge- and slope-forming lenticular sandstone, siltstone, limestone, and intraformational conglomerate; mostly red, but lavender, white, and brown sandstone is common; 58 to 104 meters (190-340 ft) thick, with no specific geographic thinning or thickening trends.

Jmo **Moenave Formation** -- Red, flat-bedded, fine-grained sandstone and siltstone, thin to thick cliff-forming beds; exposed along Cockscomb and westward; Wingate-like lithology is present near the base; intertongues with the Wingate under the Kaiparowits Plateau; about 90 to 134 meters (290-440 ft) thick and locally divisible into three units, ascending, Wingate Sandstone, Dinosaur Canyon Member, and Springdale Sandstone Member (not mapped separately).

Jw **Wingate Sandstone** -- Red-orange or brown cliff-forming, massive sandstone; exposed only in the Escalante River Canyon in the east part of the quadrangle; 61-91 meters (200-300 ft) thick.

Chinle Formation

TRc **Chinle Formation, undivided**.

TRcp **Petrified Forest Member** -- Varicolored, banded, slope-forming mudstone, claystone, sandstone, siltstone, limestone, and conglomerate; locally contains abundant petrified wood; 152 to 198 meters (500-650 ft) thick from the Cockscomb westward; may be thicker in the subsurface to the northeast.

TRcl **Lower unit (Monitor Butte and Shinarump Members)** -- Conglomeratic sandstone, sandstone, mudstone, lenticular, and cliffy; 0 to 47 meters (0-155 ft) thick along outcrops in southwest corner of quadrangle; may be as much as 76 meters (250 ft) thick in the subsurface.

Moenkopi Formation

TRm **Moenkopi Formation, undivided**.

TRmu **Upper red member** -- Dark-brown, fine-grained sandstone in thin to thick, cliffy beds; about 38 meters (125 ft) thick.

TRms **Shnabkaib Member** -- Light-brown and white, earthy-weathering sandstone, siltstone, and gypsum; about 67 meters (220 ft) thick.

TRmm **Middle red member** -- Light red-brown, lightly banded, fine-grained, gypsiferous and earthy-weathering sandstone; about 113 meters (370 ft) thick.

TRml **Lower red member** -- Red, fine-grained, slope-forming sandstone and siltstone capped by about 10 meters (30 ft) of tan, platy, to thin-bedded, ledge-forming, calcareous sandstone (Virgin Limestone Member); about 76 meters (250 ft) thick.

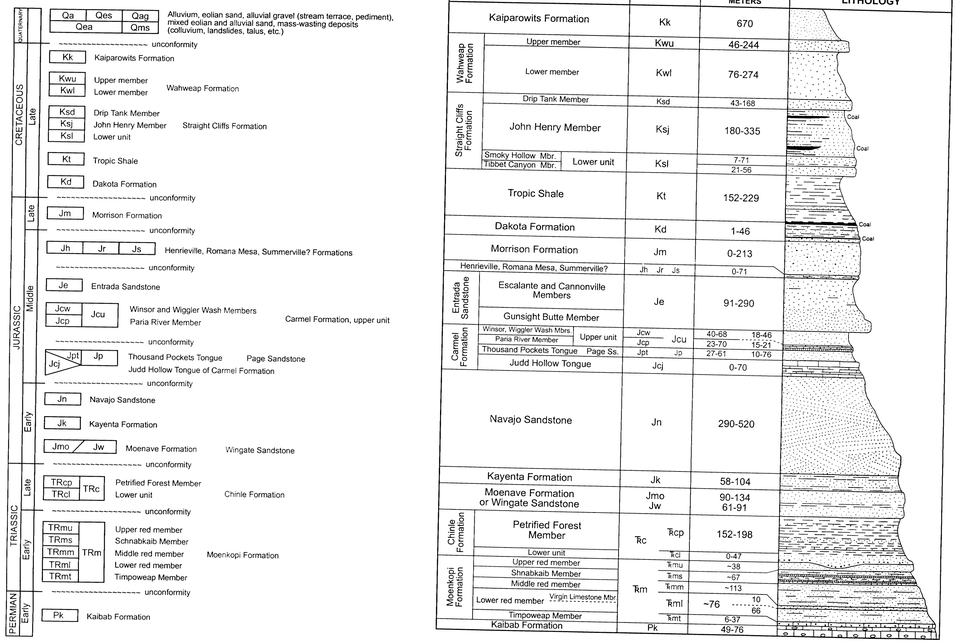
TRmt **Timpoweap Member** -- Hard limestone, sandstone, siltstone, and chert breccia; 6 to 37 meters (20-120 ft) thick.

Pk **Kaibab Formation** -- Thick to massive, cliff-forming, fossiliferous and cherty limestone (mostly subsurface); about 49 meters (160 ft) thick in the southwestern part of the quadrangle; expected to thin eastward in subsurface, but may locally exceed 76 meters (250 ft) in thickness.

MAP SYMBOLS

- Contact; dashed where inferred. Units are not shown where covered by Lake Powell.
- Geologic fault; dashed where inferred; dotted where covered; bar and ball on downthrown side.
- Anticlinal axis; arrow paralleling axis shows direction of plunge.
- Synclinal axis; arrow paralleling axis shows direction of plunge.
- 1500 — Structure contours drawn at base of Dakota Formation. Contour interval 100 meters.
- Oil and/or gas test well location.
- Natural arch.
- Mine.
- A ——— A' Line of cross section. Horizontal scale on both cross sections is 1:100,000. Vertical exaggeration approximately 2.2x; thinner units further exaggerated.

CORRELATION OF MAP UNITS



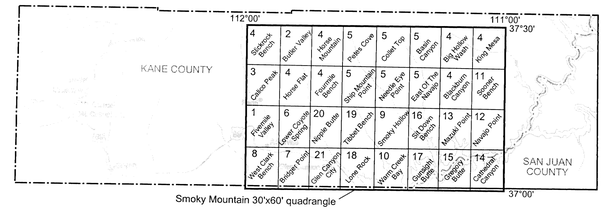
FORMATION OR MEMBER			MAP SYMBOL	THICKNESS IN METERS	LITHOLOGY
Kaiparowits Formation			Kk	670	
Wahweap Formation	Upper member		Kwu	46-244	
	Lower member		Kwl	76-274	
Straight Cliffs Formation	Drip Tank Member		Ksd	43-168	
	John Henry Member		Ksj	180-335	Coal
	Smoky Hollow Mbr. / Tibbet Canyon Mbr.	Lower unit	Ksl	7-71 / 21-56	Coal
Tropic Shale			Kt	152-229	
Dakota Formation			Kd	1-46	Coal
Morrison Formation			Jm	0-213	Coal
Henrieville, Romana Mesa, Summerville?			Jh Jr Js	0-71	
Entrada Sandstone	Escalante and Cannonville Members		Je	91-290	
	Gunsight Butte Member				
Carmel Formation	Winsor, Wiggler Wash Mbrs. / Paria River Member / Thousand Pockets Tongue	Upper unit / Page Ss.	Jcw Jcp Jcu / Jpt / Jp	40-68 / 23-70 / 27-61	18-46 / 15-21 / 10-76
	Judd Hollow Tongue		Jcj	0-70	
Navajo Sandstone			Jn	290-520	
Kayenta Formation			Jk	58-104	
Moenave Formation or Wingate Sandstone			Jmo Jw	90-134 / 61-91	
Chinle Formation	Petrified Forest Member		TRc TRcp	152-198	
	Lower unit		TRcl	0-47	
Moenkopi Formation	Upper red member		TRmu	~38	
	Shnabkaib Member		TRms	~67	
	Middle red member		TRm TRmm	~113	
	Lower red member / Virgin Limestone Mbr.		TRml	~76	10 / 66
	Timpoweap Member		TRmt	6-37	
Kaibab Formation			Pk	49-76	

GIS Production Specialists: Kent D. Brown and Kelli Bacon

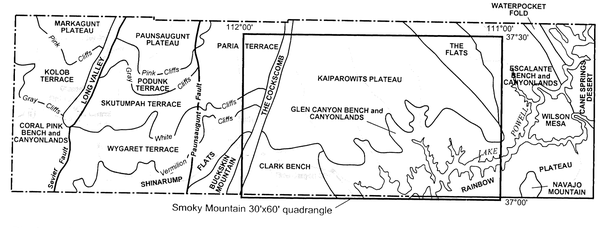
Utah Geological Survey, 1594 W. North Temple, PO Box 146100, Salt Lake City, Utah 84114-6100
ph: 801-537-3300; fax 801-537-3400; http://www.ugs.state.ut.us

PLATE 2
Interim Geologic Map of the Smoky Mountain 30' x 60' Quadrangle
Kane and San Juan Counties, Utah and Coconino County, Arizona

compiled by Hellmut H. Doelling
Open-File Report 359 December 1997
UTAH GEOLOGICAL SURVEY
a division of
Utah Department of Natural Resources
in cooperation with
U.S. Geological Survey



Index to U.S. Geological Survey 7.5' quadrangles and sources of geologic mapping. Numbers refer to "Geologic Map Sources".



Physiographic subdivisions of south-central Utah.