

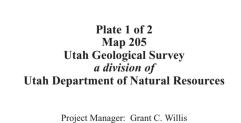
Base from U.S.G.S. La Sal 30' x 60' quadrangle, 1983 2004 MAGNETIC DECLINATION AT CENTER OF SHEET

GEOLOGIC MAP OF THE LA SAL 30' x 60' QUADRANGLE, SAN JUAN, WAYNE, AND GARFIELD COUNTIES, UTAH, AND MONTROSE AND SAN MIGUEL COUNTIES, COLORADO compiled by Hellmut H. Doelling

This geologic map was funded by the Utah Geological Survey and the U.S. Geological Survey, National Cooperative Geologic Mapping Program, through USGS STATEMAP award number 98HQAG2067. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S Government.

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Cartography: James W. Parker

Plate 2 of 2 **Utah Geological Survey Map 205**

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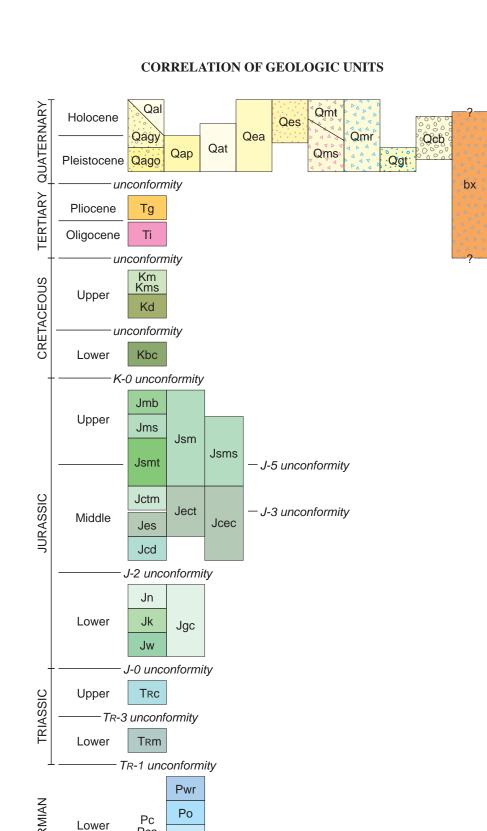
compiled by Hellmut H. Doelling

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DESCRIPTION OF GEOLOGIC UNITS Alluvial deposits

Stream alluvium: Sand, silt, clay, and granule, pebble, and cobble gravel along streams, active washes, and rivers: unconsolidated, poorly to well-sorted channel fill, low terrace, and low-level valley fill deposits: thickness varies widely but commonly less than 12 meters (40 ft) thick; Holocene.

Younger alluvial gravel deposits: Alluvial gravel and rubble composed chiefly of poorly to moderately sorted, rounded cobbles with interstitial sand, silt, and clay derived from sedimentary, igneous, and minor contact-metamorphic rocks exposed in the La Sal Mountains: includes middle-level terrace deposits: as much as 7.5 meters (25 ft) thick; Holocene to upper

Older alluvial gravel deposits: Alluvial gravel and rubble composed chiefly of poorly to moderately sorted, weathered, rounded cobbles with interstitial sand, silt, and clay derived from sedimentary, igneous, and minor contact-metamorphic rocks exposed in the La Sal Mountains; commonly coated with caliche and found chiefly on higher benches and mesas above modern stream valleys; as much as 7.5 meters (25 ft) thick; upper Pleistocene.

Pediment-mantle deposits: Poorly to moderately sorted, rounded to angular boulders, cobbles, pebbles in a poorly sorted matrix of sand, silt and clay; deposited as alluvial fans on flanks of the La Sal Mountains; some incised by modern stream channels and washes; as much as 9 meters (30 ft) thick; mostly upper

Terrace deposits: Cobbles, pebbles, sand, silt, and clay; moderately to moderately well sorted; generally cap benches adjacent to rivers and streams; locally as high as 200 meters (650 ft) above the present stream courses; generally contain clasts from distant upstream sources, including metamorphic, igneous and chert clasts; typically less than 5 meters (16 ft) thick; Holocene to middle Pleistocene.

Mixed eolian and alluvial deposits Mixed eolian and alluvial deposits: Light-brown, red. and grav-vellow wind-blown sand and silt in thin sheet-like deposits covering tops of mesas and plateaus or as thicker deposits filling broad valleys, hollows, and other basins: locally interspersed with silt, sand and gravel of alluvial origin; generally dominated by eolian deposits: grades into stream-deposited sand and silt along washes and includes some modern alluvium: commonly displays a well-developed caliche soil horizon near the top; as much as 12 meters (40 ft) thick: Holocene to middle Pleistocene.

Eolian deposits Eolian sand: Mostly white, reddish-brown, or pink, well-sorted, fine- to coarse-grained, unconsolidated sand in dunes and thin sheets; generally less than 15 meters (50 ft) thick; mostly Holocene.

Mass-movement deposits Talus deposits: Mostly angular debris consisting of rock-fall blocks, boulders, small angular gravel, sand and silt deposited in cone-shaped sloping heaps below cliffs and steep slopes; abundant below outcrops of La Sal Mountains igneous rocks; generally less than 4.5 meters (15 ft) thick; Holocene to upper Pleistocene.

Slumps and landslides: Irregular hummocky deposits of rotated and slumped material made up of small to large blocks of sandstone foundering in thick smectitic clays and silts; moved downslope due to gravity; most common on slopes of the Jurassic Morrison Formation and to a lesser extent on the Triassic Chinle Formation and other formations; variable in thickness and extent;

Holocene to upper Pleistocene. Rock glacier deposits: Lobate masses of large blocks of igneous and resistant sedimentary rocks, mostly vering floors of cirques or steep valleys in the La Sal Mountains; show evidence of downslope flowage;

thickness unknown; Holocene to upper Pleistocene. Bouldery colluvium: Large angular blocks covering slopes in the La Sal Mountains: broken by freeze and thaw of hard rock units: may be as thick as 30 meters (100 ft); Holocene to upper Pleistocene. Glacial deposits

Glacial till: Very poorly sorted, angular to subangular, weathered till and glacial erratics that obscure underlying bedrock; ranges from clay to large boulde clasts, larger clasts commonly striated; as much as 90 meters (300 ft) thick; upper Pleistocene.

> Collapse breccia: Broken sedimentary rock in masses bounded by near-circular faults; broken rock has generally been displaced downward, generally several hundred feet: breccia contains clasts from formations overlying and adjacent to the deposit; commonly bleached; probably formed by collapse into caverns formed by dissolution of salt, gypsum, or limestone; age unknown, probably Quaternary or Tertiary.

unconformity Geyser Creek Fanglomerate: Well-consolidated yellowbrown stream gravels composed of igneous and sedimentary pebbles, cobbles, and boulders; cemented with calcium carbonate; mostly conglomerate and sandstone in poorly sorted lenticular beds; sandstones have mostly fine to coarse subangular to angular grains; forms low escarpments to steep slopes in and around La Sal Mountains; 0 to 300 meters (0-1,000 ft) thick; Pliocene(?).

La Sal Mountains intrusive rocks: Hornblendeplagioclase trachyte, quartz-plagioclase trachyte, peralkaline trachyte, peralkaline rhyolite, and nosean trachyte; all porphyritic with fine-grained to aphanitic groundmass; intruded at shallow depths as laccoliths plugs, sills, and dikes; includes breccia pipes; emplaced 25 to 28 million years ago (Oligocene) (Nelson and others, 1992; M.L. Ross, Utah Geological Survey,

Sub-Tertiary unconformity in this area between Geyser

Creek Fanglomerate and Mancos Shale represents a hiatus of about 80 million years.

Mancos Shale: Dark-olive-gray, brownish-gray, darkgray, and black, fissile, thinly laminated to thinbedded, marine shale and subordinate thin beds of light-gray siltstone, vellow-gray very fine-grained sandstone, limy siltstone, dark-gray sandy limestone. and limestone nodules; forms a slope; limy units contain marine fossils--oysters, other pelecypods, and cephalopods; contact with underlying Dakota Sandstone is gradational and intertonguing. Locally contains a mappable unit (Kms) of fine-grained, fossiliferous, calcareous sandstone with minor thin interbeds of greenish-gray shale that is 60 to 120 meters (200-400 ft) thick and about 300 meters (1,500 ft) above the top of the Dakota Sandstone. The Mancos Shale is incompletely exposed in the quadrangle, a maximum of about 760 meters (2,500 ft) is present; Upper Cretaceous, Campanian to

Dakota Sandstone: Light-brown and vellowish-brown sandstone and conglomerate with interbedded carbonaceous mudstone, shale, and thin coal beds commonly divisible into three parts (not mapped separately): an upper unit up to 49 meters (160 ft) thick of light-brown, medium- to fine-grained sandstone that crops out as ledges 3 to 9 meters (10 30 ft) high; a middle unit up to 30 meters (100 ft) thick of gray shale, dark-gray carbonaceous shall thin light-brown, fine-grained sandstone beds, and thin discontinuous coal beds; and a lower unit that ranges from a few centimeters up to about 18 meters (60 ft) thick of yellowish-brown to light orangish brown medium-grained sandstone with sparse to abundant plant debris. Formation varies from 30 to 60 meters (100-200 ft) thick where complete; thicknesses of the parts range considerably because of irregular scouring into the underlying Burro Canyon Formation and by buildup of sands that intertongue into the overlying Mancos Shale; sections where the Dakota forms the tops of benches average about 30

Regional unconformity: Undulatory contact between the Burro Canvon Formation and the overlying Dakota Sandstone is unconformity representing a hiatus of about 4 million years and is the boundary between the Upper and Lower Cretaceous; scouring locally has cut deeply into the underlying formation. Burro Canyon Formation: Sandstone, conglomerat and mudstone, locally containing nodules and thin beds of limestone and shale; sandstone and conglomerate are mostly yellowish brown or gray, weathered surfaces are darker; sandstones are mostly medium-grained, moderately to moderately well sorted, with subrounded to subangular grains of quartz colored chert, and white feldspar, commonly firmly cemented by quartz cement; conglomerate consists of black, brown, red, and grayish-green subangular to rounded pebbles and cobbles averaging 12 to 13 millimeters (0.5 in) in diameter in a matrix of coarse to medium-grained sand; formation has medium to massive lenticular beds forming ledges and cliffs; locally in three parts: a basal light-gray to yellowishbrown medium- to coarse-grained cross-bedded sandstone containing pebble conglomerate lenses and

meters (100 ft) thick; Cretaceous, Cenomanian.

90 meters (80-300 ft) thick, averaging 38 meters (125 ft); Lower Cretaceous, Albian. K-0 unconformity: Contact between Burro Canyon and Morrison Formation represents a hiatus of about 30

sparse silicified logs, overlain by a sequence of light

thin beds of siliceous limestone, chert, and

green mudstone and siltstone, overlain by shale with

orthoquartzite; the lower contact is generally mapped

at the base of the lowest persistent sandstone; 24 to

million years. Brushy Basin Member of Morrison Formation Variegated siltstone, mudstone, smectitic clay, and lesser amounts of calcareous sandstone and conglomerate, locally with thin lentils of dense limestone; siltstone and mudstone are principally maroon, light purple, grayish red, and light to medium gray; crops out as gentle slopes and steep rounded hills, locally in steep slopes with slight ledges; sandstones range from poorly sorted, conglomeration and coarse-grained to well sorted, very fine grained to silty; locally has lenticular conglomeratic sandstone at base with bright-colored chert pebbles and cobbles; lower contact is generally a poorly exposed transition zone of frothy-weathering variegated mudstone and thin light-brown sandstone between the basal meratic sandstone of the Brushy Basin Member and the uppermost sandstone lens of the Salt Wash Member; locally contains petrified dinosaur bone and wood; 76 to 150 meters (250-500 ft) thick; Upper

Salt Wash Member of Morrison Formation: Interbedded lenses of light-brown, white, yellow-gray, and verypale-orange sandstone and medium red-brown and green-gray siltstone and mudstone; has local minor gray limestone and conglomeratic sandstone; sandstones are mostly medium grained with moderate sorting, however, some are fine grained and silty, others are conglomeratic; some are well sorted and others poorly sorted; conglomeratic sandstone is common at the base of the thick lenticular sandstone beds: sandstone lenses are thick and resistant, siltstone and mudstone form slopes or recesses between sandstone lenses; upper sandstone lens is generally mineralized with uranium and vanadium; 58 to 120 meters (190-400 ft) thick, thickening to the south;

Fidwell Member of Morrison Formation and Summerville Formation, undivided: These two units form a red ledgy slope between the Salt Wash Member of the Morrison and the Moab Tongue of the Curtis Sandstone; the entire ledgy slope was mapped as the Summerville Formation on previous geologic maps (see "Primary Map Sources" references); the lower part of the ledgy slope is the Summerville Formation, equivalent to the Summerville Formation of the San Rafael Swell (some investigators have called this interval the Wanakah Formation); the upper part of the ledgy slope is the Tidwell Member of the Morrison Formation; the Tidwell (Upper Jurassic) and Summerville (Middle Jurassic) are separated by the

Upper Jurassic.

J-5 unconformity.

The Tidwell Member is red-brown, fine-grained, silty sandstone and siltstone with light-gray mottlings in undulating thin beds; a few thin interbeds of pink gray crystalline limestone with red and white chert nasses are locally present that are more prominent to the north; sandstones are calcareous, fine grained to very fine grained, with subangular, moderately sorted grains; intertongues with the overlying Sal Wash Member of the Morrison Formation; 3 to 15

meters (10-50 ft) thick. *J-5 unconformity:* The contact between the Summerville and the overlying Tidwell is placed at the base of a pink-gray, thin bed of limestone containing masses of red and white chert in the north part of the map area; and above a light-brownish-gray sandstone ledge in the middle of the red slope to the south; probably represents a hiatus of about 7 million years and marks the boundary between Middle and Upper Jurassic

brown, lenticular, cross-bedded, fine- to mediumgrained, poorly to moderately sorted sandstone with Summerville Formation (Wanakah Formation on some partings and thin beds of medium reddish-brown maps): Most of the Summerville Formation consists siltstone, fine-grained sandstone, and claystone; sand of interbedded reddish-brown to light-brown, thin to grains are mostly subangular and cement is mostly medium bedded, fine-grained silty sandstone and calcareous; locally contains beds of intraformational medium reddish-brown siltstone; in the southern part pebble conglomerate with pebbles of sandstone, of the quadrangle it is capped by a light-brown, fine siltstone and claystone; medium- to thick-bedded grained cliff of sandstone that is well sorted, friable, forms thick ledges; locally contains sparse fossil wood porous, and contains subrounded grains, and is up to and thin beds of pinkish-gray limestone; upper and 4.5 meters (15 ft) thick; commonly at the base is a lower contacts gradational and intertonguing with 0.15 to 1.5 meters (0.5-5 ft) thick reworked zone of Wingate-like beds extending 3 to 6 meters (10-20 ft) yellowish-gray to light-greenish-gray, fine- to mediuminto the Kayenta Sandstone; 18 to 110 meters (60grained sandstone with moderately sorted subangular 360 ft) thick; Lower Jurassic. grains; 1.5 to 21 meters (5-70 ft) thick; generally thin Wingate Sandstone: Orangish-brown, massive, crossto the north and thick in the southeast part of the

Summerville and Morrison Formations, undivided: Shown on cross sections.

mmerville Formation and Tidwell and Salt Wash Members of the Morrison Formation, undivided; mapped in areas where too structurally complex or too poorly exposed to map separately.

Moab Member of Curtis Formation: Pinkish-gray, fine to medium-grained, cross-bedded, massive, cliffforming, non-calcareous to slightly calcareous sandstone: grains are subrounded to subangular and frosted; cliffs contain one or more prominent indentations; intertongues with "typical" greenishgray Curtis Formation northwest of the quadrangle 4 to 34 meters (80-110 ft) thick: Middle Jurassic (The Moab Member was previously considered a member of the Entrada Sandstone – see Doelling,

J-3 unconformity: The flat and sharp contact between the Slick Rock Member of the Entrada Sandstone and the Moab Member of the Curtis Formation is easily recognized in the north part of the quadrangle. In a few cases the unconformity is at a prominent indentation at the top of the massive Entrada cliff, but more commonly it is within a smooth cliff face beneath the indentations in the Moab Member. To the north the contact is placed at the top of orangishbrown, banded Slick Rock Member sandstone commonly pocked with small holes. Above the contact the Moab Member is light-pinkish-gray, is nowhere pocked with small holes, and is not banded. To the south the color banding in the Slick Rock Member is not as pronounced, but can be recognized with practice. Additionally, the Slick Rock Member weathers to smooth surfaces, whereas the Moab Member weathers to sugary surfaces. The unconformity probably represents a hiatus of less than a million years.

Slick Rock Member of Entrada Sandstone: Reddish orange, orangish-brown, and light-gray in faint to obvious color bands; mostly fine grained, but with scattered medium grains; mostly subangular to subrounded, moderately sorted grains, locally contains cross-bed streaks of medium and coarse grains; 0.3to 1.3-meter-high cross-bed sets and planar bedding weather into smooth, massive, bare-rock outcrops with few indentations; locally pocked with small holes that follow cross-bedding; slightly to moderately calcareous; thick dark-red-brown siltstone beds become common in the lower part of the member in the south half of the quadrangle and locally resemble the Carmel Formation; 18 to 95 meters (60-310 ft)

thick, thickening westward; Middle Jurassic. Slick Rock Member of Entrada Sandstone and Moab Member of Curtis Formation, undivided: Mapped in poorly exposed and structurally complex areas where units are not mapped separately at this scale; Middle

> Dewey Bridge Member of the Carmel Formation: Prominent red slope to ledgy slope zone between the Entrada and Navajo Sandstones; upper part is typical Dewey Bridge Member and is mostly mediumreddish-brown, moderately sorted, fine-grained sandstone, with white or gray mottled spots and streaks; grains are mostly subrounded to subangular has some dark-reddish-brown partings of siltstone forms slopes, recesses and ledgy slopes; upper contact with the Slick Rock is undulatory; lower part of member is grayish-yellow, light-gray, pinkish-gray or light lavender, locally red-mottled, well-sorted e-grained sandstone that may correlate with the Paria River Member of southern Utah; grains are subrounded to subangular; generally non-calcareous, medium-bedded, ledgy and sugary weathering; at the base of the member is a thin zone containing scattered arse to common chert fragments 0.3 to 3 centimeters 0.1 -1 in) in diameter; member is 6 to 24 meters (20-80 ft) thick; Middle Jurassic. (Early maps show this unit as Carmel Formation; later maps show it as a member of the Entrada Sandstone; it is herein recognized as a member of the Carmel Formation.)

Moab Member of Curtis Formation, Slickrock Member of Entrada Sandstone, and Carmel Formation. undivided: Mapped in poorly exposed and structurally complex areas where units cannot be mapped separately at this scale; Middle Jurassic. *J-2 unconformity:* Contact appears sharp and flat, but undulates over long distances; pink-gray Navajo

Sandstone with high-angle cross-beds truncated and

overlain by planar gray-yellow sandstone beds of the

lower part of the Cramel Formation; represents hiatus

of about 13 million years and marks the boundary between the Lower and Middle Jurassic. Navajo Sandstone; limestone beds in Navajo Sandstone Pale-yellowish-gray, very light-brown, and pinkish gray, fine- to medium-grained, massive, cross-bedded sandstone; grains are subrounded to subangular, well-

sorted and equant, frosted quartz; conspicuously cross

bedded with cross-bed sets that range from 1.5 to 7.5

meters (5-25 ft) in thickness; contains sparse thin

lenses of gray sandy limestone and, near the base,

gradational and intertonguing; forms rounded knobs

buttes, and mesa rims marked by a checkered pattern

150 meters (80-500 ft) thick, thinning eastward; Lower

of grooved cross-strata and weathering joints; 24 to

Kayenta Formation: Light-brown, red, and reddish-

bedded, fine-grained sandstone; grains are mostly

subangular and well-sorted; faintly banded, with few

partings: weathers into massive dark-brown vertical

to rounded cliffs, generally with bare-rock surfaces:

upper contact placed at top of massive cliff and below

thick reddish-brown ledges of the Kaventa: near tor

locally becomes flat bedded with a few medium to

thick beds of orangish-brown Wingate-like sandstone

interbedded with red-brown siltstone and fine-grained

sandstone of the Kaventa Formation: 67 to 130 meters

(220-420 ft) thick: Lower Jurassic, basal beds may

Formation, and Wingate Sandstone, undivided; shown

J-0 unconformity?: Slope-forming or recessed sandstone

and siltstone of the Upper Triassic Chinle Formation

abut sharply against the vertical cliff of the Lower

orangish-brown, fine-grained sandstone beds of the

Chinle are found directly beneath the Wingate cliff;

Chinle Formation: Reddish-brown sandstone, siltstone,

has an upper interval of grayish-red and reddish-

brown mudstone and siltstone with subordinate

conglomeratic sandstone, and greenish-gray mudstone;

quantities of red lenticular sandstone and mudstone-

colored lenticular sandstone and cobble conglomerate

interbedded with subordinate amounts of greenish-

gray mudstone; sandstones and conglomerates contain

sparse silicified and carbonized fossil wood and other

plant debris and are locally mineralized with uranium,

sparse fossil fresh-water fish, phytosaur bones and

teeth, and rare gastropods and pelecypods; forms a

steep slope interrupted by several strong ledges; lower

contact is a regional unconformity; divided into several

named members not mapped at this scale; 100 to 230

meters (330-750 ft) thick, averaging 120 to 140 meters

(400-450 ft); thickness probably affected by Paradox

TR3 regional unconformity: Generally a sharp contact

between the ledgy greenish-gray to brown fluvial

rocks of the Chinle Formation and the "chocolate"

brown siltstones and sandstones of the Moenkopi

Formation. This unconformity is angular in the

vicinity of salt anticlines, elsewhere beds above and

below are parallel, with the basal Chinle beds scoured

into the upper Moenkopi beds; in the Lisbon Valley

area the Moenkopi is cut out by pre-Chinle erosion

and rests directly on the Cutler Formation. Represents

Moenkopi Formation: Chocolate-brown or moderate-

reddish-brown, thinly laminated to medium-bedded,

fine-grained sandstone and siltstone, gray very fine-

to fine-grained micaceous sandstone and thin beds

of yellow claystone with common ripple marks, much

cracks, and thin veinlets of gypsum; forms a slope

with a few sandstone ledges; commonly 67 to 146

salt anticlines and thickest in rim synclines, and

meters (220-480 ft) thick, locally ranges from 0 to

more than 275 meters (0-900+ ft) thick, missing over

probably thins regionally eastward; locally has a lower

unit, the Hoskinnini Tongue, of pale-reddish-brown

grayish-red, light-brown, very thin to thick-bedded

siltstone and mostly very fine- to medium-grained

sandstone with scattered coarse and very coarse grains

in tabular beds weathering into knobby ledges that

are 27 to 37 meters (90-120 ft) thick; Middle(?) to

TR-1 unconformity: Represents a hiatus of about 25 to

Cutler Formation/Group: In the northeast map area the

Cutler unit is a single thick arkosic formation deposited

as coalescing alluvial fans on the southwest flank of

the Pennsylvanian-Triassic Uncompange uplift. To

the southwest the arkosic facies grades into a series

of formations and thereby gains group status. In that

area the Cutler Group consists of (descending order):

Mesa Sandstone, Halgaito Formation (southwest part

Lower Permian; refers to Cutler Group, undivided on

of map), and Rico or Elephant Canvon Formation:

Arkosic facies of Cutler Formation: Reddish-brown

red, purple, and reddish-orange, locally mottled pale-

onglomerate and minor pale-gray limestone;

gray, arkosic and subarkosic sandstone, siltstone, and

sandstones are fine to coarse grained, gritty, generally

White Rim Sandstone, Organ Rock Shale, Cedar

Lower Triassic.

30 million years.

cross sections.

a hiatus of about 10 to 15 million years.

thickens in rim synclines; Upper Triassic.

Formation salt movement, thins over salt diapirs, and

copper, and iron sulfides; other lithologies contain

pebble conglomerate and a lower interval of light-

unconformity may only be local in extent.

Jurassic Wingate Sandstone: locally tilted, thick

Glen Canyon Group: Navajo Sandstone, Kayenta

on cross sections; Lower Jurassic.

be Triassic.

lenses of reddish-brown siltstone; lower contact

White Rim Sandstone: Light-gray to yellowish-gray, fine-to coarse-grained, cross-bedded sandstone that forms a vertical cliff; exposed at the top of the Cutler Group in the west and northwest part of the map area: pinches out eastward into the arkosic facies; 0 to 76 meters (0-250 ft) thick; Lower Permian. Organ Rock Shale: Red-brown siltstone, fine-grained

grades eastward into the arkosic facies; 76 to 120 neters (250-400 ft) thick: Lower Permian. sandstone: thickly cross-bedded, massive, cliff forming: grades and interfingers northeasterly into map area: 60 to 370 meters (200-1.200 ft) thick: Lower Permian.

Lower Cutler Group, undivided: Interbedded reddish brown, grayish-red, greenish-gray, cross-bedded, very fine- to medium-grained sandstone, dark-red micaceous siltstone, and gray cherty fossiliferon limestone and dolomite ("Rico beds"); becomes thicke and contains more limestone in western sections (Elephant Canyon Formation); to southwest grades into red-brown and purple arkosic sandstone, siltstone, claystone, and conglomerate, with thin marine limestone beds (Halgaito Shale); northward, and northeastward in the subsurface, the formation tongue into the lower part of the arkosic facies; exposed principally in the western half of the map area: 0 to 60 meters (0-1,500 ft) thick; Pennsylvanian-Permian chronologic boundary may be in the lower part of this unit in the southeast part of the quadrangle; mostly

Honaker Trail Formation (local lower [IPh1] and upper [IPhu] members): Gray cherty limestone and dolomite brown, reddish-brown, and gray, fine- to coarsegrained, cross-bedded, locally micaceous and arkosic sandstone, and reddish, vellowish, and greenish. gray mudstone; limestones locally highly fossiliferous thin- to thick-bedded; forms ledges and slopes; exposed in deep canyon of the Colorado River and in a whaleback along the Lisbon anticline; 0 to 910 meters (0-3,000 ft) thick; thin or missing over some salt diapirs and thick in rim synclines, perhaps 300 to 460. meters (1.000-1.500 ft) thick in the Colorado Rive canyon and 460 to 640 meters (1.500-2.100 ft) thick in the Lisbon Valley area where it is mapped in upper (IPhu) and lower (IPhl) members; upper member has more reddish-brown sandstone and is less resistant. than lower member: lower member has more abundant and thicker limestone beds: member contact is placed at base of a light-brown, fine-grained limestone containing fossil plant fragments; Upper

unconformity: Represents a hiatus of about 1 to 2

Paradox Formation: Black, gray, and yellowish-gray shale, sandstone, gypsum and thin-bedded limestone in surface exposures (cap rock), but dominated by evaporite minerals (halite, carnallite, and sylvite) ir subsurface sections; exposed at the bottom of the Colorado River canvon in the south half of the quadrangle and in Sinbad Valley in the northeast corner of the quadrangle; 157 to 2,700 meters (515 9.000 ft) thick: thickest sections are in the cores of salt anticlines, thinnest in the rim synclines: Middle Pennsylvanian, includes underlying Pinkerton Trail Formation on cross section.

60' quadrangle include most of the Pennsylvanian Paradox Formation and all of the Pennsylvanian Pinkerton Trail and Molas Formations; the Mississippian Leadville or Redwall Limestone; the dississippian and Devonian Ouray Limestone; the Devonian Elbert (including the basal McCracken Sandstone) and Aneth Formations; the Cambrian Lynch Dolomite, Muav Formation, Bright Angel Shale, and Ignacio Quartzite; and Proterozoic gneisses

Contact - Includes approximately located; dashed at gradational facies change.

High-angle normal fault - Dashed where nferred or approximately located; dotted where concealed; solid includes concealed faults in areas where fault and contact are on down-thrown side.

Anticline - Shows trend of fold axis; arrow shows direction of plunge.

> Structure contour - Contour interval 50 meters; drawn on top of Moenkopi Formation (west half of map area); top of Tidwell Member of Morrison Formation (east half of map area); dashed where projected above ground surface; some contours omitted in congested areas; datum is mean sea level.

65 Strike and dip of bedding

fairly to poorly sorted, and irregularly bedded; contains thin, locally fossiliferous limestone beds in the lower part of the unit; forms rough slopes, ledges, and cliffs; exposed mostly around the edges of salt anticlines in the east half and in the north-central part of the map area; 120 to 1,500 meters (400-5,000 ft) thick; thin over salt anticlines and thickens in rim synclines and in the northeast corner of the quadrangle; Lower

FORMATION

Surficial deposits

AND MEMBERS

Gevser Creek

La Sal Mtns. intrusive

Mancos Shale

sandstone beds

Dakota Sandstone

Burro Canyon

Formation

Member

Salt Wash

Member

Tidwell Memb

Moab Member

Entrada Sandstone

Slickrock Member

Carmel Formation

Chinle Formation

Moenkopi Formation

Organ Rock

Cedar Mesa

Sandstone

Cutler Group

Dewey Bridge Membe

SYMBOL

Km

Kms

Kd

Kbc

meters

(0-50)

0-300

(0-1.000)

(2.500+)

(100-200)

(250-500)

58-120

18-110

Trc

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Formation

1,200)

1.500)

(0-3.000)

157-2,700 🛨

Jms | (190-400)

LITHOLOGY

Mostly dark-gray marine shale

hin fossiliferous limestone beds

Thin discontinuous coal beds

Pebble conglomerate

usually landslide covered

commonly mineralized

ointed and sucrosic weatheri

with uranium-vanadium

Banded eolian sandstone

with "stonepecker" holes

Small chert fragments at bas

Ledge and bench-forming

High-angle cross-beds

Eolian sandstone

Limestone beds

Vertical cliff

Contains fresh-water

Lower part commonly

Common ripple marks

mudcracks, and thin

veinlets of gypsum

"Hoskinnini Tongue

Arkosic sandston

eolian sandstone

Arkosic sandstone

intertongues with

with fossiliferous

limestone beds

questionable

shale that intertongue

Fossiliferous limestone

Contorted gray shale

gypsum and thin

Salt-bearing

Mostly subsurface

Only upper part shown

limestone in cap rock

Forms prominent bench

in northern Canyonland

mineralized with uraniu

fossil fish

Thin limestone with

ariegated mudstone-

Rare dinosaur bones

Red marker

Local arches

Red marker

25-28 Ma

forms ledges and slopes; is an arkosic tongue that Cedar Mesa Sandstone: White, vellowish-gray, reddish orange, and reddish-brown, fine-grained calcareous arkosic facies: exposed in the southwest part of the

sandstone and subarkosic sandstone, and sandy shale;

Pennsylvanian, Virgilian to Missourian.

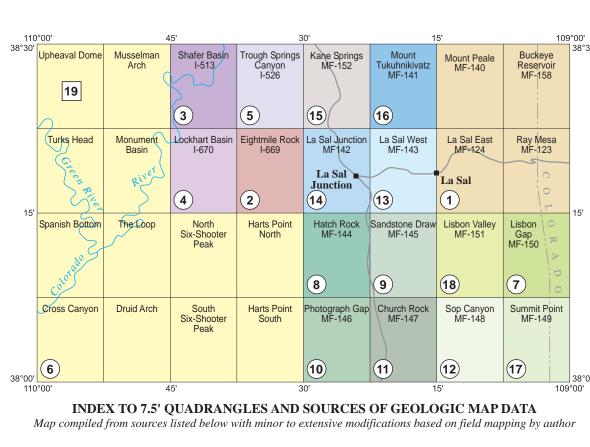
million years.

Concealed rocks: Concealed rocks of the La Sal 30' x

GEOLOGIC SYMBOLS

too close to map separately; bar and ball

Syncline - Shows trend of fold axis; arrow shows direction of plunge.



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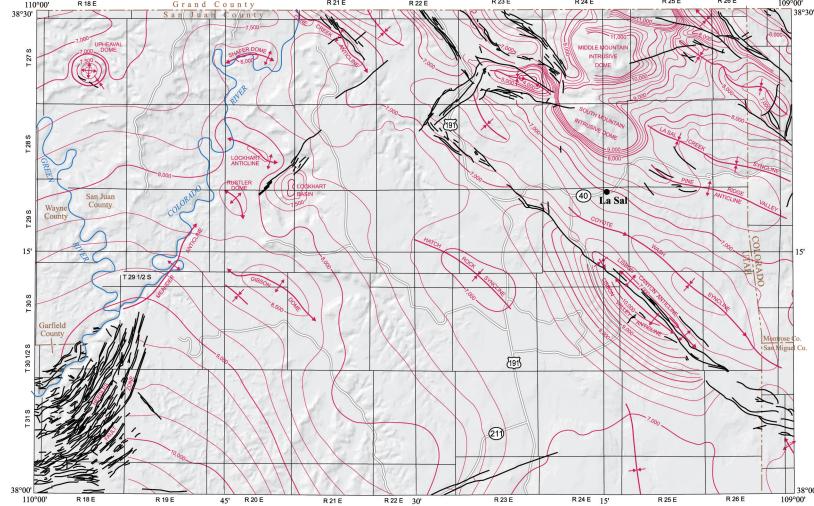
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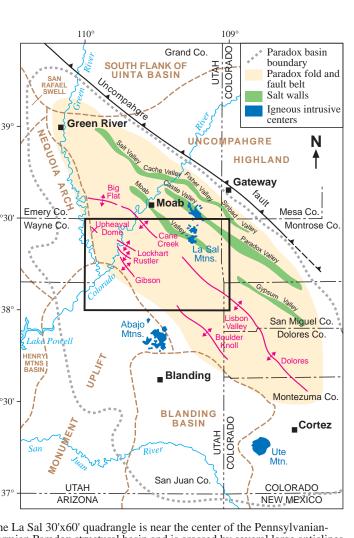
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SIMPLIFIED STRUCTURE MAP OF THE LA SAL 30' X 60' QUADRANGLE

Contour Interval 250 feet-- drawn on top of Burro Canvon Formation. Datum = mean sea level

Simplified from contours shown on plate 1 and converted to feet



The La Sal 30'x60' quadrangle is near the center of the Pennsylvanian Permian Paradox structural basin and is crossed by several large anticlines formed by salt diapirism. The La Sal Mountains laccolith intrusive domes are in the northeast part of the quadrangle, and Upheaval Dome, of enigmatic origin, possibly a meteorite impact structure, is in the northwest part

