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GEOLOGY OF THE NORTHWEST QUARTER OF THE SOLDIER SUMMIT QUADRANGLE, UTAH

by
Max W. Prescott

Brigham Young University
Department of Geology
Provo, Utah

GEOLOGY OF THE NORTHWEST QUARTER
OF THE
SOLDIER SUMMIT QUADRANGLE, UTAH

A thesis
submitted to
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In partial fulfillment
of the requirements for the degree
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by
Max W. Prescott
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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

ABSTRACT

Fifty-four square miles near the head of Soldier Creek, Utah County, Utah were mapped. The abandoned townsite of Tucker, located on U.S. Highway 6-50, is in the central part of the area.

Stratigraphic thickness of the North Horn, Flagstaff, Colton and Green River formations slightly exceeds 7,000 feet. Detailed mapping revealed the Colton formation to grade laterally and vertically into the overlying Green River and underlying Flagstaff formations.

West Soldier fault and East Soldier fault are terms applied to the two major normal faults in the area. Displacement ranges from zero in the north to about 1,200 feet in the south of the area. The faults form a graben averaging three and one-half miles wide and extending beyond the area to the south.

Water is probably the most important mineral resource at the present time. Oil shale is present, but low quality and limited quantity restrict its possibilities. No oil or gas wells have been drilled in the area, but the Clear Creek gas field is located just south of the mapped area. Fault traps in the underlying formations might have some possibilities for gas production.

INTRODUCTION

Location and Accessibility

The northwest quarter of the Soldier Summit Quadrangle, Utah (15-minute series) consists of fifty-four square miles between parallels 39°52'30" and 40°00' North Latitude and meridians 111°15' and 111° 07'30" West Longitude. This includes parts of Townships 9, 10 and 11 South, and Ranges 6 and 7 East, Salt Lake City Base Meridian and parts of Townships 5 and 6 South, Range 11 West, Unita Basin Meridian, all in Utah County except for the northeast corner which is in Wasatch County, Utah (Plate 1).

U.S. Highway 6-50 and the Denver and Rio Grande Western Railroad cross the central part of the area in an east-west direction. Minor gravel and dirt roads, leading off U.S. Highway 6-50, are located in Tie Fork, Clear Creek (Skyline drive), South Fork of Soldier Creek and Indian Creek. The southeast corner is accessible by dirt road from Utah State Highway 96 (Plate 8). Numerous trails along telephone, electric transmission lines and the railroad traverse the area; in addition, livestock trails afford foot routes to the remote areas.

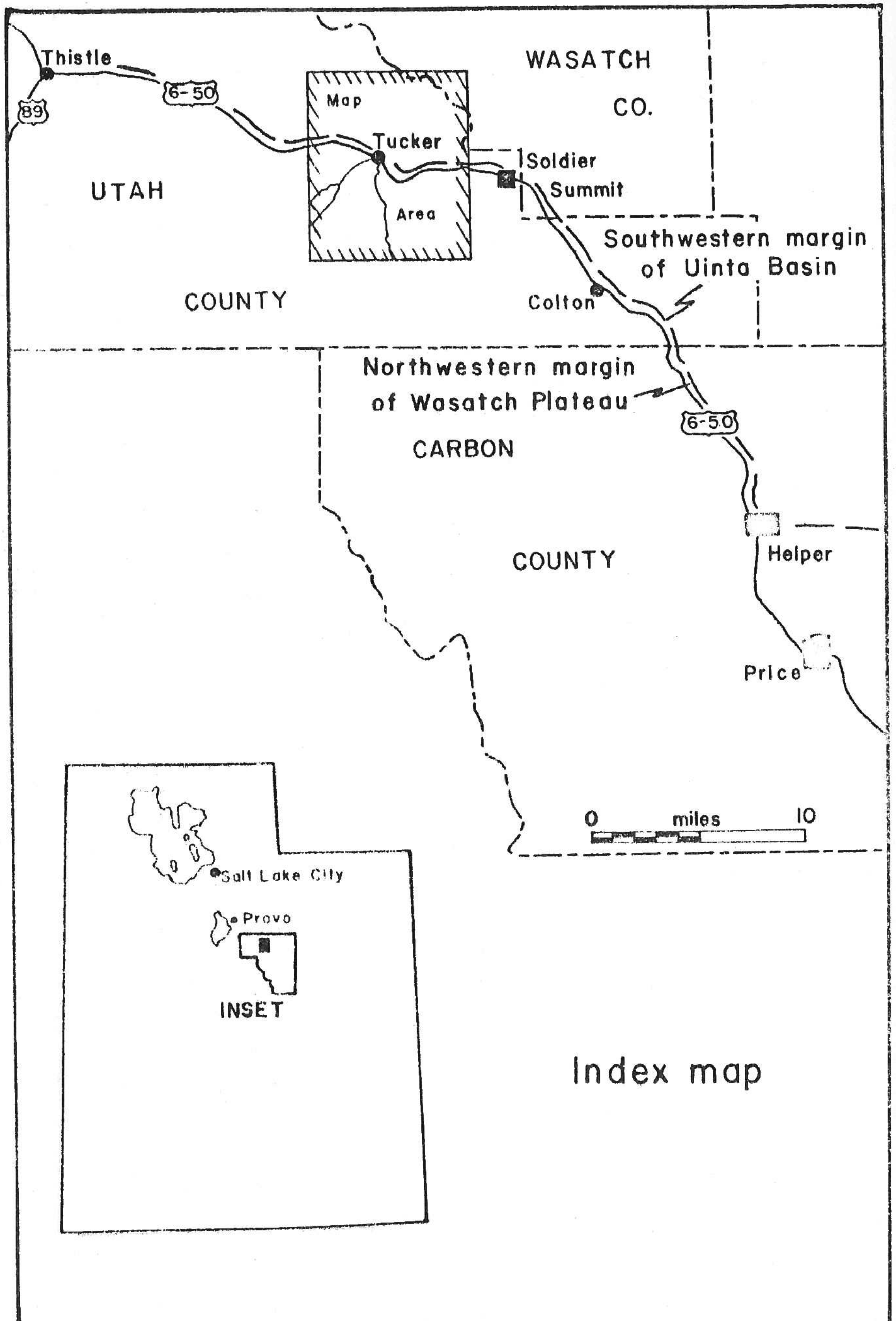
U.S. Highway 6-50 is passable throughout the year. Minor roads are passable only during summer months.

The field season varies according to the weather conditions. Winter snow falls settle in around the latter part of October and last until the middle of April. During the summer months dense foliage covers the area, leaving the early spring and late fall as the best times of year for field work.

Physical Features

The mapped area consists predominately of a cuesta type topography with steep southern slopes and gentle northern dip slopes.

Plate I



Index map

Soldier Creek traverses the area in an east-west direction, forming a subsequent stream valley through the middle of the area. Clear Creek, South Fork of Soldier Creek, Tie Fork and Indian Creek are tributaries of Soldier Creek and have carved the larger canyons in the area. A somewhat dendritic stream pattern drains the area and feeds the above mentioned streams. Faults have had only a secondary effect on the drainage in the map area, but to the south fault movement has controlled the drainage pattern.

Fault scarps are obvious in the southern part of the area. Here downdropped blocks form graben-type valleys which trend north-south (Plate 8). The highest points in the area reach an elevation of 9,000 feet in the northeast and southwest corners of the area, the lowest point is approximately 6,000 feet in Soldier Canyon near the western boundary.

Previous Work

E. M. Spieker and J. B. Reeside Jr. (1925) published a preliminary account of the stratigraphy of the Wasatch Plateau. They presented a section of Late Cretaceous and Early Tertiary beds exposed in the Price Canyon vicinity. Spieker added to this description in 1931 and later (Spieker 1946) defined the lower member of the Wasatch formation as the North Horn formation. He also applied the term Flagstaff limestone to the strata previously referred to as the Flagstaff limestone member of the Wasatch formation and applied the term Colton formation to the strata that formerly referred to the upper member of the Wasatch formation. The Green River formation was named by Hayden (1869) from beds near Green River, Wyoming.

Present Work

Field work started in March 1957 and proceeded intermittently until completion in October, 1957. The work consisted of interpreting and mapping the stratigraphic and structural features. Field mapping was done on aerial photos, scale 1:20,000. The information was later transferred to a controlled mosiac, scale 1:62,500, then to the topographic map of the Soldier Summit Quadrangle, scale 1:62,500, and finally to an enlarged portion of the topographic map which was used for the base map. The completed map was reduced to a scale of 1:31,250 (Plate 8).

Steel tape and Abney level were utilized in measuring the stratigraphic sections (Plate 3). Strikes and dips were taken with the Brunton compass. Formation contacts and faults were walked out in the field and pin-pointed on the photos. Later, standard photogeologic methods were used, in addition to field work, to complete the final map. Fossils and rock samples were collected during the field mapping, with more detailed sampling undertaken during measurement of stratigraphic sections.

Laboratory work consisted of curating and indentifying rock and fossil samples. Thin sections of the tuffs and algal masses were cut and identified (Plate 5). Fossils were studied and illustrated (Plates 5 and 6).

GENERAL GEOLOGY

The Upper Cretaceous, Tertiary and Quaternary are represented in the sedimentary rocks of the area.

A thickness of slightly more than 7,000 feet of sandstone, siltstone, shale, conglomerate, freshwater limestone, oil shale and small amounts of tuff is exposed in the area. These rocks are indicative of alternating fluviatile, flood-plain and lacustrine deposits and compose the upper North Horn, Flagstaff, Colton and Green River formations.

The Colton, Flagstaff and North Horn formations were formerly considered part of the Wasatch formation as used by Hayden in 1869. Spieker (1946, p. 137), who proposed the above formational names, also discusses the problem of identifying the Wasatch formation in central Utah.

CRETACEOUS AND TERTIARY SYSTEMS

North Horn Formation

Definition and distribution. - The lower member of the Wasatch formation as identified in the Wasatch Plateau and surrounding area was redefined as the North Horn formation by Spieker (1946, p. 132). This excluded the basal conglomerate which was placed in the underlying Price River formation (Cretaceous). The type locality is North Horn Mountain, in the Wasatch Plateau.

The North Horn formation crops out in the southernmost part of the mapped area (Plate 8), with an areal extent of approximately 13 square miles. The contact with the underlying Price River formation is not exposed within the map area but it is exposed in the bottom of the South Fork of Soldier Creek Canyon, and in Bennion Creek Canyon about one mile south of the southern limit of the mapped area. The upper contact extends in a fault-cut pattern across the area in an east-west direction (Plate 8).

The formation is well exposed in the canyons of South Fork of Soldier Creek and the Left Fork of Clear Creek. Throughout the area, upper beds of the formation are best exposed on the steep slopes beneath the Flagstaff limestone.

Lithologic character and topographic expression. - The upper strata of the North Horn as exposed in the mapped area consists of quartzose sandstone, shale, siltstone, limestone and conglomerate. Sandstones and shales predominate. Shales are predominantly gray to tan but some are mottled red and purple. Sandstone beds are predominantly quartzose, are fine to coarse-grained, grains are rounded to subrounded, and are gray to tan but weather lighter colored. Strata are thin to massive bedded, are crossbedded; some ripple and oscillation marks are present. The gray sandstones generally contain black and pink quartz grains and are generally fine to medium-grained. The sandstones commonly show a decrease in the amount of black grains and an increase in the amount of pink grains. Some of the coarser grained sands contain limestone fragments that range from silt to pebble-size. Prominent among some of the sandstones are white siltstone particles which give the rock a conglomeratic aspect.

The conglomerate is composed of pebble-sized quartzite, limestone and chert particles, with a light brown, quartzose, sand matrix. The quartzite particles exhibit a variety of colors whereas the limestones are blue, gray or light brown. A bryozoan, Penniretepora sp., was found in a blue limestone pebble. This helps to establish the source of the material as being Upper Paleozoic limestones probably from the Wasatch Mountains, some distance to the west. Probably the quartzitic material had its origin also to the west.

The interbedded limestones appear somewhat conglomeratic in that they contain brown fragmental and rounded algal masses with a gray sand matrix (Plate 5, fig. 4, 5). The algal masses have as a nucleus either fragments or complete gastropod or pelecypod shells, sand grains or siltstone particles. The algal masses vary in size from minute particles to ten inches in diameter (Plate 5, fig. 2, 3, 4, 5). Many of the algal masses weather free and are found in the float.

Topography expressed by the formation consists of alternating slopes and ledges. The slopes are formed by the shales and thin-bedded

friable sandstones. The ledges are composed of massive sandstones.

Age, correlation and thickness. - Stratigraphic position is one of the criteria for the Paleocene age of the portion of the North Horn exposed in the area. Spieker (1946, p. 134) states that the age of the North Horn is determined by two groups of fossils, one a freshwater Molluscan fauna and the other a vertebrate fauna. The vertebrate fauna is composed of dinosaurian and reptilian remains. At North Horn Mountain, the dinosaurian remains come from the lower 500 feet of the formation. The middle part has yielded no vertebrate fossils diagnostic of age, but the upper part contains mammalian bones unquestionably Paleocene in age. Within the mapped area no vertebrate fossils and only a few specimens of Helix sp., (Plate 6, fig. 1, 1a), Viviparus sp. and Physa sp. were found. A leaf was found embedded in a piece of ripple marked sandstone float.

In sections 6 and 7, T. 11 S., R. 7 E., Salt Lake Base Meridian, the writer measured the upper 1,317 feet which is assumed to be about half the total thickness of the formation in the vicinity of the mapped area (Plate 3).

TERTIARY SYSTEM

Flagstaff Limestone

Definition and distribution. - Spieker (1946, p. 135) defined the Flagstaff limestone and elevated it to formational rank because its thickness and extent placed it among the major stratigraphic units of central Utah.

The Flagstaff limestone crops out in the southern part of the mapped area (Plate 8). It trends across the area in a general east-west direction roughly parallel to the outcrop pattern of the underlying North Horn formation.

Exposures of the Flagstaff limestone occur in the Left Fork of Clear Creek Canyon, particularly on the west side, and in the South Fork of Soldier Creek Canyon. The ridges between are generally capped by limestones. Dip slopes on the high ridges south of U.S. Highway 6-50, east of the abandoned townsite of Tucker, are formed on limestones of this formation (Plate 8).

Lithologic character and topographic expression. - The Flagstaff is predominantly limestone, with interbedded shale and sandstone. Spieker (1946, p. 136) reports minor amounts of gypsum, oil shale, volcanic ash, coal and silicified limestones. The writer did not find in the mapped area any oil shale, recognizable volcanic ash, or coal that could be considered to belong in the Flagstaff. Silicified limestone is present along with insignificant amounts of gypsum.

Lithologic character of the formation is highly varied. Colors of the beds range from nearly white, through buff to tan, light to dark brown, gray, dark blue, blue-gray and mottled combinations. Thick bedding is predominant but thin to massive strata are present. The blue-gray and dark blue fossiliferous beds are generally thin to medium-bedded. The limestone is dense and sublithographic. Under a hand lens freshly fractured surfaces show a very-fine sugary texture. Dark blue and blue-gray beds weather medium to light blue-gray. Tan or buff beds weather light tan; all others weather typically light gray. A grayish white, chalky weathered surface is characteristic of many of the beds regardless of their color. Interbedded shale is predominantly gray, but some variegated maroon and gray rock is found near the west boundary in the lower part of the formation.

Sandstones in the lower transition zone are similar to those of the North Horn. Sandstones higher in the section are finer grained, more calcareous, and more gray than those below. The upper transitional sands show the same type of gradational relationship into the Colton formation.

Certain of the limestone beds are charged with fresh-water mollusks. Complete specimens are present in some beds, whereas others contain only fragments or hash. The dark blue beds are consistently fossiliferous. With this relationship appearing throughout the formation, the writer believes there are cyclic variations within the limestones and the shales. Some of the fossils are illustrated on Plate 4.

Age, correlation and thickness. - The exact age of the Flagstaff is not known with certainty. The invertebrate fossil record is not a sound basis for dating because the range of many of the species extends beyond the limits of the enclosing formation. The apparent conformable

relations of the Flagstaff and the North Horn indicate that deposition of the Flagstaff formation followed rather closely that of the North Horn formation. A late Paleocene-early Eocene age is assigned to the Flagstaff because of the similarity that the fauna has with the dating given by La Rocque (1955). La Rocque (1955, p. 140) states that diagnostic character of the Paleocene North Horn is the abundance of Viviparus, Lioplacodes, and the rarity of Physa and Hydrobia. The lower Flagstaff (Paleocene) has the same genera, but Hydrobia is much more abundant and cannot be overlooked in spite of its small size whereas, in the upper Flagstaff (Eocene) Lioplacodes is absent, Hydrobia is rare, and Goniobasis, Gyralus and Physa are present in large numbers.

A list of fossils collected and identified by the writer is given below.

Pelecypods:
- Unio danae Meek & Hayden (10929)
- U. sp. (10929)
- Sphaerium planum Meek Y Hayden (10933)

Gastropods:
- Physa bullatula White (10932)
- P. bridgerensis White (10932)
- P. pleromatis White (10932)
- P. sp. (10930)
- Viviparus leidyi Meek & Hayden (10932, 10929)
- V. reynoldsianus Meek & Hayden (10932)
- V. sp. (10930)
- Helix evanstonensis? White (10932)
- Goniobasis endlichi? White (10929)
- G. nebrascensis? Meek & Hayden (10933)
- G. carteri Hall (10928)
- Planorbis (Bathyomphalus) planoconvexus? Meek & Hayden (10933)
- Planorbis (Bathyomphalus) kanabensis Meek & Hayden (10931)

Other specimens that were present but not identifiable are believed to belong to the genera Hydrobia?, Micropyrgus? (specimen found was very much larger than Micropyrgus minutulus Meek & Hayden). Ostracods are also present. Some of the above fossils are illustrated on plate 6.

Colton Formation

Definition and distribution. - Spieker (1946, p. 139) included in the Colton formation strata that had formerly been classified as the upper member of the Wasatch formation. As thus defined the Colton consists of the strata between the Flagstaff limestone and the Green River formation. The name was taken from the town of Colton, Utah, where the beds are well exposed.

The Colton formation crops out in the east-central part of the area, and the outcrop band gradually narrows toward the west (Plate 8). The rocks are best exposed along the railroad cuts on the south side of Soldier Creek Canyon. Soldier Creek has eroded the soft beds of the Colton and parallels the formation for some distance east of the mapped area. The variegated beds are also exposed on the north side of the main highway for about one and one-half miles west of the eastern boundary. At this point the East Soldier fault crosses the canyon and drops the upper part of the Colton below the valley fill (Plate 8). Beyond the fault, the upper contact is either covered by valley fill, river gravels or is indistinct as a result of earth-flows. An area of about three and one-half square miles of Colton formation is shown on the map (Plate 8).

Lithologic character and topographic expression. - The Colton formation in the mapped area consists of variegated shale, siltstone, sandstone and some limey mudstone. Shale is the predominate rock type with siltstone, sandstone and limey mudstone less common, in that order. The shale is dark maroon, gray, tan or purple and is highly susceptible to weathering and erosion. The siltstone has a similar range in color but generally shows more resistance to weathering and erosion. Some of the siltstone beds have a tannish yellow weathered surface.

The sandstone shows a wider variety than either the shale or the siltstone. Sandstone beds are predominantly maroon or gray, and weather brown to dark maroon, are fine to coarse-grained, silty and quartzose. Light brown units are also present. Thin to massive, discontinuous bedding with some crossbedding is common, and the rocks are generally calcareous. Maroon colored sands are generally fine-

grained and well cemented, whereas the gray sands are coarser grained and friable.

The gray sands, sometimes referred to as "salt and pepper" sands, and the shales are more abundant in the upper Colton and the lower part of the Green River. This indicates a gradational relationship between the two formations rather than a sharp contact. The gradational zone is interbedded shale, sandstone, siltstone and some marly limestone. In the west-central part of the mapped area (Sec. 21 and 22, T. 19 S., R. 6 E. Salt Lake Base Meridian) Green River lithology rests with apparent conformity on Flagstaff. The contact is gradational and consists mostly of shaly material with Flagstaff-type limestone in the lower part and Green River type above (Plates 2, 8). This situation presents the problem of establishing a mappable contact. The writer has followed the suggestion of Spieker (1946, p. 139) that the contrast in color presents a valid criterion for mapping. Using this as a basis for mapping, it is evident in the mapped area, that the Colton grades laterally and vertically into the overlying Green River and underlying Flagstaff formations, thus causing the disappearance of the typical variegated maroon and gray colored Colton formation (Plate 2, fig. 1). Also, the Green River thickens at the expense of the Colton to a greater degree than does the Flagstaff.

It is believed by the writer that this marks the southwestern-most limit of the Colton formation, as defined by Spieker (1946, p. 139). As the Colton is considered a fluvial or floodplain deposit it could easily reappear as localized lenses beyond the limits of the mapped unit.

The weak friable character of the Colton is expressed by the topography in that it forms valleys and dip slopes.

Age, correlation and thickness. - The Colton is stratigraphically equivalent to the lower part of the Green River formation and is considered as early Eocene in age.

Spieker (1946, p. 139) concludes there is at present no paleontologic evidence to show that the Colton formation is not of Wasatch age (lower Eocene); nor on the other hand, is there any paleontologic evidence to prove that it is Wasatch.

A list of fossils collected and identified by the writer is given below. None of the fossils found in the Colton offer any substantial disagreement with the early Eocene age.

Helix? veterna Meek & Hayden (10926)
Goniobasis endlichi? White (10927)
G. carteri Hall (10927)
G. tenera? Hall (10927)
Bulimus rhomboides Meek & Hayden (10927)
B. longisculus Meek & Hayden (10927)
Viviparus leai Meek & Hayden (10927)
V. sp. (10926)

All of the above fossils are gastropods some of which are illustrated on Plates 5 and 6.

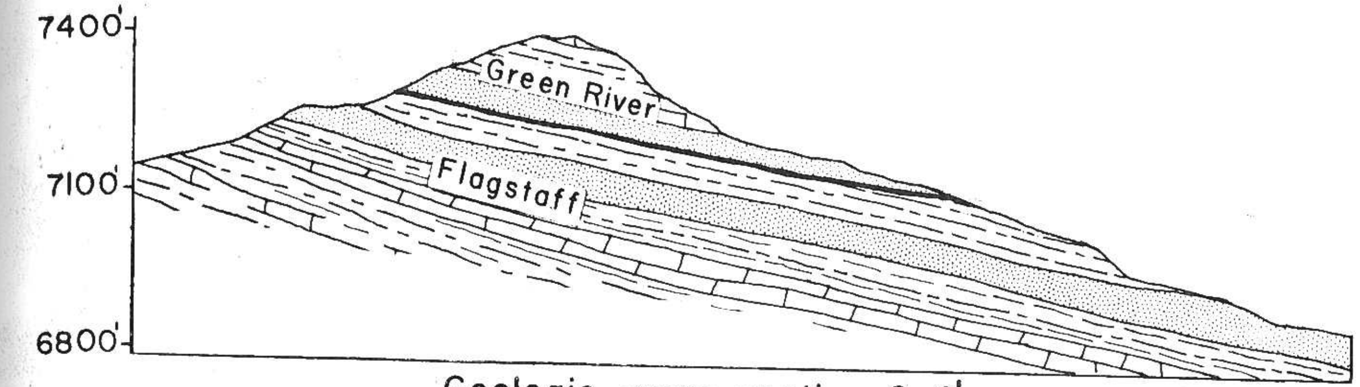
Above Kyune, two miles east of Colton at the head of Price River Canyon, the Colton formation is 1,500 feet thick (Spieker 1946, p. 139). In Sec. 21, T. 10 S. and R. 7 E. Salt Lake Base Meridian, the Colton is 777± feet thick as measured by the writer. The lowest unit of the measured section is composed of the broken, eroded beds of the earth-flow zone, and so the thickness was estimated; this seemed to the writer as reliable as attempting to measure the beds on the dip slopes and encountering the problem of repetitious beds. The measured sections indicate a thinning westward from the type area where it is 1,500 feet thick to complete absence on the western side of the mapped area, a distance of approximately 15 miles. The thinning is fairly even except for the southwestern limit of the formation where it is relatively abrupt.

In the Thistle area (Plate 1) Metter (1955, p. 138) designated a unit composed of conglomerate, with some shale and sandstone, as the Colton formation. The writer has shown, in mapping the southwestern extent of the Colton formation (Plate 8), that it does not extend into the Thistle area. It is, however, possible that a reenterant of the Colton does exist, but the writer prefers the usage of Peterson (1952) and Rawson (1957) in the Thistle area.

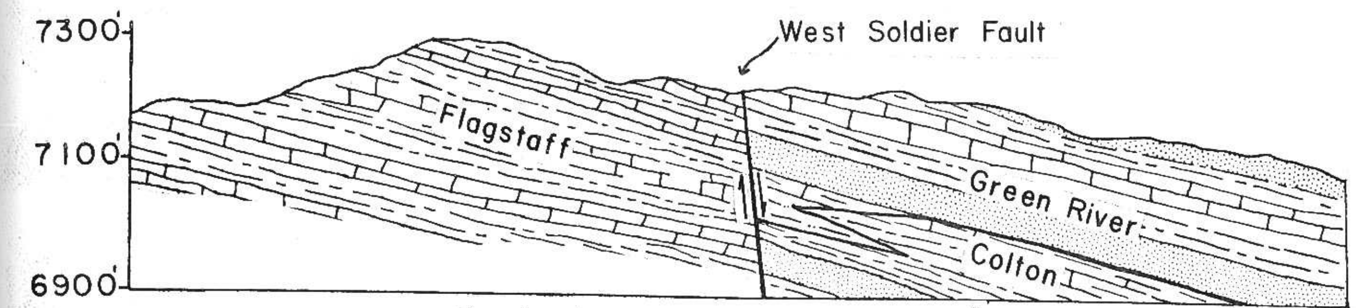
Green River Formation

Definition and distribution. - The Green River formation was named by Hayden (1869) for rocks exposed along the Green River, near the town of Green River, Wyoming.

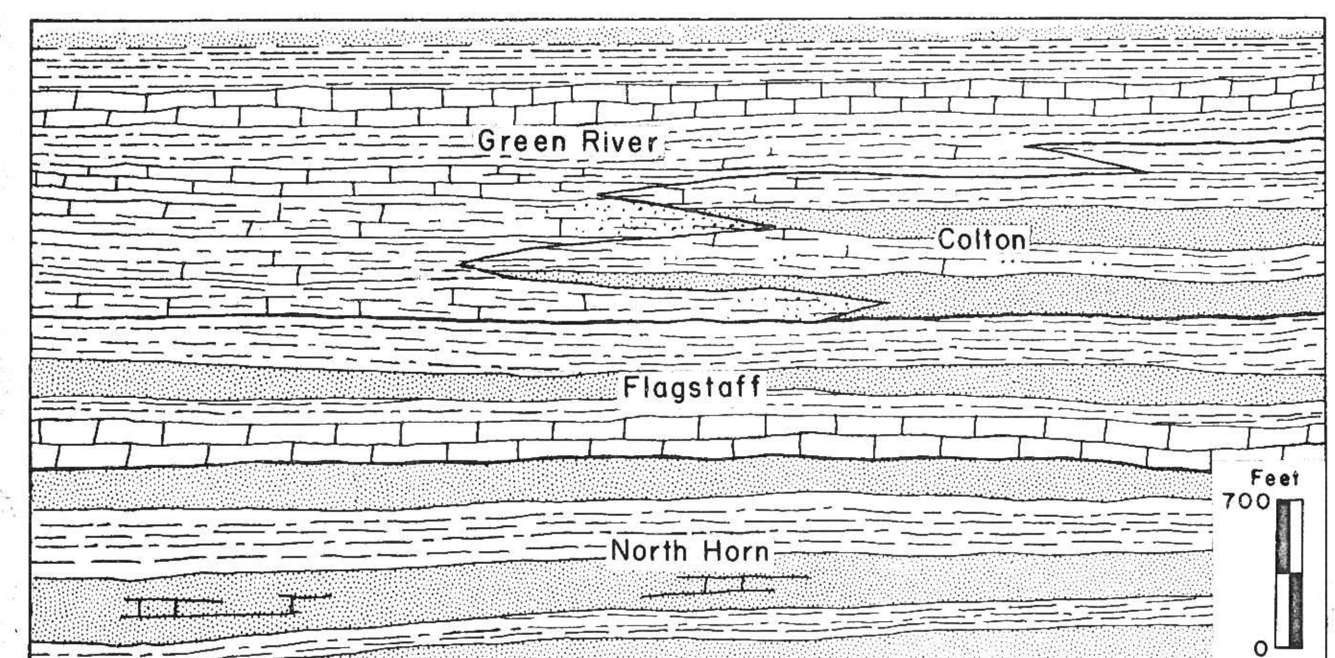
The formation crops out in the northern half of the present area, and has an areal extent equal to the combined other formations (Plate 8).



Geologic cross section C-C'
Text-fig. 3



Geologic cross section D-D'
Text-fig. 2



Idealized east-west restored cross section of stratigraphic relationship of upper North Horn, Flagstaff, Colton and lower Green River formations
Text-fig. 1

The contact with the overlying Bridger-Uinta formations was not encountered during the present work. The Colton-Green River contact is present but poorly exposed. This contact is best seen on the north side of the main highway, in the east-central part of the area. On the western side of the area, rocks of Green River lithology rest with apparent conformity on the Flagstaff limestone, (Sec. 21 and 22, T. 9 S. and 6 E., Salt Lake Base Meridian, Plate 8).

Lithologic character and topographic expression. - The formation is extremely varied, consisting of sandstone, siltsone, mudstone, marlstone, shale, "paper" shale, oil shale, limestone, coquina beds, volcanic tuff and some lignitic coal beds.

Sandstones and siltstones are tan to gray-green and weather slightly lighter colored. They are fine to medium-grained, thin to thick-bedded and are quartzose and micaceous. Cross-bedding and ripple marks are common in the discontinuous channeled and wedged sandstone beds.

Due to their similarity, the shales, mudstones and marlstones are grouped together. For definitions and usage of the above terms, see Bradley (1931. p. 6). They range in color from gray, green, cream through tan to buff, maroon, brown or purple and are the most abundant rock types. Limestone is tan, light to dark brown, blue-gray and light gray-green. Tan beds are generally silty. Light brown beds are dense, sublithographic, silty and weather chalky white. Dark brown beds are commonly filled with fossil hash. Blue-gray beds, associated with the dark brown beds, also contain fossil hash. Light gray and gray-green beds are generally non-fossiliferous and dense. Coquinoid limestones are composed of pelecypods, gastropods, ostracods or mixtures of these shells (Plate 5, fig. 7).

The "paper" shale is carbonaceous, fossiliferous and interbedded with thin limestone beds. In places the shale is low grade oil shale. The oil shale is dark brown, thin to thick-bedded, with intermixed chert and silt. It weathers light gray and forms semi-ledges. The oil shale crops out in the northeast portion of the map (Plate 8).

The blue-gray and dark-brown fossiliferous limestones are in the lowermost part of the formation and resemble those of the Flagstaff. Other limestone types are intercalated throughout the formation. The predominance of "paper" shale is in the lower part, above the blue-gray and dark-brown limestones, whereas the oil shale is in the upper part. A zone of shale, limestone and marlstone separates the "paper" shale from the oil shale. Tannish sandstone and siltstone are most abundant in the upper part, above the oil shale zone. Coquinoid limestones and lignitic coal beds are in the lower part of the formation; evidence of algal reef material is also present in the float from some of the lower beds.

The alternating resistant and non-resistant beds form cuesta type topography throughout the area of outcrop.

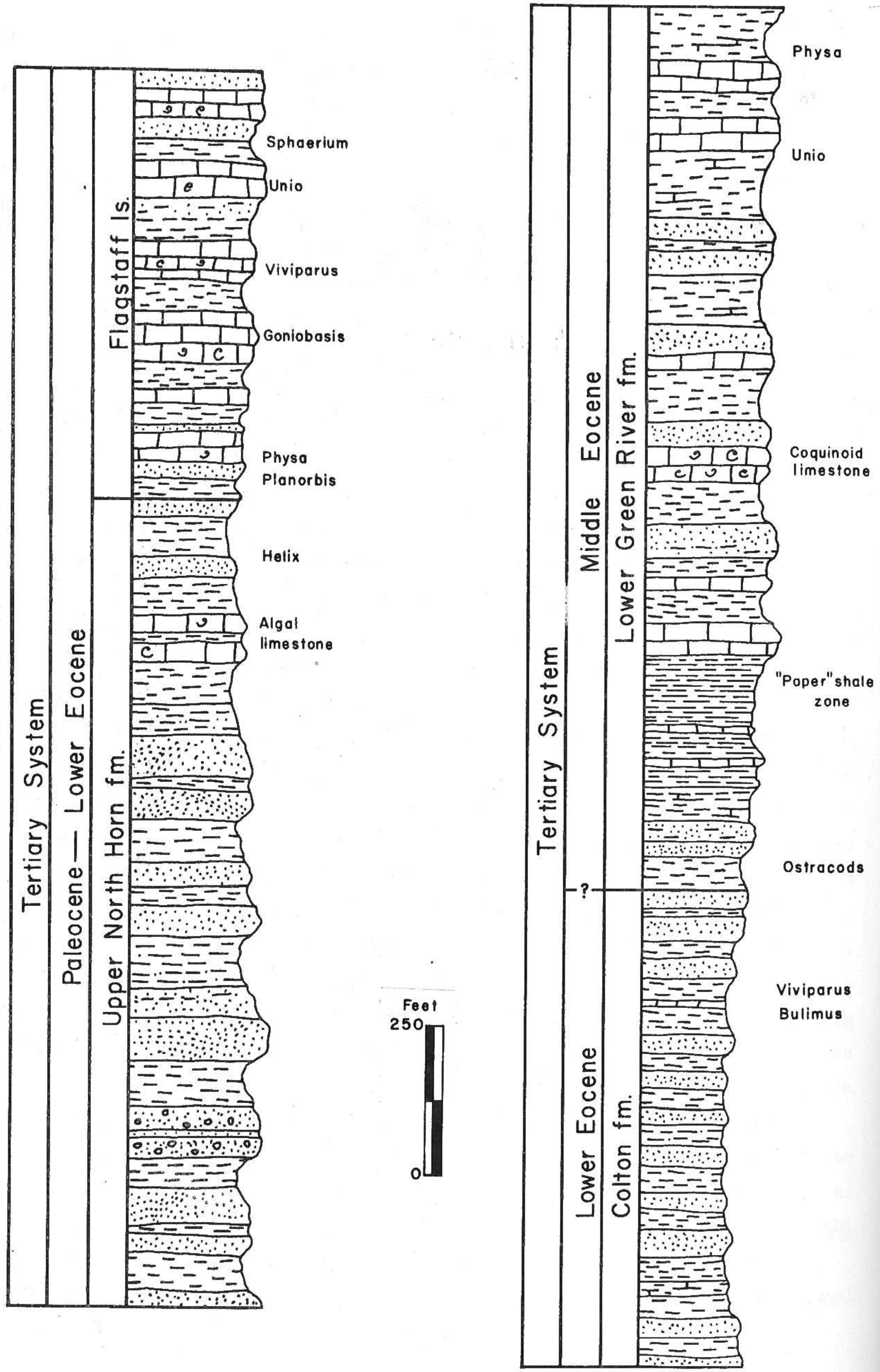
Age, correlation and thickness. - The Green River formation is Middle Eocene age (Berry 1925). It is exposed extensively in the Uinta Basin to the north but is generally missing in the Wasatch Plateau to the south (Plate 1).

The writer measured the lower 1,473 feet of the formation and estimates this to be about one third to one fourth the total thickness of the Green River in the mapped area (Plate 3). Bradley (1931, p. 17) measured a complete composite section 4,900 feet in Indian Canyon, Utah. Within the section Bradley recognized a basal lacustrine phase that resembles the Green River and a tongue that resembles the Colton. Above this are recognized in ascending order: (1) a second lacustrine facies, (2) a thick delta facies, (3) an oil shale facies and (4) at the top a barren and saline facies. In the mapped area the writer has recognized what he believes is the basal lacustrine phase, which is characterized by brown "paper" shale, and the oil shale facies. The zone of shale, limestone and marlstone separating the paper shale and the oil shale is therefore equivalent to the delta facies. The tannish sandstone and siltstone above the oil shale zone are thought to correlate with the group of sandstone beds in the lower 600 feet of Bradley's barren and saline facies. Bradley (1931, p. 19) states that this group of beds possibly contains the westward extension of the Horse Bench sandstone.

Within the oil shale zone of the mapped area, a semi-ledge forming oil shale unit is present, above which is a four to six-inch tuff bed. It is believed that this may be equivalent to the Mahogany ledge and Mahogany marker of the Uinta Basin proper.

A list of fossils collected and identified by the writer is given below, some of which are illustrated on Plates 5 and 6.

Plate 3



Generalized Columnar Section

Pelecypods:

Unio shoshonensis White (10925)
Unio danae Meek & Hayden (10925)
Unio sp. (10925, 10919)
Sphaerium sp. (10924)

Gastropods:

Goniobasis carteri Hall (10925, 10920)
Physa pleromatis White (10925)
Viviparus panguitchensis White (10925, 10923, 10920)
Cerithidea ? nebrascensis Meek & Hayden (10925)
Fish fragments (10921)
Turtle fragments (10922)

Ostracods:

Heterocypris n. sp. (10923, 10920)
Cypris pagei Swain (10923, 10920)
Potamocypris n. sp. ? (10923, 10920)

QUATERNARY SYSTEM

Alluvium

Alluvium and colluvium are present as valley fill in the canyons, particularly in the canyons of Soldier Fork and Tie Fork (Plate 8).

River Gravel

River gravels are present in both unconsolidated and consolidated states. All the formations in the mapped area are represented in the gravels along with numerous quartzitic constituents. Texture ranges from sand to boulder size material. The gravels are found along South Fork of Soldier Creek, Left Fork of Clear Creek and west of Tucker along Soldier Creek (Plate 8).

GEOMORPHOLOGY

Earthflow

Geomorphic features in the area are earthflows, river terraces and fault scarps. The earthflows occur in the Green River and Colton formations. The two best examples are found in the SW 1/2 of Sec. 2, T. 9 S., R 6 E. Salt Lake Base Meridian and in SE 1/4 of Sec. 21, T. 10 S., R. 7 E. Salt Lake Base Meridian (Plate 8). Both flows are approximately one thousand feet wide and have moved about one thousand feet.

Dip slopes of Flagstaff limestone and limestone beds of the Green River formation furnish good glide planes for the overlying material to break loose and move down dip. This action is undoubtedly hastened when groundwater conditions are such that the bedding planes are well lubricated. Earthflows and erosion are probably the main factors in forming the broad stripped dip slopes of Flagstaff limestone on the south side of the main highway east of Tucker.

River Terraces

The river terraces are somewhat restricted due to erosion but rounded gravels unmistakably mark their existence. As previously mentioned, all the formations are represented in the gravels. Some of the gravels have become consolidated and appear as conglomerates. Well developed terraces are found along Soldier Creek just west of the mapped area, with a dip of 2-3 degrees toward the west. The terraces are about 200 feet higher than the present stream level.

It is believed by the writer that these terraces and gravels mark a previous level of the present stream system. Evidence of a channel east of Tucker is missing. It is thought that the higher level formed during the existence of Lake Bonneville or during the Pleistocene epoch.

Fault Scarps

Fault scarps and fault line scarps are well developed along East Soldier Fault and West Soldier fault respectively. A fault line scarp

in Sec. 31, R. 10 S., R. 6 E. and sections 6 and 8, T. 11 E., and a fault scarp in sections 4 and 9, T. 11 S., R. 6 E., are well developed and easily detected from the topographic map (Plate 8). These fault features and those to the south in the Schofield and Hiawatha Quadrangles, are considered by some geologists to be classical examples. Spieker (1940, p. 1178-1179) discusses the faulting and its effect on the drainage in the Joe's Valley area.

STRUCTURE

General Statement

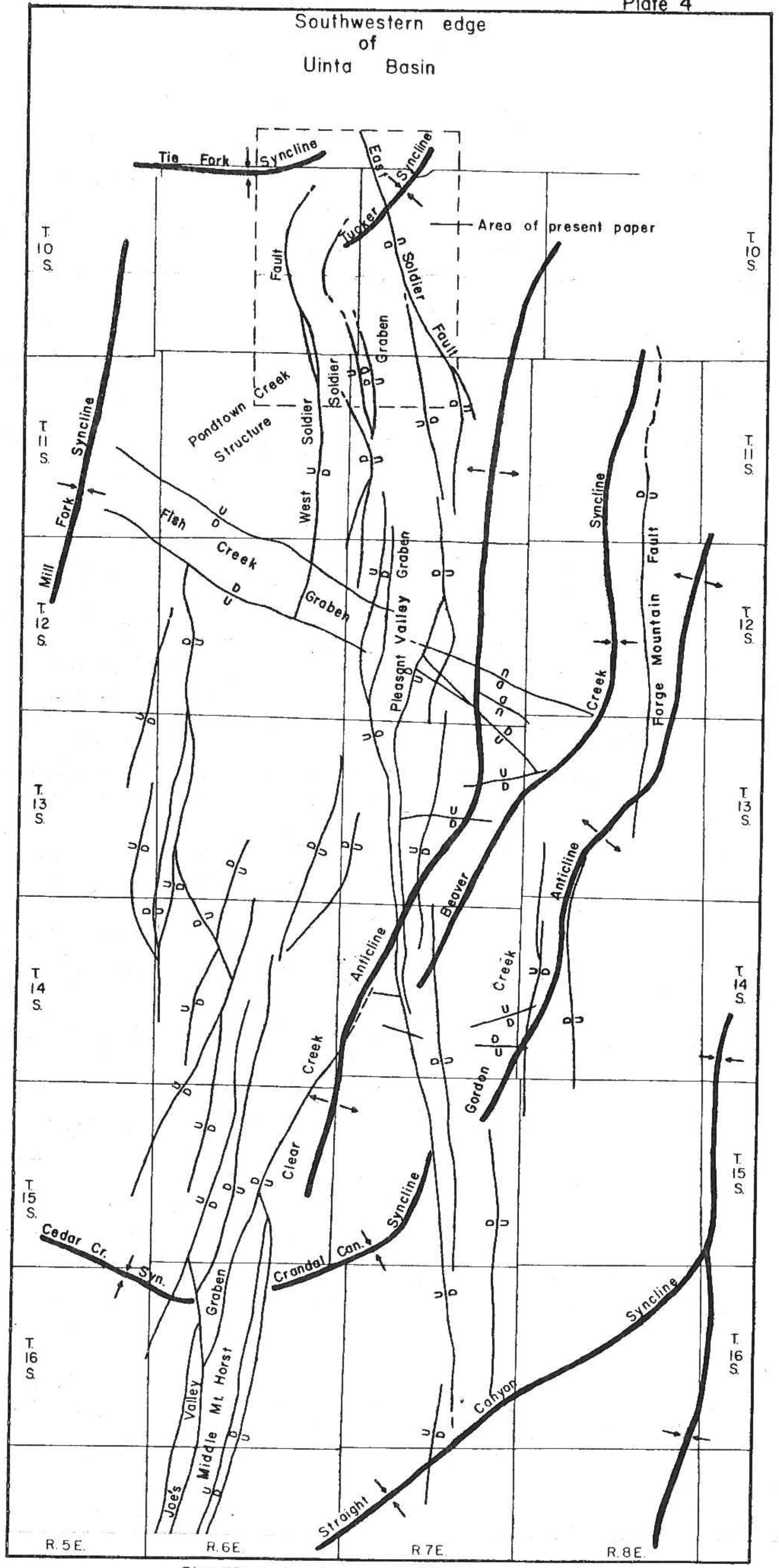
The structural history of the mapped area is related to that of the Uinta Basin and the Wasatch Plateau. The writer considers it more closely related to that of the Wasatch Plateau. Walton (1954, p. 79) outlines the Plateau as a vast mountainous area extending from Soldier Summit 75 miles south to Salina Canyon, and from the Book Cliffs and San Rafael Swell on the east 25 miles west to Sanpete-Sevier Valley. The Plateau is essentially a north-south monocline in the southern part with the northern end flexed into a broad anticlinal uplift consisting of two major folds which plunge northward into the Uinta Basin (Plate 4). The mapped area is situated on the northern end of the Plateau where the rocks plunge northward into the western end of the Uinta Basin in the Soldier monocline (Spieker 1949, p. 40), (See Plate 4).

Folds

Because of the structural position of the mapped area it has a monoclinal aspect. Average strike is N. 75^{o} E., dips average about 17 degrees to the northwest. Faults have upset the original fold causing local structural variations.

Two synclinal folds have developed in the Green River beds in the northern part of the area. In the northwest corner, Sec. 2 and 3, T. 9 S., and R. 6 E. Salt Lake Base Meridian, a syncline trends nearly east-west. Walton (1954, Plate 6) refers to it as the Tie Fork syncline. A second syncline trends northeast from Tucker, here named

Plate 4



Simplified structure map– Wasatch Plateau
(Modified from Walton 1954)

the Tucker syncline. Both synclines flatten out into northerly dips of the Uinta Basin (Plate 4 and 8).

Surface data indicates that the folding is post-Green River in age, this being the youngest exposed formation in the area that is folded. Walton (1954, p. 81) has given a subsurface profile from South Fork of Soldier Creek through the northeast Schofield Reservoir area to Price River Canyon that shows such a marked thinning of interval between the top of the Castlegate sandstone (Cretaceous) and the base of the Flagstaff that pre-Flagstaff folding and erosion seems unquestionable. Also, post-Green River rejuvenation of the principle folds was the final and most profound effect.

Faults

Fault scarps, offset beds, and brecciated zones mark numerous faults in the area. Two major faults, one on the western, the other on the eastern side of the area extend the full length and continue beyond the mapped area. The writer names these the West Soldier fault and the east Soldier fault respectively (Plate 8). The West Soldier fault is well exposed in Sec. 35, T. 10 S., and R. 6 E. Salt Lake Base Meridian, where it strikes about N. 20° W., has approximately 1,250 feet throw and dips about 70° to the east. The East Soldier fault strikes about N. 20° W., dips about 60-70° west and is best exposed in Sec. 33, T. 10 S. and R. 7 E. Salt Lake Base Meridian, where it has about 350 feet throw. These faults seem to be related for they are parallel, dip steeply (60-70 degrees), and trend generally north-south. The amount of displacement decreases toward the north on all of the faults in the area (Plate 8).

Between the faults is a graben approximately three and one-half miles wide. The downdropped block is cut by additional minor, north-south faults. These second-order faults form secondary horsts and graben with varying displacement (Plate 8 structure section B-B'). The Soldier graben alignment extends to the south for some distance, and is probably the graben that Spieker (1949, p. 42) refers to as the Soldier graben. It is believed that the Soldier graben, the Pleasant Valley graben and Joe's Valley graben, though not directly connected, belong to the same system (Plate 4).

Walton (1954, p. 81) states that the faults are younger than the folds and therefore are post-Green River or probably even post-Oligocene. Spieker states (1949, p. 45) in describing the Wasatch monocline that although the monocline is an outstanding example it does not everywhere present a perfectly curved pattern. At its shoulder the rocks rarely curve over in typical form, but begin their downward plunge somewhat abruptly at the graben system. He also states that the shoulder graben is easily understood as a natural result of the tension developed in the upper two-thirds or more of the strata in the convex bend at the beginning of the downplunge, and replaces the bending that would normally have occured if the rocks had stretched instead of breaking.

After deposition of the Green River formation during Middle Eocene, (Berry, 1925) folding took place in the late middle Eocene. Some normal faulting, probably started at this time. The folded strata were then dissected by streams. Deep canyons were carved into the plateau and were subsequently disrupted by normal faulting. This faulting is believed to account for the major displacement and to be part of the Basin and Range faulting. Spieker (1940, p. 1192) has shown that faulting has occurred as late as Pleistocene time in the Wasatch Plateau along this fault system. The writer believes movement has been sporadic from Post-Green River time to Pleistocene and probably to Recent time.

PALEONTOLOGY

During the field work the writer recognized that, even though the invertebrate fauna has a long range, relative abundance of genera is different in each of the formations. Additional detailed work should yield helpful information concerning a more accurate dating of the formations.

The limestones of the North Horn are commonly composed of algal material. The Flagstaff limestone is characterized by the genera Viviparus and a host of small Hydrobia-type shells. Goniobasis, Unio and Ostracods are numerous in the Green River formation whereas the colton shows affinities to both the Flagstaff and the Green River formations. The paleontology of the area is summarized in Plate 7. Ecology of the genera is by La Rocque (1955).

EXPLANATION OF PLATE 5

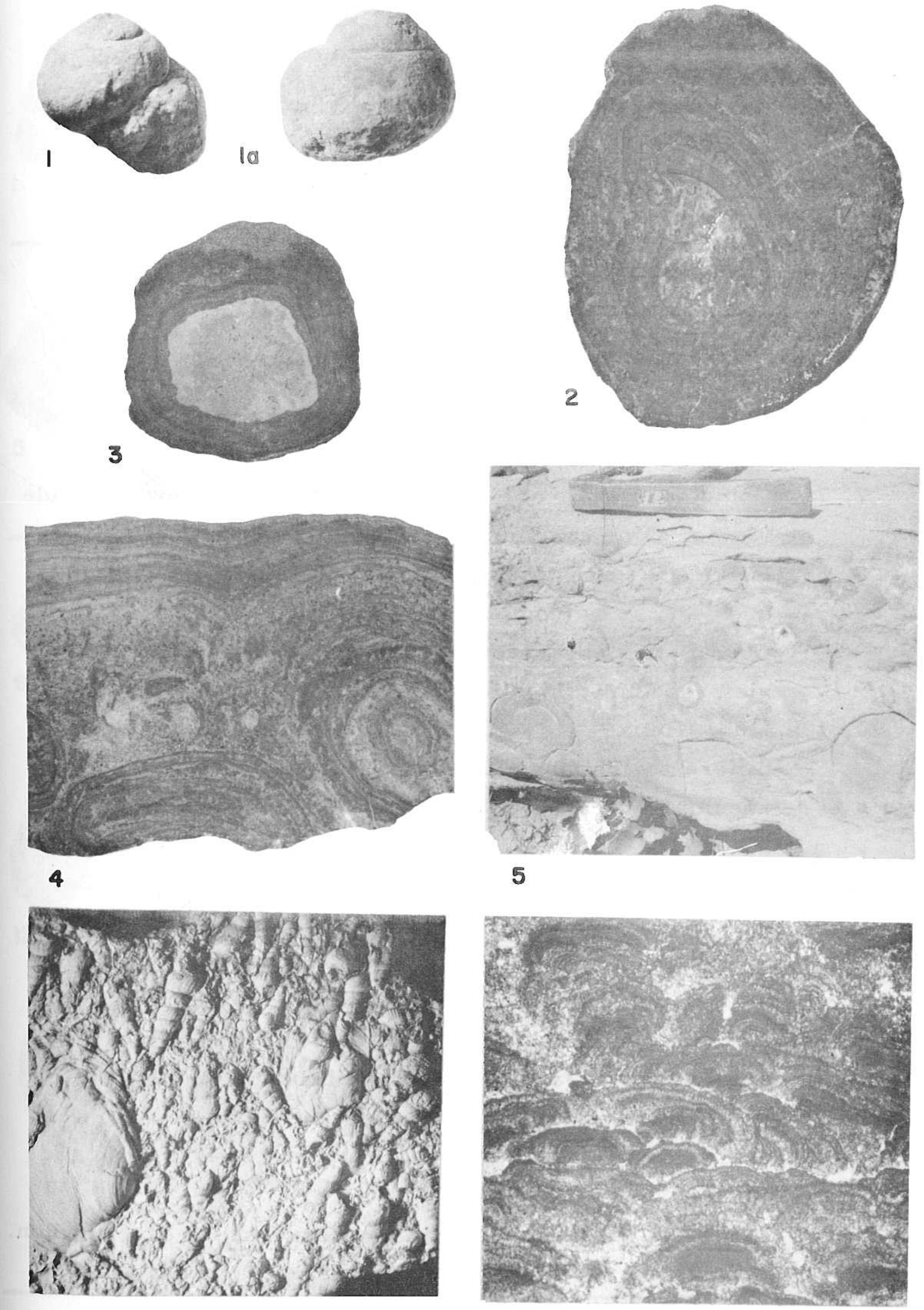
(All magnification X1 unless otherwise indicated)

Figure 1, la. Helix leidyi? Hall & Meek. 1, apertural view; la, side view of same specimen (cast).

2. Algal mass with gastropod nucleus.
3. Algal mass with siltstone nucleus.
4. Polished surface showing encrusting nature of algae.
5. Bed of algal material.
6. Thin section of algal mass (X-20).
7. Coquinoid limestone of Green River formation.

All figures except 7 came from the North Horn formation.

Plate 5



North Horn and Green River Tertiary Fossils

6-X20

EXPLANATION OF PLATE 6

(all magnifications X1 unless indicated otherwise)

Figure 1, 1a. Goniobasis carteri Hall. 1, side view; 1a, apertural view of different specimen.

2, 2a. Viviparus panguitchensis White. 2, apertural view; 2a, side view of same specimen (somewhat crushed).

3. Physa pleromatis White. Side view.

4. Unio shoshonensis White. View of right valve.

5, 5a. Viviparus leai Meek & Hayden. 5, apertural view; 5a, side view of same specimen.

6, 6a. Bulimus rhomboides Meek & Hayden. 6, apertural view; 6a, side view (aperture broken).

7, 7a. Goniobasis endlichi? White. 7, apertural view; 7a, side view of same specimen (aperture broken).

8, 8a. Helix? veterna Meek & Hayden. 8, apical view; 8a, apertural view (compressed cast).

9. Goniobasis nebrascensis? Meek & Hayden. Apertural view (specimen highly weathered).

10, 10a, 10b. Helix? sp., 10, apical view; 10a, side view of different specimen; 10b, umbilical view different specimen.

11. Physa bullatula? White. Side view (weathered specimen).

12, 12a. Physa bridgerensis White. 12, apertural view; 12a, side view of same specimen (aperture and apex broken).

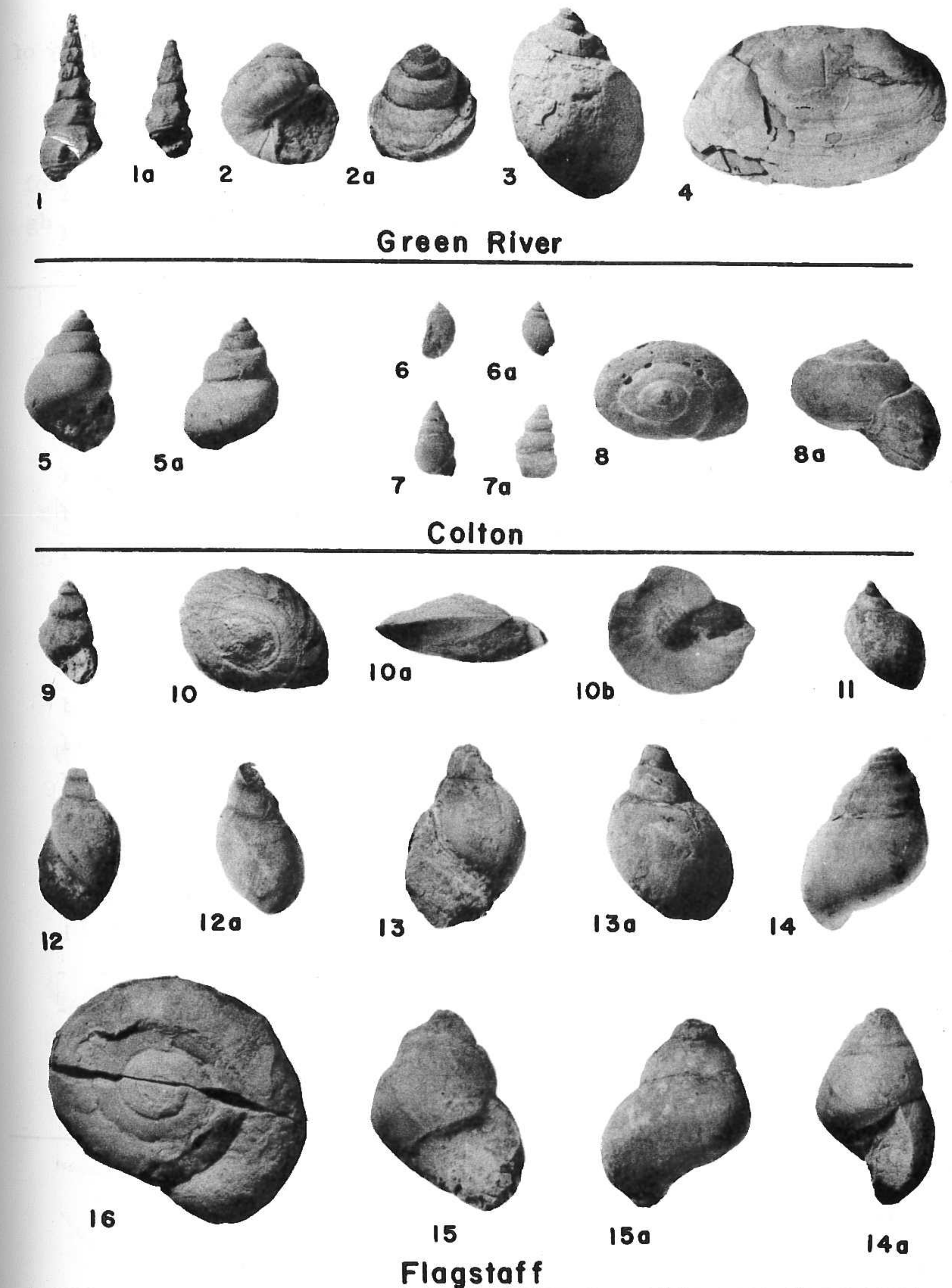
13, 13a. Physa pleromatus White. 13, apertural view; 13a, side view of same specimen (aperture and apex broken).

14, 14a. Viviparus leidyi Meek & Hayden. 14, side view; 14a, apertural view (aperture and apex broken and weathered).

15, 15a. Viviparus raynoldsiansus Meek & Hayden. 15, apertural view; 15a, side view (aperture and apex broken and weathered).

16. Planorbis (Bathyomphalus) planoconvexus Meek & Hayden. Apical view (speciman weathered and cracked).

Plate 6



Tertiary Mollusks

PALEONTOLOGIC SUMMARY

PELECYPODS	K-TN	Tf	Tc	Tg	Ecology of genera
Unio danae		X		X	gb f
U. shoshonensis				X	gb f
U. sp.		X		X	gb f
Sphaerium planum		X		X	gb f
GASTROPODS					
Viviparus leai			X		gb f
V. leidyi		X			gb f
V. reynoldsianus		X			gb f
V. panguitchensis				X	gb f
V. sp.	X	X			gb f
Physa pleromatis	X	X		X	lb f
P. bridgerensis		X			lb f
Bulimus rhomboides			X		-- -
B. longuisculus			X		-- -
Goniobasis carteri		X	X	X	gb f
G. tenera			X	X	gb f
G. endlichi ?		X	X		gb f
Cerithidea ? nebrascensis				X	-- -
Helix ? veterna				X	lb l
H. evanstonensis ?			X		lb l
H. leidyi	X				lb l
Helix ? sp.	X	X	X		-- -
Planorbis planoconvex ?		X			-- -
P. kanabensis		X			-- -
algal masses	X	X		X	-- -
OSTRACODS					
Heterocypris n. sp.				X	
Cypris pagei				X	
Potamocypris n. sp ?				X	

Key for interpretation of Plate 7

K-Tn = North Horn formation, Tf = Flagstaff formation, Tc = Colton formation, Tg = Green River formation, X = fossil present in formation, gb gill breather, lb = lung breather, f = fresh-water, l = land.

ECONOMIC POSSIBILITIES

Economic possibilities in the mapped area are limited. Water furnished by springs and seasonal run-off is the most important resource at the present time.

Oil shale is present in the Green River formation in the northeastern corner of the area (Plate 8). The limited amount of high grade oil shale restricts the possibility of using the shale as a source of petroleum. Bradley (1931) discusses the oil shale of the Uinta Basin.

A hydrocarbon (Ozokerite ?) is found in the cracks and joints of the sandstone in the upper part of the Colton formation. Ozokerite and Wurtzilite have been mined at Soldier Summit but the mines are now abandoned. Merrow (1957, p. 161) has given a report concerning the deposits at Soldier Summit, Utah.

From the underlying Cretaceous rocks, coal is produced from the Blackhawk formation and gas from the Ferron sandstone member of the Mancos shale in the vicinities of Price and Schofield, Utah respectively. No wells or prospects are located in the mapped area. Fault traps offer the best possibilities for gas accumulation. The upthrown side of the West Soldier fault is most likely the best place for exploration. Walton (1954, Plate 6) refers to this general area as the Pondtown Creek structure (Plate 4). On the upthrown side of the East Soldier fault, southeast of the mapped area, a well was recently drilled and appears to be of economic importance. However, it is not producing at the present time (September 1957).

GEOLOGIC SUMMARY

Only a part of geologic history is recorded by the North Horn, Flagstaff, Colton and Green River formations in the mapped area. For a broader and more extensive summary of the history see Spieker 1946, 1949, Bradley 1930, 1931, Hunt 1956, and Bissell 1952.

During early Paleocene time near lake-level conditions existed where shifting stream action spread clastic sediments over a broad floodplain. The provenance was to the west in the Wasatch Mountains. Conglomerate indicates that stream competency was at times high. Interbedded limestone suggests shallow bodies of fresh-water existed for short periods of time wherein algal masses were abundant. Plants, land and fresh-water mollusks existed during the deposition of the North Horn formation.

The transition from sandstone through shale and into even-bedded limestones of the Flagstaff formation show the floodplain conditions gave way to a body of fresh-water, Lake Flagstaff. This lake was widespread throughout Utah and existed during late Paleocene into early Eocene time. During this time many different types of sediments were deposited within the lake. Alternating limestone and shale being the dominant type in the mapped area. The fossil record is more varied and abundant than during North Horn time. The algal masses that are characteristic of the Flagstaff limestone (Eardley 1932) to the west are, however, relatively scarce.

During early Eocene time fluvial and floodplain sediments of the Colton formation swept into the area, filling in much of the Flagstaff basin. Deposition of lacustrine sediments continued in the western part of the area during the time of deposition of the fluvial Colton formation in the eastern part of the mapped area. Later, in early and middle Eocene time, the lake expanded over a much greater area and formed Lake Green River. Within the limits of this shallow, fresh-water lake the highly varied sediments of the Green River formation were deposited. Evidence as to how long the Green River Lake existed is not present in the mapped area, but it is believed to have disappeared in the late middle Eocene.

After the deposition of the Green River sediments, folding and probably some normal faulting occurred. Dissection of the uplifted strata by stream action cut deep canyons which were later disrupted by normal faulting. This faulting is considered to be part of the Basin and Range faulting.

APPENDIX

STRATIGRAPHIC SECTIONS

Stratigraphic section of the lower part of the Green River formation measured by the writer in Sec. 21 and 16, T. 10 S., R. 7 E., Salt Lake Base Meridian. Upper contact not present in the mapped area.

Unit	Description	Thickness (feet)
	Note: section ended on top of ridge north of highway. Above this measurement is a zone of shale, limestone and marlstone. Overlying this is a zone of oil shale, above the oil shale is a zone of tannish sandstone, siltstone and limestone. The writer feels that these zones and the "paper" shale zone of unit 9 correlate with Bradley's (1931) zones in Indian Canyon, Utah.	
12	Same as units 11 and 10 except for the presence of coquina beds of pelecypods, gastropods and ostracods.	107
11	Same as unit 10 except for more cover and some silty, brown, medium-bedded, fossiliferous limestone beds.	145
10	Limestone: tan and blue-gray, weathers tan and light gray, medium-bedded, with some interbedded shales. Pelecypods, gastropods and ostracods present.	71
9	Shale: papery, brown, weathers light brown, carbonaceous, thin bedded to laminated. Some thin interbedded limestones present. Coquina beds same as unit 12.	219
8	Same as unit 7 except for increase in tan and gray shale and light gray, thin-bedded sandstone.	277
7	Limestone and shale: limestone is blue-gray, brown, dense, weathers light gray, medium to thick-bedded, fossiliferous. Shale is gray-green.	85
6	Covered: appears to be shale and sandstone, similar to units 4 and 5.	88
5	Mostly covered: except for some gray, thin-bedded limestone and gray, medium-grained, thin to medium-bedded sandstone in upper part. Lower part appears to be interbedded shale and sandstone with some limestone. Fossil hash present.	239
4	Mostly covered: appears to be shale and sandstone. Shale is gray-green with some maroon. Sandstone is light brown, medium-grained, cross-bedded and ripple marked.	42
3	Shale and limestone: same as unit 2 except shale is more abundant than limestone. Some of the shales are brown, thin-bedded and weather into chips.	77
2	Limestone: interbedded with tan and gray-green shale. Limestone is tan, blue-gray, brown, weathers light gray and tan. It is thick-bedded and contains chert nodules and irregular chert bands.	86
1	Shale: interbedded with limestone, siltstone and sandstone. Shale is gray, tan, purple and maroon, weathers darker. Limestone is gray, weathers light gray, thin to medium-bedded. Sandstone is tan and gray-green, weathers tan, fine to medium-grained, medium to thick-bedded. Fossil hash present.	114
	Total	1,473

Gradational contact

Colton formation

Stratigraphic section of the Colton formation measured by the writer in Sec. 21, T. 10S., R.7E., Salt Lake Base Meridian.

Green River formation

Gradational contact

Unit	Description	Thickness (feet)
4	Shale: same as unit 3.	312
3	Shale: variegated maroon and gray with siltstone and sandstone. Sandstone: maroon, weathers darker maroon, medium-grained, medium-bedded, silty and quartzose. Siltsone: tan and maroon, weathers darker, thin-bedded.	79
2	Covered by valley fill, probably same as units 1 and 3.	311
1	Covered and broken by earthflows. The thickness was estimated 75± feet. Probably shale, siltstone, and sandstone, variegated maroon, gray, and tan. Weathers dark maroon and gray.	75±
	Total	777±

Gradational contact

Flagstaff limestone

Stratigraphic section of Flagstaff limestone measured by the writer on the west side of the South Fork of Soldier Creek Canyon, in Sec. 35, T. 10S., R. 6 E., Salt Lake Base Meridian.

Colton formation

Gradational contact

Unit	Description	Thickness (feet)
22	Mostly covered with low outcrops of alternating limestone, shale and sandstone. Limestone: tan and gray, weathers light gray or tan, thin-bedded, has a chippy weathering character. Sandstone: gray, weathers medium brown, fine-grained, thin to thick-bedded, calcareous and quartzose. Shale: gray with some tan and buff, weathers lighter. Estimated thickness 80± feet. Fossils: Viviparus sp. and fossil hash.	80±

21	Limestone and shale: low outcrops due to cover. Limestone: medium brown, weathers gray, thick-bedded, dense. Shale: gray, weathers lighter gray. Fossils: Goniobasis tenera, Viviparus panguitchensis, Sphaerium formosum, Unio sp.	95
20	Limestone and shale: low outcrops due to cover. Shale: gray, weathers lighter. Limestone: medium brown, weathers light brown, thin to thick-bedded, dense. Some individual beds are mottled tan and gray. Fossils: Viviparus sp., hash.	130
19	Limestone: dark blue, weathers medium blue to light blue, coarse crystalline, thick-bedded, partly covered. Fossils: Viviparus sp., Goniobasis sp.	5
18	Limestone and shale: similar to unit 17. Lower 15 feet is gray shale. Upper 15 feet is limestone with shale partings, dense, and thick-bedded. Fossils: Physa sp., Unio sp., Viviparus sp., and hash.	30
17	Limestone and shale: gray shale in lower part. Limestone: medium brown, weathers light gray, thick-bedded, dense. Note: at this point slickensides are present on the bedding planes of the limestone. As they are located on the bedding planes it is the opinion of the writer that no appreciable amount of section is missing.	11
16	Limestone and shale: lower two thirds is alternating gray shale and medium brown, weathers light gray, dense limestone. Upper one third is dark blue-gray, weathers brown to blue, thin to thick-bedded limestone. Thin-bedded limestones are medium brown, weather tan, some beds laminated. Algal masses present. Fossils: Viviparus sp., hash.	61
15	Limestone and shale: lower part is limestone: medium brown, weathers light gray, dense, rounded surfaces. Middle part is shale: mostly gray, weathers lighter. Upper part is alternating light brown and dark	

Unit	Description	Thickness (feet)
	blue limestone which weathers light brown or dark blue respectfully, light brown is dense. Top of the unit is marked by a mottled tan and light gray limestone. This unit exhibits a semi-meringue weathering in comparison to the rounded weathered surface of other units. Dark blue limestone is charged with fossil material. Fossils: *Viviparus* sp., and hash.	50
14	Limestone and shale: similar to unit 13.	10
13	Limestone and shale: limestone is light brown, tan and dark blue, weathers light gray, tan and blue-gray, these beds alternate. Medium to thick-bedded, dark blue limestone generally occur above the light gray and tan beds giving a series of beds that appear cyclic. Fossils: *Unio* sp., *Viviparus* sp., *Physa pleromatis*.	11
12	Limestone and shale: limestone is similar to that below, tan, dark blue, and dense. Upper 10 feet predominantly dark blue-gray, weathers lighter gray, thick-bedded, charged with fossil material. Fossils: *Physa pleromatis*, *Viviparus leai*, and hash. Shale: gray.	28
11	Limestone: light brown to dark blue, weathers blue-gray, some beds are gradational from the brown into the blue-gray without a break. Fossils: *Unio* sp., *Viviparus* sp.	7
10	Covered: probably shale.	10
9	Limestone: interbedded with shale, and sandstone. Sandstone: gray, weathers tannish gray, fine-grained, medium-bedded, quartzose, calcareous. Shale: gray, weathers light gray. Limestone: medium brown, weathers light gray, dense. Top of unit is 4 foot bed of fossiliferous blue-gray limestone. Fossils: *Unio* sp., *Viviparus leai*?, *Viviparus reynoldsianus*?, hash and fragments.	33

Unit	Description	Thickness (feet)
8	Limestone: interbedded with shale and sandstone. Same as unit 9 except for the sandstone being silty, and some of the limestone weathers tan. Fossils: *Unio* sp., *Viviparus* sp.	33
7	Sandstone: tan to brown, weathers brown, fine-grained, thin to medium-bedded, quartzose.	8
6	Mostly covered: low outcrops of tan, dark-blue to light gray, and light brown limestone, weathers light gray. Dark blue-gray beds charged with fossil hash. Some tan and brown sandstones and gray shale present. Fossils: *Unio* sp., *Viviparus* sp.	38
5	Sandstone: tan to brown, weathers dark brown, fine to medium-grained, thick to massive-bedded, quartzose, calcareous.	15
4	Covered: probably shale with thin-bedded limestone.	25
3	Limestone and shale: limestone is dark blue to brownish blue, weathers dark blue-gray and medium brown, thin-bedded, silty, contains fossil hash.	15
2	Covered: probably shale.	16
1	Sandstone: poorly exposed, tan and brown, weathers light tan and brown, fine-grained, thick-bedded, quartzose, calcareous.	5
	Total	706±

Gradational contact

North Horn formation

Stratigraphic section of upper North Horn formation measured by the writer in Sec. 6 and 7, T. 11 S., R. 7 E., Salt Lake Base Meridian.

Flagstaff limestone.

Gradational contact

Unit	Description	Thickness (feet)
25	Covered: gross description taken from exposures in Left Fork of Soldier Creek Canyon.	

Shale, siltstone, sandstone and small amounts of limy mudstone. Units are generally mottled tan and brown, weather tannish yellow or gray. Approximate percentages: shale and siltstone 75 percent, sandstone 20 percent, limey mudstone 5 percent. 275

24 Limestone: brown, weathers brownish gray, thick to massive-bedded, dense, contains algal masses. 11

23 Sandstone: interbedded with shale and siltstone. Sandstone in lower part is gray, weathers tannish gray, medium-grained, thick to massive-bedded. Shale and siltstone in upper part mottled tan and gray, weathers lighter. 90

22 Sandstone: bottom part covered. Top is tan to gray, weathers lighter tan and gray, medium-grained, thick to massive-bedded, quartzose, and is interbedded with tan and gray shale. 68

21 Covered: probably sandstone, shale and siltstone similar to unit 20. 88

20 Sandstone: mostly covered except for some tan and gray, weathers dark tan and gray, fine-grained, thick-bedded, silty, quartzose sandstone beds. 49

19 Sandstone: ledge similar to unit 17 except that the limestone particles are smaller and not so abundant. 21

18 Sandstone and limestone: lower part is sandstone, tan to gray, weathers lighter tan and gray, fine to medium-grained, thick-bedded, quartzose. Middle part is algal limestone with brownish-gray, sand matrix. Algal masses are dark brown, generally rounded or subrounded, and range in size from sand particles to 10 inch diameter. They weather free and are found in the float. The upper part is sandstone tan, weathers medium tan, medium-grained and thick-bedded. 50

17 Sandstone: lower part is tan, weathers dark tan, fine-grained, thick-bedded, silty, quartzose and grades upward into a tan siltstone. Upper part is sandstone, light tannish gray, weathers light gray, coarse-grained to grit size. Grit particles are generally pink and white. This unit contains a pebble conglomerate of limestone, quartzite and some siltstone particles. Particles are similar to those of unit 15. This grades upward into a coarse-grained, dark brown quartzose sandstone. 24

16 Sandstone: lower part covered probably sandstone, siltstone and shale? Upper part is sandstone: tan to gray, weathers dark tan or gray, fine to coarse-grained, thick to massive-bedded, quartzose. 107

15 Conglomerate: composed of pink, red, white, gray, black and light blue quartzite pebbles with some gray chert pebbles. Matrix is white and pink quartzose sand. 14

14 Covered: except 2 feet thick sandstone bed in lower part which is gray, weathers light gray, fine-grained, quartzose and well cemented. Covered part appears to be sandstone, shale and siltstone, varying in color from tan to gray to maroon. 100

13 Sandstone: tan, weathers medium tan, fine to coarse-grained, massive, quartzose, crossbedded, silty and forms massive ledges. Some pebble sized particles scattered throughout. The lower part contains white and pink grains, is fine-grained and interbedded with mottled tan and maroon siltstone. 37

12 Covered: probably similar to unit 13? 53

11 Covered. 68

10 Sandstone: tan, weathers lighter, fine-grained, silty, quartzose. The upper part is thin-bedded whereas the lower part is thick to massive. 51

9 Covered: probably sandstone and siltstone? 26

8 Covered: probably sandstone and siltstone? 11

7	Covered: probably sandstone and siltstone?	9
6	Covered: except for conglomeratic sandstone in upper few feet.	5
5	Sandstone: light tan, weathers dark tan, coarse-grained to fine grit size, medium to thick-bedded, quartzose, silty, friable and some cross-bedding. White, pink and tan grains give a speckled appearance.	21
4	Covered: probably sandstone and siltstone except for 13 feet light gray, weathers medium gray, fine to medium-grained, medium-bedded silty, quartzose sandstone in the middle of the unit.	77
3	Sandstone: tan and brown, weathers medium brown, medium-grained, thick-bedded, cross-bedded, quartzose, silty. Some pebble sized siltstone particles along the bedding planes give a conglomeratic appearance.	36
2	Sandstone: brown, weathers medium tan, medium-grained, thick-bedded, quartzose, silty. Upper part is covered.	19
1	Sandstone: brown, weathers medium tan, medium-grained, thick-bedded, quartzose, silty. Upper part is covered.	71
	Total	1,317

Base of formation not exposed in the mapped area.

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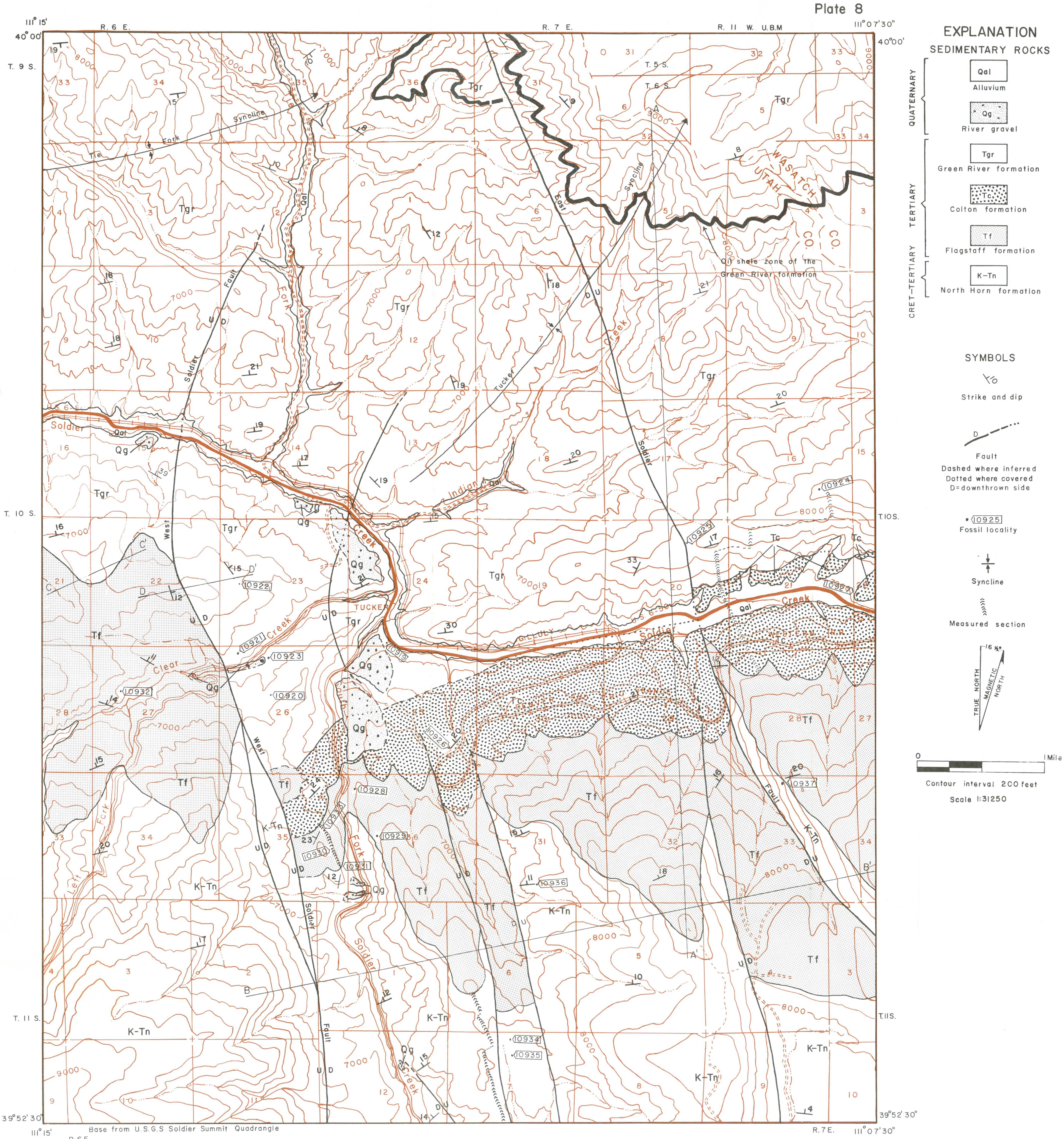
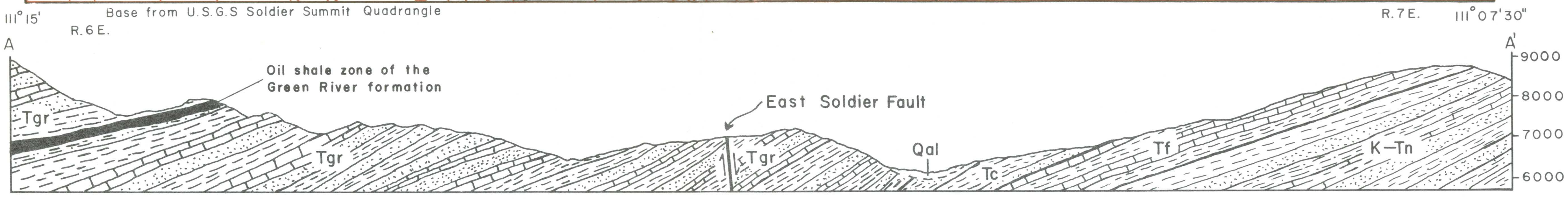
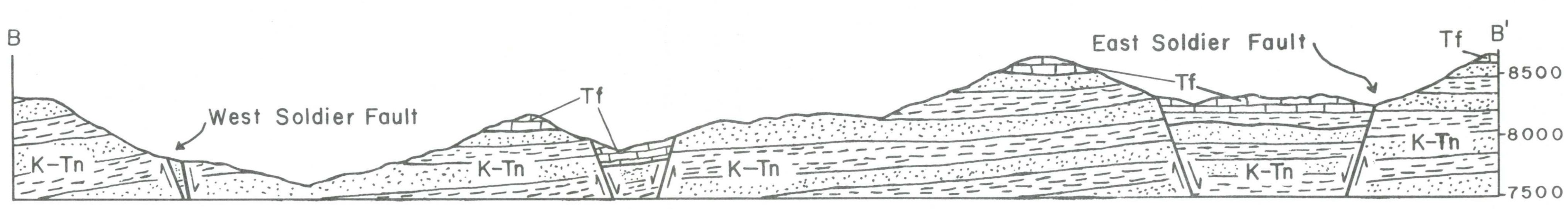
Plate 8







GEOLOGIC MAP AND STRUCTURE SECTIONS OF THE NORTHWEST QUARTER OF THE SOLDIER SUMMIT QUADRANGLE, UTAH

by

MAX W. PRESCOTT

1958