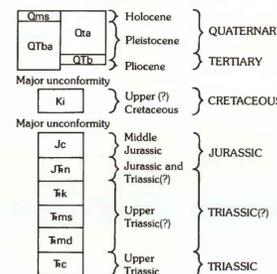


**EXPLANATION OF MINERAL AND ENERGY RESOURCE POTENTIAL**  
 [Entire study area has low resource potential for (1) oil and gas, with certainty level B, and (2) all metallic minerals other than silver, copper, gold, uranium, and vanadium, with certainty level C. Entire study area has no energy resource potential for coal, with certainty level D.]

**H/D** Geologic terrane having (1) high energy resource potential for low-temperature geothermal sources, with certainty level D, and (2) moderate mineral resource potential for silver, copper, uranium, vanadium, and gold, with certainty level B

**CORRELATION OF MAP UNITS**



**DESCRIPTION OF MAP UNITS**

- Qms** Mud slide deposit (Holocene)—Unconsolidated muddy debris derived from the Carmel Formation. Covers area of less than 1/4 mi<sup>2</sup> about 1 mi north of study area. Probably less than 10 ft thick.
- Qta** Terrace alluvium (Holocene and Pleistocene)—Unconsolidated alluvial deposits resting on relatively flat surfaces from a few feet to as much as 500 ft above level of modern streams. Includes narrow bands of modern floodplain and channel alluvium along some streams. Maximum thickness about 80 ft.
- QTBa** Basaltic andesite (Pleistocene and Pliocene)—Dark-gray, olivine-bearing, basaltic andesite flows (53.4 percent SiO<sub>2</sub>, sample 437SGNE86). Contains large (1-6 mm) phenocrysts and glomerocrysts of olivine and zoned plagioclase (about An<sub>70</sub>), and quartz xenocrysts about 1 mm across. Groundmass consists of plagioclase (An<sub>70-80</sub>), olivine, and clinopyroxene. Caps mesas along western edge of study area; source was probably to the north. Thickness 0-100 ft.
- QTB** Basalt (Pleistocene or Pliocene)—Dark-gray basalt (43.5 percent SiO<sub>2</sub>, sample 417HUNW86) cone and flows in paleovalley (now in part, a basalt-capped mesa). Contains olivine and augite phenocrysts and glomerocrysts 0.3-3.0 mm across. Most augite phenocrysts show sector and oscillatory zoning. Whole rock K-Ar age is 1.7±0.1 Ma (Best and others, 1980, table 1, no. 23, sample SG-80). Thickness 0-80 ft.
- Ki** Iron Springs Formation (Upper? Cretaceous)—Poorly exposed interbedded mudstone and lenticular sandstone bodies. About two-thirds of the Iron Springs consists of grayish-pink, moderate-red, and light-gray to green-gray, little-indurated mudstone in beds 5-15 ft thick. Weathers to puffy-surfaced slopes. Sandstone lenses are grayish-orange to moderate yellowish-brown, 5-15 ft thick, well cemented to friable, fine to medium grained, locally crossbedded, and commonly show lasegung banding. Present only in northwest corner of study area. Maximum thickness about 700 ft in map area.
- Jc** Carmel Formation (Middle Jurassic)—Consists of three units. Upper unit is light-gray to reddish-brown, cherty calcareous mudstone about 50 ft thick. Middle unit consists chiefly of interbedded calcareous shale, sandy limestone, and limestone; limestone is medium gray, thin bedded, fossiliferous, locally oolitic, and shows bimodal crossbedding; thickness of middle unit about 200 ft. Lower unit, which corresponds to the Sinuave Member of the Temple Cap Sandstone (Peterson and Pippings, 1979), consists of two 60-ft-thick sequences of red-brown mudstone and sandstone separated by 15 ft of gypsum. Present only in northwest corner of study area. Total thickness of Carmel about 385 ft.
- Jfn** Navajo Sandstone (Jurassic and Triassic?)—Fine- to medium-grained, well-sorted, moderately well cemented to poorly cemented sandstone. Characterized by large-scale eolian crossbedding and strong jointing. Color of lower half is moderate reddish-orange, upper half commonly is white. Forms massive cliffs. Underlies most of study area. Thickness about 2,000 ft.
- Tk** Kayenta Formation (Upper Triassic?)—Moderate-reddish-brown to reddish-orange, locally streaked and spotted with light-gray, thinly laminated to thick-bedded sandy mudstone and muddy sandstone. Minor ripple crossbedding, mud cracks, and sand load casts are present. Locally gypsiferous or calcareous. Sandstone predominates in upper part of formation. Crops out along eastern edge of study area. Thickness about 1,200 ft.
- Moenvae Formation (Upper Triassic?)**—Includes Springdale Sandstone Member and Dinosaur Canyon Member.
- Trms** Springdale Sandstone Member—Light-gray, pale-red, or grayish-yellow, massive appearing to crossbedded, fine- to medium-grained sandstone interbedded with pale-red claystone and clay-pebble conglomerate beds 1-2 ft thick. Sandstone forms hogbacks, rounded ledges, and low domes. Detrital carbonaceous material is locally abundant in conglomerate and sandstone beds and is associated with silver, copper, and uranium-vanadium mineralization in nearby Silver Reef mining district. Crops out within about 300 ft of eastern edge of study area. Thickness 300-100 ft.
- Trmd** Dinosaur Canyon Member—Light-green-gray and brown-red mudstone, and moderate-red-brown muddy sandstone. Thick bedded. Crops out about 400 ft east of study area. Thickness 300-370 ft.
- Trc** Petrified Forest Member of the Chinle Formation (Upper Triassic)—Consists of bentonitic mudstone of variegated pastel shades, and crossbedded, arkosic pebbly sandstone that locally contains petrified wood. Exposed within about 500 ft of eastern edge of study area. Thickness about 400 ft.

LEVEL OF RESOURCE POTENTIAL	U/A	H/B	H/C	H/D
		HIGH POTENTIAL	HIGH POTENTIAL	HIGH POTENTIAL
	UNKNOWN POTENTIAL	M/B MODERATE POTENTIAL	M/C MODERATE POTENTIAL	M/D MODERATE POTENTIAL
		L/B LOW POTENTIAL	L/C LOW POTENTIAL	L/D LOW POTENTIAL
				N/D NO POTENTIAL
	LEVEL OF CERTAINTY →			
	A	B	C	D

**LEVELS OF RESOURCE POTENTIAL**

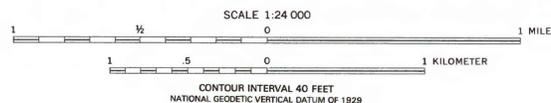
- H** High mineral resource potential
- M** Moderate mineral resource potential
- L** Low mineral resource potential
- U** Unknown mineral resource potential
- N** No known mineral resource potential

**LEVELS OF CERTAINTY**

- A** Available data not adequate
- B** Data indicate geologic environment and suggest level of resource potential
- C** Data indicate geologic environment, give good indication of level of resource potential, but do not establish activity of resource-forming processes
- D** Data clearly define geologic environment and level of resource potential and indicate activity of resource-forming processes in all or part of the area

Diagram showing relationships between levels of mineral resource potential and levels of certainty. Shading shows levels that apply to this study area

Base from U.S. Geological Survey  
St. George NE and Hurricane NW,  
unrevised advance prints



Geology mapped by B.B. Houser, 1986,  
assisted by F.N. Houser

**MAP SHOWING MINERAL AND ENERGY RESOURCE POTENTIAL, GEOLOGY, AND SAMPLE LOCALITIES FOR THE COTTONWOOD CANYON WILDERNESS STUDY AREA, WASHINGTON COUNTY, UTAH**

- 417HUNW86** Rock sample
- 102** Stream-sediment, panned-concentrate, and rock sample
- 005** Stream-sediment and panned-concentrate sample