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Contents

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Geology of Stansbury Island, Tooele County, Utah*

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ABSTRACT.—Stansbury Island is a north-south trending block-faulted range located approximately 33 miles west of Salt Lake City, and approximately 10 miles north of Grantsville, Utah, extending into the southern end of the Great Salt Lake. Exposed sedimentary rocks total approximately 11,000 feet in thickness and range in age from Precambrian to Mississippian. Lower and Middle Paleozoic rocks are well exposed with only minor breaks in the rock column.

Paleozoic rocks on the island have undergone gentle Laramide folding followed by later Laramide thrusting. Stansbury Anticline has been sheared and thrust a minimum horizontal distance of three miles to the east. Early Basin and Range normal faulting followed the thrusting which was in turn followed by east-west trending strike slip faults and smaller east-west, northwest striking transverse normal faulting. Two large east-west trending strike slip faults separate the island into three structurally distinct blocks. The central block moved westward with respect to the southern and northern blocks. Late Basin and Range normal faulting has raised the island to its present topographic position.

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*A thesis submitted to the faculty of the Department of Geology, Brigham Young University, in partial fulfillment of the requirements for the degree Master of Science.

ILLUSTRATIONS

INTRODUCTION

Purpose and Scope

Little has been written on the geology of Stansbury Island and the literature has been confined to regional stratigraphic investigations. Stansbury Island is geologically important because it furnishes a well-exposed section of Lower and Middle Paleozoic rocks along with Precambrian exposures of the Big Cottonwood Formation and a near-complete history of the Lower and Middle Paleozoic tectonism in the area.

Location and Accessibility

Stansbury Island is approximately 33 miles west of Salt Lake City and 10 miles north of Grantsville and is in T. 1 and 2 N., R. 6 W. The island covers 52 square miles, of which approximately three quarters is exposed bedrock.

The area is no longer an island, but is a peninsula accessible by a gravel road which intersects U. S. Highway 40-50 at Flux, approximately 7 miles northwest of Grantsville, and continues north 7 miles to the southern end of the mapped area. The road splits near the southern margin of the area and encircles the northern-most tip of the island. The road on the west side is a good gravel road and extends to the northern-most tip of the island. The road on the east is a jeep trail extending three quarters the length of the range.

Numerous dirt roads lead into most of the large canyons on the west side and southern tip of the range. Two roads transect the range—both are jeep trails located near the northern tip of the range.

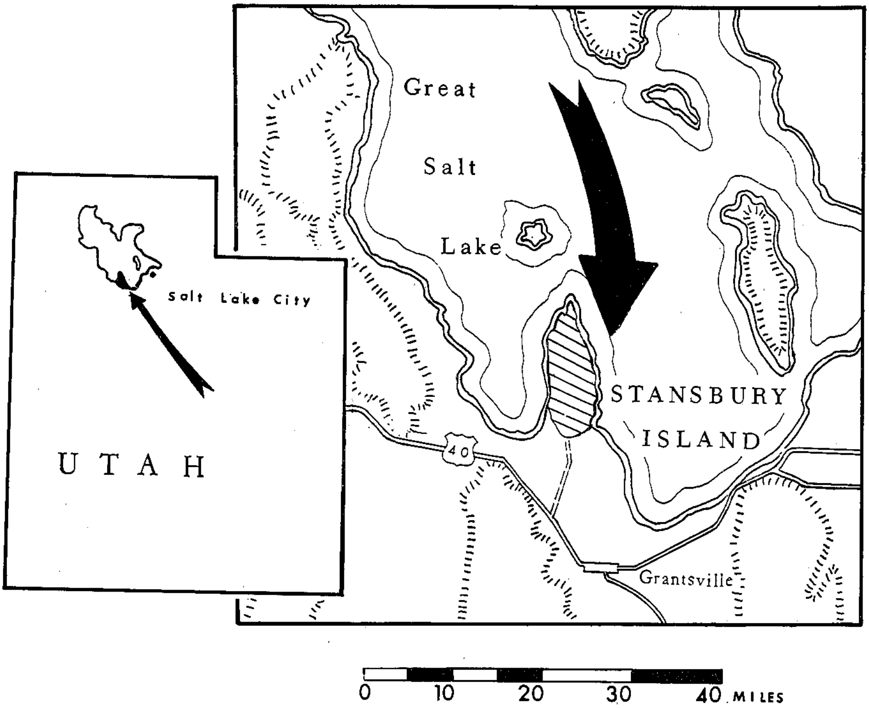
Physical Features

Stansbury Island is a northerly trending range, typical of the Basin and Range Province, approximately 10 miles long and 5 miles wide. The island is physically isolated from nearby ranges by lake sediment and valley fill. It has a maximum elevation of 6,649 feet and maximum relief of 2,449 feet.

Several warm brackish springs are present along the east base of the range and are probably related to a large normal fault. Springs are absent within the higher part of the range and there are no perennial streams. The climate is arid or semi-arid and vegetation is sparse.

Previous Work

Hughes (1959) constructed a geologic map of Stansbury Island which was later used in the compilation of the Utah State Geologic Map. He differ-



TEXT-FIGURE 1.—Index map to Stansbury Island, along the southern margin of Great Salt Lake, Utah. The shaded area is that included in the geologic map.

entiated formations within Ordovician, Silurian, Devonian and Mississippian sequences, but failed to differentiate Precambrian and Cambrian sequences. Petersen (1956) studied the Devonian strata of Stansbury Island as part of a regional study and included in his work a detailed description and regional correlation of the Devonian Victoria Quartzite, now included in the Stansbury Formation. Rigby (1958), working 5 miles to the south of Stansbury Island, studied the geology of the Stansbury Mountains, and correlated Lower and Middle Paleozoic stratigraphy and tectonic history in the Stansbury Mountains with adjacent areas.

Rigby (1959, p. 202-218) described a Late Devonian disturbance which affected much of Central Utah and in particular the Stansbury Mountains and surrounding areas. The Stansbury Formation is thought to represent coarse clastics shed from a highland located within the Stansbury Mountains area.

Present Work

Field work began in June of 1968 and was completed in April of 1969. Structural features and stratigraphic contacts were plotted in the field on aerial photographs (scale 1:20,000) and later transferred to a topographic map (scale 1:24,000). Stratigraphic measurements were made with a steel tape and Brunton compass.

Acknowledgments

The writer extends grateful appreciation for the helpful advice and assistance of Dr. M. S. Petersen, who served as committee chairman throughout the completion of the study. Acknowledgments are also extended to Drs. W. K. Hamblin, H. J. Bissell and J. K. Rigby for their helpful advice. Thanks is extended to Mrs. Mary Newman for typing the final draft of the manuscript

Sincere appreciation is extended to my wife Barbara for her help and encouragement and to my brother Kim for help in the field.

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SEDIMENTARY ROCKS

PRECAMBRIAN SYSTEM

Big Cottonwood Formation

Rocks of the Big Cottonwood Formation are exposed north of Pass Canyon and extend approximately three miles to the northern tip of the mapped area. The best sections are on the east side of the island.

Although 1,547 feet of quartzite, conglomerate and phyllite of the Big Cottonwood Formation are represented, the top and bottom are not exposed. The Precambrian rocks can be subdivided into three units: a lower medium to massive bedded unit; a medial phyllite; and an upper thin to thick bedded quartzite and quartzose conglomerate.

The lower unit is composed of approximately 347 feet of light brown to white quartzite which weathers light brown. It is composed of medium to coarse grained quartz and chert with occasional pebble conglomeratic lenses. The pebbles are less than one inch in diameter, well-rounded, and composed of red and black chert and white quartzite. The sand grains are angular; however this may be due to in part to quartz overgrowth. The lower unit is a ledge-former, medium to massive-bedded with weakly developed crossbedding. The crossbeds are large, slightly curved and form at a low angle to the depositional strike. Exfoliated weathering is well-pronounced and many of the quartzites are rounded before transportation. Leisegang banding is common, leaving distinctive reddish brown bands on much of the quartzite. A well developed north-south, east-west conjugate joint system transects the unit. The base of the lower unit is not exposed. The top of the lower unit is marked by the first occurrence of phyllite.

The second or medial unit is composed of pale olive to light olive-grey phyllite. The unit is approximately 80 feet thick and is a partially covered slope-former. It weathers platy along cleavage planes which transect remnant bedding at approximately 30 degrees. A few pieces of maroon-colored slate were found as float suggesting the presence of a thin, covered slate bed.

The third or upper unit is a thin- to thick-bedded, white to light-brown quartzite. The quartzite weathers light-brown to medium-brown and is distinctly more brown and thinner bedded than the lower quartzite unit. The unit is approximately 1,120 feet thick and is composed primarily of grit and coarse-grained quartz sand with well-rounded conglomeritic pebbles ranging from one inch to three inches in diameter. Red, black and green chert and white quartzite make up most of the pebbles, with quartzite dominating. Conglomerate beds as thick as four feet are scattered intermittently throughout the unit, increasing in frequence towards the top. Most conglomeratic beds weather moderate brown due to iron oxide cement. Crossbedding is common and is restricted to one- and two-foot beds. The crossbeds are slightly concave and form at a low angle. Exfoliation weathering is well-pronounced but leisegang banding, while present, is less apparent in this unit than in the lower unit. A 24-foot, medium- to fine-grained, grayish olive-colored quartzite is found at the base of the upper unit and may represent reworking of the shales below.

CAMBRIAN SYSTEM

Tintic Quartzite

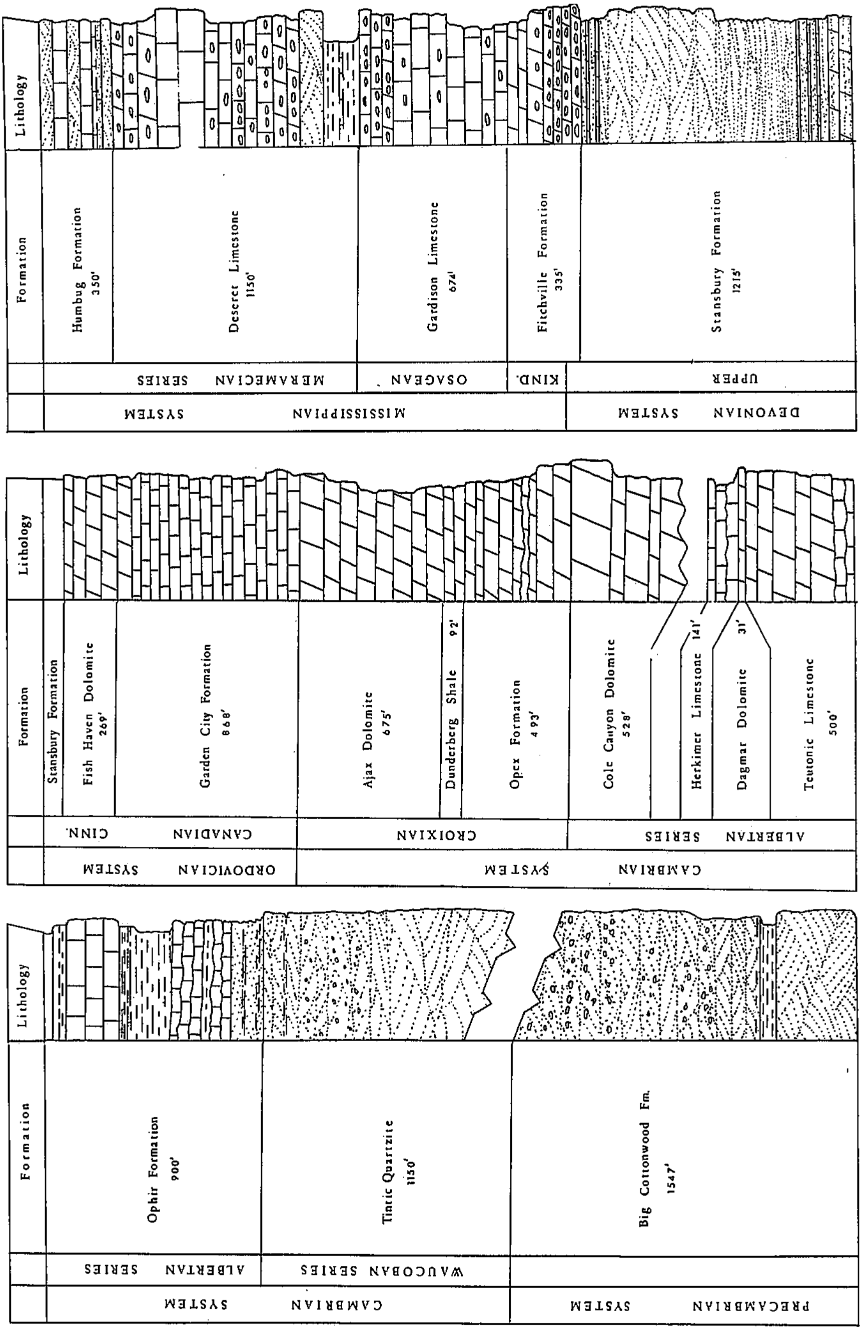
A partial section of Tintic Quartzite crops out on the northwest side of the island, approximately one mile due west of Pass Canyon. These are the only Tintic Quartzite exposures in the range. Approximately 1,150 feet of Tintic Quartzite were measured, but the base of the formation is not exposed.

Two distinctive units can be differentiated within the formation; a lower, thick- to massive-bedded quartzite and an upper, medium- to thick-bedded quartzite. Approximately 375 feet of the lower unit is exposed, consisting of light-brown to white quartzite, which weathers light-brown with scattered medium-brown iron stains. The quartzite is composed primarily of white, medium- to coarse-grained quartz, but occasional conglomeratic lenses occur scattered through the unit with pebbles less than one inch in diameter. Crossbedding is well-developed and individual forsets are large, slightly concave, and dip at a low angle. When seen from a distance, the lower unit is a very light-brown, thick-to massive-bedded, ledge-former in contrast to the light-brown to grayish olive, thinner bedded, slope-forming upper quartzite. The top of the lower unit is marked with the first occurrence of grayish olive quartzite.

The upper unit is approximately 775 feet thick and is composed of medium to thick-bedded, light-brown to grayish olive quartzite. The unit weathers light medium-brown to grayish olive and is distinctively thinner bedded and darker brown than the unit below. Silica is the most important cement in this unit but iron oxide is also abundant and upon weathering gives the quartzite a characteristic brown color. Quartzite of this unit weathers flaggy to slabby, in contrast to the massive weathering quartzites in the lower unit. Thin, conglomerate lenses are present sporadically throughout the unit but become more frequent towards the top. Conglomerate pebbles are less than one inch in diameter and are composed of chert and quartzite. Two thin beds of green shale—the lower bed approximately two feet thick and the upper bed approximately four feet thick—occur near the top of the Tintic Quartzite. The shale beds are separated by approximately two feet of quartzite. Crossbedding, similar to that found in the lower unit, is present throughout. Seen from a distance, the upper unit is a medium brown, flaggy and slabby-weathering, slope-forming quartzite.

The top of the Tintic Formation is marked by the first occurrence of the coarse-grained calcareous quartzite of the Ophir Formation. Quartzites at the base of the Ophir Formation are thin to medium-bedded and are darker brown than the underlying Tintic Quartzite. The contact appears to be conformable. No fossils were found in the Tintic Quartzite in Stansbury Island.

Prospect Mountain, Tintic; and Brigham quartzites as described in their type areas are Early Cambrian in age and correlate with the Tintic Quartzite mapped on Stansbury Island.



TEXT-FIGURE 2.—Stratigraphic sequence, Stansbury Island.

Ophir Formation

The Ophir Formation is partially exposed on the northwest side of Stansbury Island north of Corral Canyon and southwest of Pass Canyon. The Ophir Formation is not completely exposed at any one locality, but a compilation of two measured sections gives an estimated thickness of approximately 900 feet.

Five distinct units can be separated within the Ophir Formation in the mapped area and herein shall be called Units A, B, C, D, and E.

Unit A.—Unit A is the lowest unit and comprises approximately 143 feet of interbedded quartzite and limestone, with quartzite dominant. The quartzite beds are light to medium-brown and weather medium-brown to dark yellow-brown. Well-rounded, medium to coarse-grained quartz grains are the major constituents of the quartzites, with calcite, silica, and iron oxide as cementing agents. Quartzite beds are thin to medium-bedded, weather flaggy to slabby, and highly crossbedded. Foresets on crossbeds are small, one to three feet long, and slightly curved. Interbedded limestones are dark-grey, weather dark yellowish orange and granular in appearance. The top of Unit A is placed at the first occurrence of pisolitic limestone, and the bottom is taken at the first appearance of thin-bedded, moderate brown-weathering quartzite above the lighter brown Tintic Quartzite.

Unit B.—Medium dark-grey, pisolitic limestone with yellowish orange to yellow-grey argillaceous partings is the characteristic lithology of Unit B. The unit is thin- to medium-bedded in the lower part but becomes thick-bedded near the top. A few beds of light-green shale are present in the lower part of the unit and are interbedded with pisolitic limestone. The pisolites are formed of girvanellid algae and range in size from very small (2 mm) to oncolites three and one-half inches across the long axis. Oolites are also common throughout the unit. Unit B is approximately 280 feet thick and appears conformable with Unit C.

Unit C.—Unit C consists of approximately 260 feet of shale and limestone. Limestone is found near the center of the unit in a ten-foot bed and in the upper third of the unit where the limestone is thinly interbedded with shale. The medial limestone is oolitic, dark-grey, weathering medium blue-grey and is thin bedded with yellowish orange argillaceous partings distinctly developed along bedding planes. The upper limestone is dark-grey and occurs in beds one to three inches thick which uniformly alternate with thin beds of shale. Thin-bedded, grayish olive, micaceous shale makes up the bulk of Unit C. The shale weathers platy along well-developed cleavage planes and is composed primarily of mica, which is aligned parallel to the slaty cleavage, and silt-sized quartz grains. The lower part of the unit is often partially covered while the upper part, due to the resistant nature of the interbedded limestones, is usually well exposed. The base of the massive-bedded, cliff-forming limestone of Unit D marks the top of the unit.

Unit D.—Unit D is incompletely exposed in any one section but a composite of two sections yields an estimated thickness of approximately 200 feet. The unit is composed of granular appearing, medium-grey limestone which is thick to massive-bedded. Small pisolites and oolites are scattered throughout the unit, but they are not as characteristic as are the large pisolites of Unit B. Yellowish orange argillaceous partings are weakly developed and sparse. Fragments of fossil trilobites and brachiopods are present but generically unidentifiable. The top of the unit is marked by the first appearance of grayish olive micaceous shale of Unit E.

Unit E.—Unit E is approximately 20 feet thick and consists of grayish olive micaceous shale. The unit is very thin-bedded and weathers slaty and pencilly along well developed cleavage planes. The shale is lithologically similar to the shale in Unit C below.

The contact between Unit E and the Teutonic Limestone is partially covered and it is possible that some of the shale may be interbedded with limestone in a gradual change from shale to limestone.

The Ophir Formation of Stansbury Island correlates with the Ophir Formation as described in the Oquirrh Mountains (Lindgren and Loughlin, 1919, p. 25), and the Tintic district (Morris and Lovering, 1961, p. 19-25), and with the Ophir Group and Ophir Shale as described in surrounding areas (Rigby, 1958, p. 11-13; Young, 1955, p. 15; Olson, 1956, p. 45-47). The Ophir Formation has been assigned a lower Albertan Age (Morris and Lovering, 1961, p. 22).

Teutonic Limestone

Excellent exposures of the Teutonic Limestone are found on the ridge north of Cane Canyon and on the ridge northwest of Corral Canyon. Additional less complete sections crop out in a band south of Ben Allen Canyon.

A composite of the two sections yielded an estimated thickness of approximately 500 feet for the Teutonic Limestone. These units include a lower argillaceous limestone, a medial light medium-brown-grey dolomite, and an upper dark medium-grey, mottled dolomite. The lower unit is approximately 50 feet thick and is composed of thin-bedded, medium blue-grey limestone with abundant yellowish orange argillaceous partings. The limestone is fine grained and very similar in appearance to the limestone of Unit C in the Ophir Formation. The base of the lower unit is placed at the last occurrence of grayish olive shale of the Ophir Formation, and the top is placed at the base of the massive-bedded light-medium brown-grey dolomite of the medial unit.

Approximately 50 feet of light-medium brown-grey dolomite forms the medial unit. The dolomite is granular in texture and massively bedded. It is typically a ledge-former and is easily recognized above the medium blue-grey limestone of the lower unit and the dark medium-grey dolomites of the upper unit.

The upper unit is estimated to be approximately 400 feet thick and is composed of argillaceous-mottled, dark medium-grey dolomite. The argillaceous material is light grey and occurs along bedding planes. White, "twiggy" bodies, pisolites and oolites are locally abundant throughout the unit. Some intraformational conglomerate beds are present near the top of the unit. A few chalk-white weathering, very fine-grained dolomite beds up to one foot thick are present in the upper unit. These dolomite beds resemble the overlying Dagmar Dolomite. The upper unit is thin to massive-bedded and is a ledge-former.

The top of the Teutonic Limestone is mapped at the first appearance of the "tiger striped" dolomite of the overlying Dagmar Dolomite.

The Teutonic Limestone is considered Medial Cambrian (Morris and Lovering, 1961, p. 27). The formation on Stansbury Island correlates with the Teutonic Limestone as described in the Stansbury Mountains (Rigby, 1958, p. 13-16) and in the Tintic district by Morris and Lovering (1961, p. 25-28).

Dagmar Dolomite

The only exposure of the Dagmar Dolomite on Stansbury Island is located near the top of the pronounced ledges on the ridge north of Cane Canyon. The central unit within the Dagmar Dolomite weathers chalk white and serves as an excellent marker bed.

The Dagmar Dolomite is 31 feet thick and consists entirely of very fine-grained, calcareous dolomite. Rigby (1958,) coined the term "tiger stripe" for the mottled or streaked weathering of the upper and lower units of the Dagmar Dolomite in the Stansbury Mountains. The term "tiger stripe" fits equally well for the weathering fashion of the upper and lower units of the Dagmar Dolomite on Stansbury Island. Calcareous dolomite of the upper and lower units is light medium-grey to dark-grey, very fine-grained, laminated and weathers in a streaked fashion with uniformly alternating, light-grey and light medium-grey parallel streaks or stripes. Both upper and lower units weather blocky and are ledge-formers.

The central unit is approximately 11 feet thick and consists of very fine-grained, light medium-grey, calcareous dolomite. Thin pronounced lamination, a blocky weathering habit and the chalk-white weathering best characterize the central unit.

The Dagmar Dolomite is correlated with certainty with the Dagmar Dolomite as described in the Stansbury Mountains and with the type area in the Tintic District based on the similarity of lithology and stratigraphic position. Fossils were not found within the Dagmar beds, but the formation is considered Medial Cambrian (Morris and Lovering, 1961, p. 30).

Herkimer Limestone

The Herkimer Limestone is best exposed on the ridge north of Cane Canyon with a less complete and overturned section located on the ridge due west of Corral Canyon. There are no complete sections of the Herkimer Limestone exposed on the island.

An estimated thickness of 140 feet is assigned to the Herkimer Limestone on the ridge north of Cane Canyon. The top of the formation is not exposed, but the above thickness is thought to be a nearly complete section.

The Herkimer Limestone consists of dark medium-grey limestone which weathers dark medium-grey to medium blue-grey. Weakly-developed, light-grey argillaceous partings are found in the lower part of the formation giving the dark medium-grey limestone a mottled appearance similar to the dolomite of the Teutonic Limestone below. Well-developed, yellowish orange argillaceous partings are prevalent in the medium blue-grey limestone above. White "twiggy" bodies, pisolites, oolites, and intraformational pebble conglomerates are locally abundant within the formation.

The Herkimer Limestone of the map area correlates with the Herkimer Limestone in the Stansbury Mountains (Rigby, 1958, p. 17) and with the Herkimer Limestone in the type area in the Tintic district (Morris and Lovering, 1961, p. 31-36). Fossils have not yet been found within the Herkimer Limestone on Stansbury Island.

Cole Canyon Dolomite

The two best exposures of Cole Canyon Dolomite are located in the core of Stansbury Anticline on the southern tip of the island and on the southern ridge of Pass Canyon, on the northeast side of the island. Additional outcrops are located on the ridge at the head of Corral Canyon and on the first ridge just east of Plug Peak.

The base of the Cole Canyon Dolomite is not exposed on Stansbury Island, but approximately 528 feet of the formation was measured in the core of Stansbury Anticline. This is thought to be a near-complete section.

The Cole Canyon Dolomite is composed entirely of light-grey and dark-grey dolomite which weathers to form very distinctive alternating light and dark-grey bands. Light-grey bands are approximately four times as abundant as dark-grey bands and become thicker towards the top of the unit; the uppermost bed is approximately 190 feet thick.

Light grey-weathering dolomites are light-to dark-grey on freshly brocken surfaces and range from fine-grained to coarsely granular in texture. Most fine-grained dolomites are laminated or very thin-bedded. Bedding is even to irregular, and argillaceous partings are quite common on the bedding planes of finer grained dolomites. The coarser, granular dolomites appear structureless and are thick to massive-bedded, often forming ledges.

The dark-grey-weathering dolomites are dark-grey on freshly broken surfaces and granular in texture. Faint, light-grey argillaceous partings and white "twiggy" bodies are common. Bedding is medium to thick. These dolomites are commonly slope-formers.

The top of the formation is placed at the top of the uppermost light-grey dolomite bed and below the dark-grey dolomite of the lower Opex Formation. The formation correlates with the Cole Canyon Dolomite of surrounding areas and with the type area in the Tintic District. The Cole Canyon Dolomite is considered to be uppermost Medial Cambrian age, but no fossils have yet been collected within the formation on Stansbury Island.

Opex Formation

Complete sections of the Opex Formation are best exposed in the core of Stansbury Anticline and on the ridge south of Pass Canyon on the northeast side of the mapped area. Less complete sections outcrop on the ridge at the head of Corral Canyon and approximately one-half mile west of Plug Peak.

Complete thickness of the Opex Formation is 493 feet. Two members have been differentiated on the geologic map; a lower member 152 feet thick, and an upper member 341 feet thick. Loughlin (1919, p. 29-30), working in the type area in the Tintic District, originally proposed the lower and upper members of the Opex Formation. Morris (1957, p. 8), in later work in the Tintic District, chose to include the lower dark-grey dolomite member of the Opex Formation within the Cole Canyon. I have chosen to follow the older terminology of Loughlin as did Rigby (1958, p. 23) in the Stansbury Mountains.

The lower member consists of dark-grey dolomite which weathers dark-grey. The dolomite is thin- to medium-bedded and medium- to coarse-grained, weathering with a granular or sucrosic texture. Bedding planes are irregular and mottled with light-grey argillaceous material. Pisolites, oolites, and white "twiggy" bodies are common in some beds and range throughout the member. The dark-grey dolomite of the lower member of the Opex Formation stands out in sharp contrast to the light-grey dolomite units above and below. The unit weathers blocky and is a ledge-former.

The upper member is composed of light to medium-grey, medium to coarse-grained dolomite which weathers light-grey, light medium-grey and pale yellow orange, often with a sucrosic texture. Yellowish orange and yellowish grey argillaceous partings, occuring along irregular bedding planes, are well developed in the central part of the member. Intraformational conglomerates and oolites are present, distributed intermittently throughout the entire upper member. Thin, irregular-bedded, light medium-grey-weathering dolomite is present at the base of the member and granular, massive-bedded and structureless, light-grey-weathering dolomite forms the top unit. When seen from a distance the unit is a slope-former and appears faintly banded with light medium-grey, light-grey and pale yellowish orange alternating bands.

Dunderberg Shale

Complete sections of the Dunderberg Shale are exposed in the core of Stansbury Anticline, northwest of Plug Peak and on the ridge south of Pass Canyon on the northeastern side of the island.

Total thickness of the Dunderberg Shale is approximately 92 feet. The formation is everywhere present above the Opex Formation and below the Ajax Dolomite on Stansbury Island and it appears to be uniform in thickness.

The formation is composed of thin-bedded, medium-grey dolomite and limestone. Dolomite is the dominant lithology and weathers yellowish grey and pale olive. Yellowish orange and yellowish grey argillaceous partings are distributed through the formation at intervals of approximately two inches or less. Intraformational pebble conglomerates are common and increase towards the top of the formation. Medium-grey limestone is found near the top of the formation in patches which grade laterally into dolomite. The top of the formation is marked by a ten-foot bed of medium yellowish orange-weathering dolomite. Dunderberg Shale is a slope-former and weathers platy to flaggy.

The lower contact of the formation is mapped at the top of the massive, light-grey-weathering dolomite bed of the upper member of the Opex Formation. The upper contact is placed below the medium to dark-grey weathering dolomite beds of the Ajax Dolomite. The upper contact is commonly covered.

Ajax Dolomite

The Ajax Dolomite is the uppermost Cambrian formation within the mapped area. Complete sections crop out in the core of Stansbury Anticline and in a north-south trending band across the head of Cane Canyon. Additional exposures are located along the ridge north of Ben Allen Canyon and on the ridge due west of Corral Canyon.

The formation is 675 feet thick and is composed of medium to coarse-grained dolomite. The formation can be conveniently divided into two distinct units, a lower medium to dark-grey-weathering unit and an upper light-grey-weathering unit.

The lower unit consists of medium-grey to dark, somber-grey-weathering dolomite. Light medium-grey to dark medium-grey-weathering dolomite beds are present near the base of the formation but gradually give way to the dark, somber-grey dolomites of the central and upper beds of the unit. Yellowish orange and yellowish grey argillaceous partings are prevalent in the lower part of the unit but are totally absent in the upper beds. Central and upper beds weather dark, somber-grey with nodular bedded chert present towards the top of the unit. The chert is light-brown to pinkish brown and weathers light-brown to dark-brown. Oolites and pisolites are common throughout the darker grey middle and upper dolomite beds. The lower unit is thin to thick-bedded and weathers flaggy to massive. Massive units commonly form ledges while thinner bedded units form slopes.

The upper unit is approximately 168 feet thick and consists of massive weathering, light medium-grey dolomite which weathers light-grey. Dolomite within the upper unit is medium to coarse-grained and weathers with a sucrosic texture. The unit is an excellent marker bed for the top of the Cambrian sequence. It stands out in sharp contrast with the somber grey dolomites below and the medium-grey limestone of the Ordovician Garden City Formation above. Yellowish orange argillaceous partings are present near the top of the unit.

Fossils were not found within the Ajax Formation on Stansbury Island but Arnold (1956, p. 10) identified *Prosaukia misa* (Hall) and *Idahoia* sp. from the middle part of the Ajax Dolomite in the northern Stansbury Mountains. Teichert (1958, p. 17), working in the southern Stansbury Mountains, identified *Billingsella* sp. from the Ajax Dolomite. The Ajax Dolomite on Stansbury Island correlates with the Ajax Dolomite of surrounding areas and is considered Late Cambrian.

ORDOVICIAN SYSTEM

Garden City Limestone

The Garden City Limestone crops out in two locations, one on the east and west flanks of Stansbury Anticline extending from the southern tip of the area northward to Cedar Canyon and the second in a continuous one-mile long, north-south outcrop band east of and below Castle Rock. The most accessible outcrops are located within the core of the Stansbury Anticline near the southern part of the range.

The lower unit of the formation is approximately 800 feet thick and is composed of well-bedded, medium to fine-grained, medium-grey limestone which weathers medium blue-grey. Yellowish orange argillaceous partings are characteristic of the entire unit and appear at varying intervals from one inch to a few feet apart. Intraformational pebble conglomerates and penecontemporaneous slump folds are also common, scattered throughout the unit. The unit is thin to medium-bedded, weathers massive and is a ledge-former.

The upper unit is composed primarily of thin to medium-bedded, medium-grey dolomite which weathers a characteristic yellow-orange. Argillaceous partings are present but partially masked due to the yellow-orange weathered color of the dolomite. A bed of limestone, approximately four feet thick and similar to the limestone below, appears near the top of the unit. The upper unit is a semi-slope-former.

The lower contact of the formation was placed at the contact between light-grey dolomite of the Ajax Dolomite and medium blue-grey argillaceous limestone of the lower unit. Upper boundaries were marked at the first occurrence of medium-grey dolomite of the Fish Haven Dolomite and above the yellow-orange dolomite of the upper unit.

The Garden City Limestone described herein is Canadian in age and correlates with the Garden City Formation of surrounding areas. Fossils were not collected from the formation on Stansbury Island.

Fish Haven Dolomite

The Fish Haven Dolomite unconformably overlies the Garden City Limestone throughout its outcrop band on the island. It is exposed continuously on the east and west flanks of Stansbury Anticline, extending northward from the southern tip of the mapped area, approximately four miles to the northern ridge of Shanty Canyon. An additional exposure extends in a continuous one-mile long, north-south outcrop band below and east of Castle Rock.

The Fish Haven Dolomite is 269 feet thick and consists of light medium-grey dolomite. Bands of alternating medium and dark-grey dolomite, which weather light medium-grey and dark-grey respectively, make up the lower two-thirds of the formation. Individual dark-grey bands range in thickness from 1 to 10 feet and are quite characteristic even when seen at a distance. Light medium-grey-weathering dolomite is prevalent in the upper part of the formation. Dolomite of the lower two-thirds is medium-grained, and in the upper beds it is fine to medium-grained. The formation is medium to thick-bedded and is a slope-former.

Due to the absence of identifiable fossils within the formation on Stansbury Island it is difficult to determine if rocks of the Silurian Laketown Dolomite are represented. Regional thickness of the Fish Haven Dolomite, compared with the thickness of the Fish Haven Dolomite measured within the mapped area, suggests that the entire unit is Fish Haven Dolomite, rather than in part Silurian Laketown Dolomite. The Laketown Dolomite overlies approximately 270 feet of Fish Haven Dolomite in the northern Stansbury Mountains (Rigby, 1958, p. 32); approximately 514 feet of Fish Haven Dolomite in the Lakeside Mountains (Young, 1956, p. 23) and approximately 200 feet of Fish Haven Dolomite in the Promontory Mountains (Olson, 1956, p. 52). Thickness of the Fish Haven in surrounding areas suggest that perhaps most, if not all of the Laketown Dolomite, has been stripped away by the late Devonian unconformity described by Rigby (1959, p. 202-218).

DEVONIAN SYSTEM

Stansbury Formation

The Stansbury Formation was named by Stokes and Arnold (1958) from exposures in the northern Stansbury Mountains. Pebble and cobble conglomerate, orthoquartzite, and interbedded carbonates combine to form a thickness in excess of 1,700 feet in the type section (Stokes and Arnold, 1958, p. 137-142).

The Stansbury Formation on the island is composed primarily of light-brown quartzose sandstone and is the most striking formation in the mapped area standing out in sharp contrast to the grey dolomite above and below. The formation is consistently present above the Ordovician Fish Haven Dolomite and below the Devonian Fitchville Formation. It is the most widely exposed formation on the island cropping out nearly continuously from the southern tip of the island north to Corral Canyon.

The total thickness of the Stansbury Formation on Stansbury Island is 1,215 feet. Petersen (1956, p. 20) measured 869 feet here but did not include the lower interbedded dolomite and sandstone sequence. The base of the Stansbury Formation is placed at the bottom of the first sandstone above the Fish Haven Dolomite for the present study. The first sandstone bed is approximately one foot thick and is followed by approximately 45 feet of dolomite.

Three distinct stratigraphic units can be recognized in the Stansbury Formation: a lower interbedded dolomite and quartzose sandstone; a medial very thin-bedded, slope-forming, quartzose sandstone; and an upper medium-bedded, ledge-forming quartzose sandstone with interbedded carbonates at the top of the unit. The lower unit consists of light and dark medium-grey dolomites interbedded with light-grey to white, quartzose sandstone which weathers light-brown to very light-brown. Dolomites are thin to medium-bedded and medium to coarse-grained, often containing floating quartz grains. Some very fine-grained dolomite beds also occur. The sandstones are friable to well-cemented and contain well-sorted, rounded, medium to coarse quartz grains. Silica and iron oxide are the cementing agents. Bedding is very thin and ranges from one inch to one foot. Dolomite is the dominant lithology in the lower part of the interbedded sequence but individual dolomite bands thin towards the top and give way to quartzose sandstone. The top of the unit is marked by an eight-foot bed of dolomite. The entire unit is a slope-former.

The medial unit consists entirely of thin-bedded, light-brown to white quartzose sandstone which weathers light-brown. Some reddish brown sandstone was noted in the lower part of the unit. Quartz clasts are medium to coarse-grained, well-rounded, and well-sorted, and are cemented with silica and iron oxide cement. Thin, well-cemented beds, one to two inches thick, alternate uniformly with thin friable beds throughout much of the unit and accentuate the thin bedding. Individual beds may represent very low angle foreset beds in a crossbedded sequence.

Thin to thick-bedded, light-brown-weathering quartzose sandstone typifies the upper unit. The upper unit is 719 feet thick and is a ledge-former in distinct contrast to the slope-forming units below. Sandstone of the upper unit is similar to that below but is generally more tightly cemented. Circular brown pock marks, up to two inches in diameter, are represented on weathered surfaces of many of the thicker bedded sandstones. Their origin is probably due to differential weathering of iron oxide cement. Two four-foot beds of light-grey dolomite occur approximately 100 feet from the top of the formation and are separated by approximately five feet of sandstone. A five-foot, fossiliferous limestone bed is present approximately 30 feet from the top of the formation. Minor conglomeratic beds are present near the top of the formation and are composed of quartzite pebbles. Pebbles have a maximum diameter of one and one half inches and are encased in a quartz sand matrix.

DEVONIAN AND MISSISSIPPIAN SYSTEM

Fitchville Formation

The Gardner Formation was originally named from outcrops of dolomite and limestone overlying the Devonian Pinyon Peak Limestone in Gardner Canyon in the Tintic District, Utah (Lindgren and Loughlin, 1919, p. 82). The formation was separated into a lower dolomitic member and an upper limestone member. Morris and Lovering (1961, p. 82) treated the lower and upper members as distinct formations, naming the lower dolomitic member the Fitchville Formation and the upper limestone member the Gardison Limestone. The Fitchville Formation and the Gardison Limestone were considered Early Mississippian in age (Morris and Lovering, 1961, p. 82). Recently, Late

Devonian conodonts have been found in the lower part of the Fitchville Formation (Beach, 1961, p. 41-43).

Outcrops of the Fitchville Formation are well exposed on the east and west flanks of Stansbury Anticline and extend north nearly continuously from the southern tip of the mapped area to Corral Canyon. Western exposures are easily accessible from the gravel road on the west side of the island and excellent exposures on the east side can be reached via a dirt road extending up Broad Canyon.

Total thickness of the Fitchville Formation on Stansbury Island is 335 feet. The formation is composed of dolomite with abundant chert in the lower part. It can be divided into a lower and upper unit. Interbedded chert and dolomite best characterize the lower unit of the Fitchville Formation. The dolomite is dark medium-grey, weathers light medium-grey, and is medium-grained. "Meringue" weathering is common to much of the dolomite. Brown chert is uniformly interbedded with the dolomite in beds up to five inches thick near the top of the unit. Chert makes up approximately 50 percent of the lowermost part of the unit, but gradually gives way to dolomite up section. The lower unit is a ledge-former.

The upper unit consists of dark medium-grey dolomite which weathers light medium-grey. Chert is virtually absent in the upper unit. Bedding is thin to medium, and the entire unit is a slope-former, in contrast to the ledge-forming lower unit.

Fossils are very common within the upper part of the lower unit and throughout the entire upper unit. The following genera were recognized in the Fitchville Formation on Stansbury Island:

Syringopora sp.
Turbophyllum sp.
Lithostrotion sp.
Caninia sp.
Spirifer sp.
Straparollus (*Euomphalus*) sp.

The Fitchville Formation on Stansbury Island correlates with the Fitchville Formation described by Morris and Lovering (1961, p. 82) in the Tintic District, Utah, and with the lower member of the Gardner Formation described in the Stansbury Mountains (Rigby, 1958, p. 40).

MISSISSIPPIAN SYSTEM

Gardison Limestone

The Gardison Limestone, as defined by Morris and Lovering (1961, p. 89) in the Tintic District, Utah, includes the limestone sequence above the dolomitic Fitchville Formation and below the basal phosphatic shale of the Deseret Limestone.

Excellent exposures are found along the east and west flanks of Stansbury Anticline. Outcrops of the formation extend northward from the southern tip of the mapped area to Corral Canyon. Easily accessible exposures occur along the entire west climb of the anticline and within Broad Canyon on the eastern limb of the anticline.

The Gardison Formation on Stansbury Island is 674 feet thick. It can be divided into a lower, chert-free, limestone member and an upper cherty dolomite and limestone member. The lower member is 545 feet thick and consists of light medium- to dark medium-grey limestone which weathers the same color. Thin to thick-bedded, slope-forming, medium to coarse-grained, chert-free limestone characterizes the lower member of the Gardison Formation.

The upper member is 129 feet thick and consists of dolomite and limestone with bedded chert. Interbedded dolomite and chert makes up the lower third of the member and interbedded limestone and chert form the upper two-thirds of the member. The dolomite and limestone is light medium to dark medium-grey and weathers the same color. The limestone generally weathers darker grey than the dolomite, and both are medium to coarse-grained. The chert ranges in color from light medium-grey to black and weathers grayish orange-pink to dark-grey. Chert beds are common throughout the entire upper member becoming increasingly thick and more closely spaced towards the top of the member. Individual chert beds range in thickness from 1 to 10 inches and collectively constitute as much as 4 percent of the rock towards the top of the formation. A ten-inch bed of black chert forms the top of the Gardison Formation. The upper member is a ledge-former in contrast to the slope-forming lower member and the slope-forming shale of the overlying Deseret Formation.

Fossil genera recognized within the Gardison Limestone on Stansbury Island include the following:

Aulopora sp.
Caninia sp.
Lithostrotion sp.
Syringopora sp.
Spirifer sp.
Composita sp.
Straparollus (*Euomphalus*) sp.
turretellid gastropods

Careful study of proper identification of the fossils within the Gardison Limestone on Stansbury Island will likely reveal a fauna similar to that described by Rigby (1958, p. 41-42) in the northern Stansbury Mountains.

The Gardison Limestone is considered to be Late Kinderhookian(?) and Osagean (Beach, 1961, p. 43). The formation correlates with Gardison Limestone as described by Morris and Lovering (1961, p. 89-90) in the Tintic District and with the upper member of the Gardner Formation and lower cherty limestone of the Pine Canyon Formation as described by Rigby (1958, p. 41-44).

Deseret Limestone

The Deseret Limestone was named by Gilluly (1932, p. 25) and was recently redefined by Morris and Lovering (1961, p. 93-104) in the Tintic District, Utah. The Deseret Limestone in the Stansbury Island area is the same as the Desert Limestone described in the Tintic District by Morris and Lovering. The base of the Deseret Limestone is mapped at the base of the phosphatic shale unit above the cherty Gardison Limestone and the top is mapped at the first occurrence of sandstone in the Humbug Formation.

Outcrops of the formation are found on the ridge northeast of Broad Canyon and on the ridge north of Cedar Canyon. The best section is present in the latter locality, with partial sections cropping out below and west of Castle Rock.

The formation is approximately 1,150 feet thick and can be divided into three distinct lithologic units. The three units are: a lower shale and limestone unit, a medial quartzose sandstone unit, and an upper cherty dolomite, and cherty limestone unit. Approximately 180 feet of shale and limestone form the lower unit. Without exception the only rock which is exposed within the lower shale unit is a medial cherty limestone. The limestone is approximately 20 feet thick, is thin-bedded and weathers platy. It is dark medium-grey on the weathered and fresh surface. Black chert is interbedded with the thin beds of limestone. The entire lower unit is a slope-former and forms a saddle wherever present.

The medial unit is composed of 95 feet of light olive-grey, quartz sandstone which weathers pale brown. Quartz grains are medium to coarse-grained, well rounded, and well sorted. Silica and iron oxide are the important cementing agents. The sandstone is thick to massive-bedded and weathers massive, forming a ledge. Crossbedding is poorly developed but present.

The upper unit is approximately 875 feet thick and is composed of alternating cherty dolomite and cherty limestone. The thickest dolomite sequences are found in the upper and lower part of the unit. The base of the unit is marked by a 125-foot cherty dolomite and the top is formed of a 50-foot sequence of cherty dolomite. The chert is light medium-grey to black and weathers light orange-pink, black, and various shades of brown. Chert occurs in nodules and irregular beds one to five inches thick, which may be separated by a few inches or several feet of carbonate rock. In some parts of the unit chert is nearly equal in volume to the limestone or dolomite. Dolomite and limestone are light medium-grey to dark medium-grey and weather light medium-grey. Both range from fine to coarse-grained. Limestone is approximately twice as abundant as dolomite. Approximately 300 feet of the medial part of the upper unit is composed of crinoidal limestone and approximately 100 feet of this crinoidal limestone lacks chert. The upper unit is thin to massively bedded and is typically a semi-slope-former.

Rugose corals and spiriferid brachiopods are locally present within the Deseret Limestone. Petersen (1969) reported the occurrence of *Beyricheroceras* and *Dzhaprakoceras* ammonoids from the shale unit at the base of the Deseret Formation in the northern Stansbury Mountains. These ammonoids are Early Meramecian.

The Deseret Limestone described in the Tintic District (Morris and Lovering, 1961, p. 93-104) correlates with the Deseret Limestone in the present area.

Humbug Formation

The Humbug Formation overlies the Deseret Limestone and crops out on the ridge northeast of Broad Canyon and on the ridge north of Cedar Canyon. There are no complete sections of the Humbug Formation exposed on Stansbury Island.

Aproximately 350 feet of alternating quartzose sandstone and crinoidal limestone of the lower part of the Humbug Formation were measured on the ridge north of Cedar Canyon. The sandstone is pale brown and is very similar to the sanstone of the medial unit within the Deseret Limestone. Quartz grains in the sandstone are cemented with iron oxide and locally calcite. The limestone is medium blue-grey and is almost entirely of crinoid ossicles. When freshly broken the limestone gives off a fetid, marsh gas odor. The alternating medium blue-grey limestones and pale-brown sandstones stand out in contrast when seen at a distance.

The Humbug Formation on Stansbury Island correlates with the Humbug Formation of surrounding areas and with the type section in the Tintic District, Utah (Tower and Smith, 1899, p. 625-626).

QUATERNARY DEPOSITS

Lake Bonneville deposits and wind-blown dune deposits are discussed under the section dealing with geomorphology. Generally the alluvium consists of Lake Bonneville gravel, sand and silt deposited in most of the canyons; recent alluvial fan material at the mouths of the larger canyons; oolitic wind-blown deposits; and Great Salt Lake deposits of mud and oolitic sand. The entire area is surrounded by mud flats composed of Great Salt Lake oolitic sand and mud.

STRUCTURAL GEOLOGY

FOLDS

Stansbury Anticline

The major structural feature on Stansbury Island is the large northward plunging asymmetrical Stansbury Anticline (Eardley, 1939, pl. 1). The anticline extends from the southern tip of the mapped area northward approximately six miles to Corral Canyon. North of Castle Rock the east limb has been eroded away.

The fold axis strikes N. 16° E. on a nearly straight line from the southern tip of the island northward approximately four miles to Castle Rock. From Castle Rock the fold axis swings approximately 46° to the west and strikes N. 30° W. The abrupt shift of the fold axis to the west is primarily due to drag along the Corral Canyon Fault.

Stansbury Anticline plunges approximately 7° to the north and is asymmetrical to the east, with bedding plane dips ranging from 25° to 40° on the west limb and 60° to 80° on the east limb. Dips decrease on the west limb from the center of anticline west, suggesting the presence of a large syncline to the west of Stansbury Anticline. At depth the beds on the east limb may be overturned (Text-fig. 3).

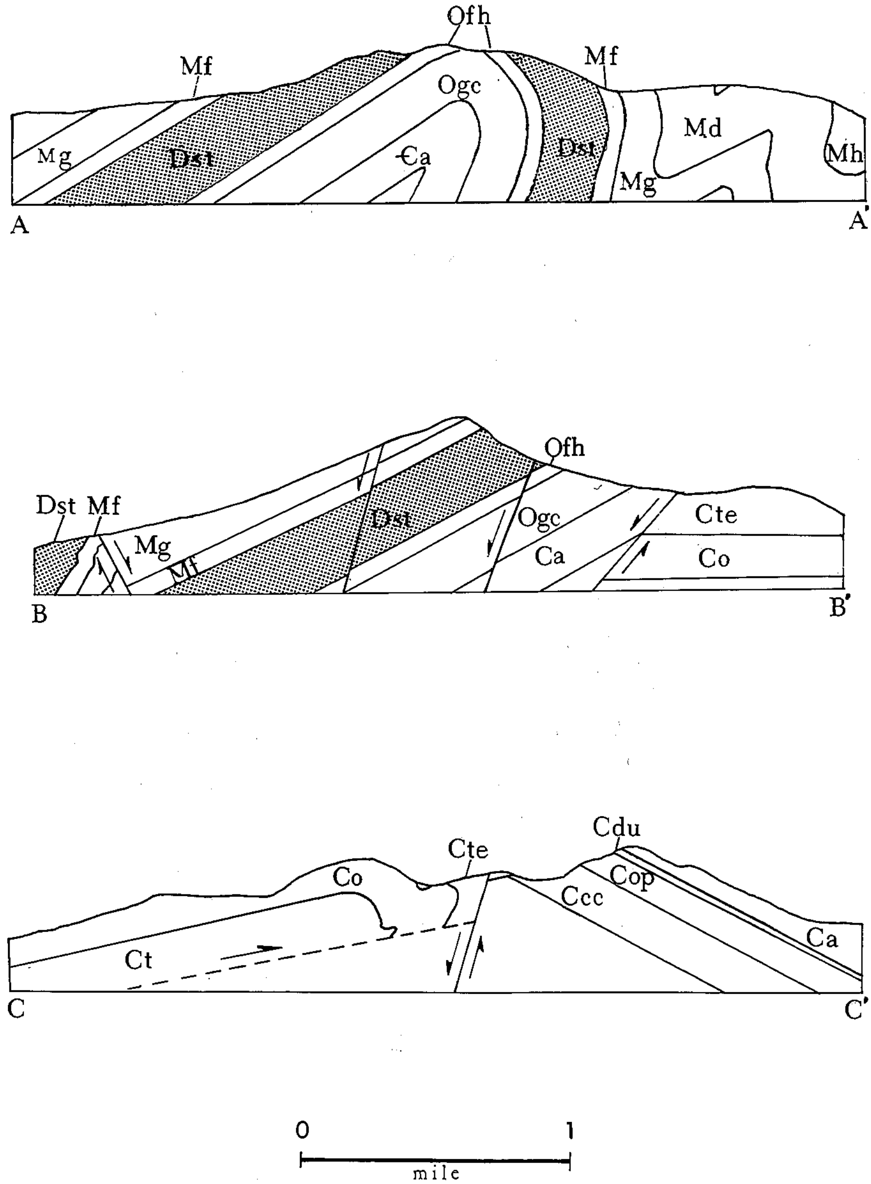
Minor Folds East of Stansbury Anticline

Smaller folds flank the larger Stansbury Anticline on the east. Their fold axes are roughly parallel to the fold axis of the larger anticline. They are exposed on the ridge northeast of Broad Canyon and on the ridge between Shanty and Cedar Canyons.

Two small synclines and a central anticline are exposed east of the larger Stansbury Anticline. The small anticline is overturned toward the east. Dips of 30° to 50° were measured on the west limb. The synclines are asymmetrical to the west.

Pass Canyon Anticline

The small anticline in the vicinity of Pass Canyon is here named Pass Canyon Anticline (Pl. 1). The axis of the anticline strikes N. 40° E. and it is doubly plunging. Pass Canyon Anticline is highly asymmetrical and overturned to the east, with dips of approximately 25° on the west limb. A northwest-



TEXT-FIGURE 3.—Structural cross-sections across Stansbury Island. A-A, east-west across the south-central part of the range showing the generally overturned major anticline of the southern block; B-B', east-west across the central part of the range; C-C', northwest-southeast across the north-central part of the range. For exact location see Plate 1.

erly trending fault which occurs through Ben Allen and Pass Canyons has dropped the fold down on the northeast. The axis of the fold on the downthrown block has been dragged from a northeast trend to an easterly trend by the large strike-slip fault north of Pass Canyon (Pl. 1).

FAULTS

Thrust Faulting

Evidence suggests that the Stansbury Anticline has been sheared and pushed or slid to the east along a major fault. The thrust fault can be traced from a point due west of Castle Rock at the base of the range, north past the bottom of Corral Canyon (Pl. 1). A large normal fault on the west side of the anticline has brought up what appears to be the lower plate of the thrust. The upthrown block on the normal fault exposes overturned rocks of the Stansbury and Fitchville Formations which dip to the west and are badly shattered and distorted (Text-fig. 3). These rocks probably represent the sheared east limb of the Stansbury Anticline and the lower plate of the thrust. Estimated horizontal displacement is approximately three miles toward the east.

Rigby (1958, p. 69-71) described a similar reverse fault in the Stansbury Mountains, postulating that the Deseret Anticline had been sheared and displaced as much as 5,000 feet to the east. Stansbury Anticline is an anticline belonging to the same fold system as the Deseret Anticline, although probably not a northward extension of that fold.

A smaller thrust fault is exposed on the ridge northeast of Corral Canyon. The Tintic Quartzite, Ophir Formation, Dagmar Dolomite, and Teutonic Limestone on the northwest corner of the island represent the upper plate of the thrust fault. The upper plate moved from the northwest to the southeast folding and overturning these upper plate beds into what is here named the Pass Canyon Anticline. Rocks of the lower plate dip southeast at approximately 30°, and are made up of Cambrian Cole Canyon Dolomite and older rocks.

A northwest-striking, transverse, normal fault extends from Pass Canyon to Ben Allen Canyon and has tilted the thrust plane towards the southwest away from the original northwest dip. The thrust plane has been elevated to its present position by a normal fault (Text-fig. 3), and is well exposed in Corral Canyon with overturned medium blue-grey Herkimer Limestone on the upper plate and light-grey Cole Canyon Dolomite below. Based upon formation relationships the stratigraphic displacement is less than 2,000 feet.

Transverse Strike-Slip Faulting System

Two large transverse strike-slip faults divide Stansbury Island into three structurally different blocks. The three structural blocks include a southern anticlinal block, a central southeast-dipping block of Cambrian rocks and a northern west-dipping block of Precambrian rocks.

The southern strike-slip fault, here named the Corral Canyon Fault, strikes N. 40° W. from Plug Peak to a point below and north of the large peak north of Castle Rock. From there the fault trace turns and strikes due west down through Corral Canyon. The fault divides the southern anticlinal block from the central structural block. The dip of the fault plane is approximately 60° to the south and the estimated vertical stratigraphic displacement is approximately 2,000 feet. The strike-slip component of the Corral Canyon Fault is significant. Horizontal movement of the southern, anticlinal block towards the east was in excess of one mile, as estimated from the drag on the axis of the Stansbury Anticline. The central structural block moved relatively to the west.

The large northern strike-slip fault is located approximately one quarter of a mile north of Pass Canyon and separates the central structural block from the northern structural block. It strikes approximately east-west, juxtaposing Precambrian rocks of the Big Cottonwood Formation on the north with the Cambrian Ophir Formation on the south. Vertical stratigraphic displacement is greater than 4,000 feet and the strike-slip component may be large. Drag features on the Pass Canyon Anticline indicate that the central structural block moved relatively west with respect to the northern structural block of Precambrian rocks.

Transverse Faults and Structural Blocks

Southern Anticline Block

The southern anticlinal block is dominated by the Stansbury Anticline. The strike of the fold axis of Stansbury Anticline swings from a northeast direction to the northwest as a result of drag on the Corral Canyon strike-slip fault. Several small transverse scissor faults have developed across the northwest-striking anticlinal axis on the northern end of the Stansbury Anticline. These faults are thought to have originated during movement on the Corral Canyon Fault. Strike of the small transverse faults is west and northwest (Pl. 1). Vertical displacement on most of the faults is greater towards the east and maximum vertical displacement on any one fault is less than 500 feet.

A large normal boundary fault on the east side of the Stansbury Anticline has been described on earlier pages. Vertical displacement on the fault is probably large but is undeterminable.

Central Structural Block

The central structural block consists entirely of Cambrian rocks which make up an allochthonous block and an autochthonous block. The autochthonous block consists of Upper and Middle Cambrian rocks which dip at an angle not exceeding 40° towards the southeast. Allochthonous rocks range from Lower to Middle Cambrian and have moved over the autochthonous rocks.

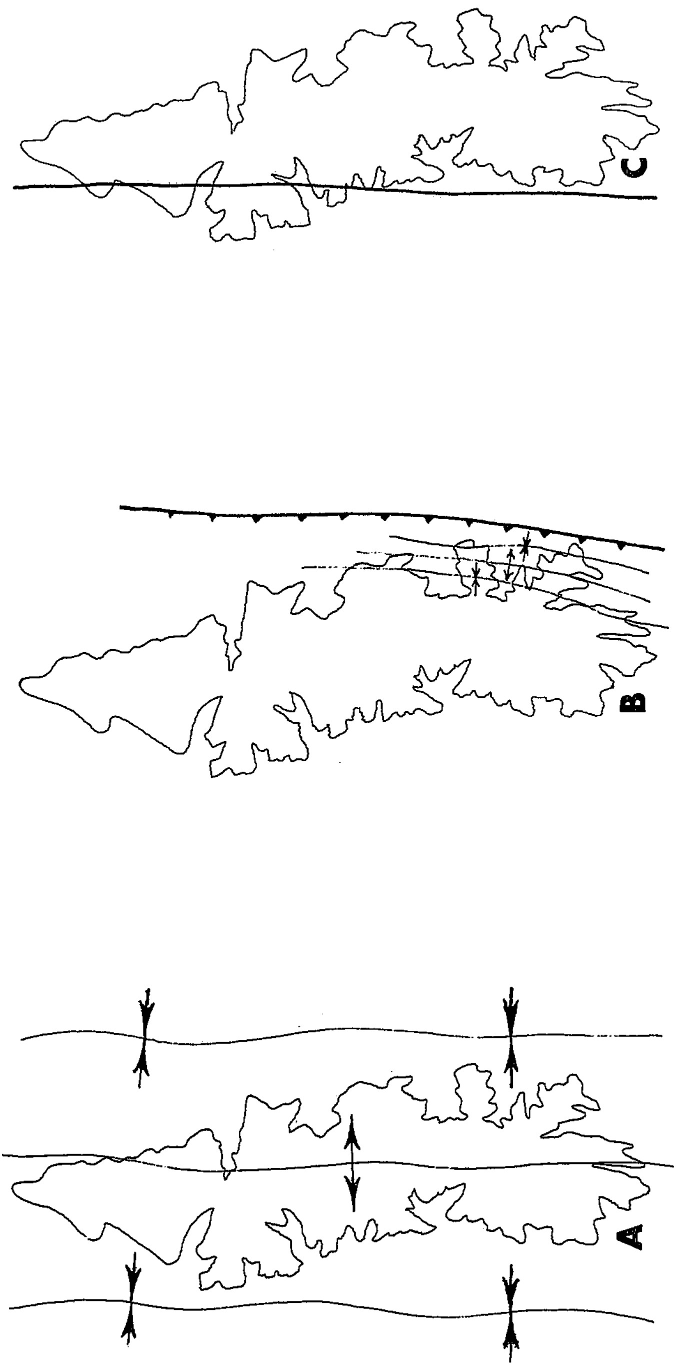
A system of northwesterly trending transverse faults has cut through the allochthonous and autochthonous blocks. Maximum vertical displacement does not exceed 1,000 feet on any of these faults. Most of the faults have estimated vertical displacements of 200 to 300 feet.

Two normal faults, which extend south from the head of Ben Allen Canyon to the Corral Valley Fault, have been displaced by the younger northwest-trending transverse faults (Pl. 1). Vertical displacement is approximately 500 feet on the easternmost fault and approximately 200 feet on the western one.

One other northeastern striking normal fault is present in the central structural block. It has brought the thrust plane to the surface and predates the transverse faults.

Northern Structural Block

West dipping Precambrian rocks make up the northern structural block. Bedding plane dips do not exceed 20°. Eardley (1969, p. 271) included the Northern Structural Block within the Northern Utah Highland.


C
B
A

TEXT-FIGURE 4.—Structural evolution of Stansbury Island. A, east-west compression of major folds; B, thrust faults with folding, generally in the east and southeast part of the range; C, normal faults along the western side of the range; D, transverse strike-slip faults block out major elements of the range; E, late Basin-and-Range block faulting; F, structures developed during A-E, exposed in Stansbury Island.

Normal Faulting

A large normal fault is postulated on the east side of the island along the entire length of the island (Text-fig. 4F). This normal fault is responsible for the present topographic relief of the island range. Several brackish-water springs are present, extending roughly in a north-south line, on the eastern side of the range and may owe their origin to this fault.

Regional Strike Slip Fault

Young (1955, p. 42) postulated a large strike-slip or tear fault extending in an east-west line past the south tip of the Grassy and Lakeside Mountains and Stansbury Island. He postulated that the northern block moved west. Evidence on Stansbury Island indicates the northern block moved relatively east in contrast to Young's conclusion.

STRUCTURAL HISTORY

Direct evidence for positive determination of structural chronology is lacking on Stansbury Island, but a sequence of structural events is easily determined. The structural history of Stansbury Island can be summarized as follows, with the likely time of occurrence of individual phases:

1. *Compressional Folding* (Laramide),
2. *Thrust Faulting* (Laramide),
3. *Early Normal Faulting* (Basin and Range),
4. *Transverse Faulting* (Basin and Range),
5. *Late Normal Faulting* (Basin and Range and Recent).

UNCONFORMITIES

Pre-Fish Haven Unconformity

Several workers have described the pre-Fish Haven unconformity in surrounding areas (Hintze, 1951, p. 21; Webb, 1953, p. 85; Croft, 1956, p. 13; Teichert, 1958, p. 65-66; Rigby, 1958, p. 80-83).

The Fish Haven Dolomite unconformably overlies the Garden City Limestone in the mapped area. It is a disconformity with no apparent erosional surface or locally recognizable angularity between the underlying and overlying beds. The Swan Peak Quartzite and Kanosh Shale present in nearby areas are totally absent on Stansbury Island.

Pre-Pinyon Peak and Stansbury Unconformity

Rigby (1958, p. 80-83; 1959, p. 207-218) described in detail the Late Devonian Stansbury unconformity which is present over much of Central Utah.

On Stansbury Island, the Devonian Stansbury Formation unconformably overlies the Ordovician Fish Haven Dolomite. The unconformity shows no angular discordance or apparent erosional surface. The Silurian Laketown Dolomite and the Devonian Sevy and Simonson Dolomites have been eroded away.

Pre-Pine Canyon Unconformity

Teichert (1958, p. 66) and Rigby (1958, p. 88) described a pre-Pine Canyon unconformity in the Stansbury Mountains. They described an angular discordance between the upper Gardner Dolomite and the basal cherty limestones of the Pine Canyon Formation. Angles of 25° were recorded between the two formations.

The angular discordance described in the Stansbury Mountains is also present within the upper cherty unit of the Gardison Limestone on Stansbury Island. Cherty limestones are present above and below the unconformity forming angles as large as 20°. A one to two-inch thick breccia is present on the erosional surface.

GEOMORPHOLOGY

Lake Bonneville Features

Shoreline features of ancient Lake Bonneville are well represented on Stansbury Island. Wave-cut and wave-built terraces of the Provo Level are the most obvious shoreline features but terraces of the Bonneville and Alpine Levels are locally preserved. As many as 40 minor recessional lake terraces have been cut and preserved in the Precambrian quartzites on the north end of the island.

Lake-deposited silt, sand, and gravel are common to all of the small canyons. Relatively thick silt deposits, which have been highly dissected by intermittent streams, are present on the northwest side of the mapped area in Pass Canyon.

Wind blown Features

Bands of white oolitic sand are found almost completely around the entire island. These bands of sand range in widths from approximately 50 feet to 1,000 feet and locally are made of dunes as high as 15 feet. Only on the north end of the island do the bands approach 1,000 feet in width. Most of the sand is found in bands less than 300 feet wide. The sands have been transported from the surrounding mud flats to the periphery of the island by wind action and are made up of calcareous oolites and coated grains which were found in nearby Great Salt Lake.

GEOLOGIC HISTORY

Precambrian

Pebbles, grit and coarse-grained sands were swept from a probably nearby northern high into a Late Precambrian geosynclinal environment in the vicinity of Stansbury Island. Precambrian Mineral Fork Tillite unconformably overlies the Farmington Canyon Complex on Carrigan Island five miles to the north of Stansbury Island. The entire Big Cottonwood Formation is absent suggesting a northern high and possible source for the coarse clastics in the mapped area. The clastics of the Big Cottonwood Formation were deposited in shallow marine waters in a geosyncline which may have been the forerunner to the Paleozoic miogeosyncline.

Cambrian

Medium to coarse-grained quartz sands were deposited in shallow marine seas in a miogeosynclinal environment during early part of Medial Cambrian times. Minor shale deposition occurred in early Medial Cambrian time and records periods of quiet water deposition, in contrast to the more agitated waters in which the earlier crossbedded sandstone was deposited. The shale may also represent a further transgression of the sea and general lowering of source areas.

Early Albertan time witnessed continued deposition of quartz sand followed by interbedded carbonates and shales. Carbonate deposition had replaced terriginous deposition by Middle Albertan time and continued more or less uninterrupted through the remainder of the Cambrian Period. Nearly constant influx of argillaceous material continued throughout most of Albertan and Croixan time. Shallow water features such as pisolites, oolites, oncolites, and intraformational pebble conglomerates are common to nearly all of the Albertan and Croixan carbonate rocks.

Albertan and Croixan times record periods of extreme shallow water deposition over what may have been the initial development of the Tooele Arch described by Webb (1958, p. 2353) in Ordovician rocks. Thicknesses of Albertan and Croixan rocks in the Stansbury Mountains (Rigby, 1958, p. 14) and in the Promontory Range (Olson, 1956, p. 44) are in excess of 5200 and 6100 feet rescpectively, and thin in the direction of Stansbury Island to less than 4,000 feet.

Ordovician

Carbonate sedimentation continued from Cambrian through Early Ordovician time with the deposition of argillaceous limestones of the Garden City Formation. Intraformational conglomerates are common throughout the Lower Ordovician sequence and probably owe their origin to wave action. Although the Kanosh Shale and parts of the Swan Peak Quartzite were likely deposited in the area during Medial Ordovician time, gentle uplift of the Tooele Arch and subsequent erosion have removed all evidence. The uplift subsided by Upper Ordovician times and deposition of carbonates resumed, with the accumulation of the Fish Haven Dolomite.

Silurian and Devonian

Carbonate deposition possibly continued throughout Silurian and much of Devonian time, until in the possibly Late Devonian when renewed uplift began again. During the Late Devonian uplift Silurian and Devonian carbonates were stripped away, leaving the Fish Haven Dolomite exposed. Then the area again subsided and interbedded sand and carbonate of the Upper Devonian Stansbury Formation were deposited unconformably over the Ordovician Fish Haven Dolomite. Low-angle foresets of the Devonian sands and the interbedded carbonates in the lower and upper phases of the sand deposition suggest that the entire sand unit was deposited in shallow marine waters. Very cherty Upper Devonian carbonates of the lower part of the Fitchville Formation overlie the sands of the Stansbury Formation and suggest a general lowering of nearby source areas.

Mississippian

Deposition of cherty carbonates continued from Devonian through Kinderhookian and Osagean time until Lower Meramecian when shale deposition occurred. Sands were deposited after the shale sequence and were in turn followed by a thick sequence of cherty carbonates. Interbedded crinoidal limestones and quartzose sandstones were laid down next and are the last rock record preserved on Stansbury Island. The entire Mississippian sequence was probably deposited in shallow marine waters within wave base.

Mesozoic and Cenozoic

Although the rock record from Meramecian time to Recent is absent on Stansbury Island the late Mesozoic and Cenozoic structural history is more complete. Broad north-south trending folds were the first significant structural event and are thought by Eardley (1962, p. 331) to have started during Late Cretaceous time, during one phase of the Laramide disturbance. Laramide thrust faulting followed the folding, and was in turn followed by early Basin and Range Tertiary normal faulting. Transverse strike-slip faulting followed, creating the smaller transverse normal faults with drag features as horizontal movement took place. Late Basin and Range normal faulting followed, elevating the island to its present topographic position.

Pleistocene

Well-developed lake shorelines and lake-deposited silt, sand, and gravel are present on the island and record the presence of ancient Lake Bonneville.

ECONOMIC GEOLOGY

Metal

Several prospects and a small mine are located within the Ophir Formation on the upper plate of the small thrust north of Corral Canyon in the central structural block. Mineralization in the area seems to have originated by the migration of mineral solutions up the Corral Canyon Fault, spreading into fractures within the Ophir Formation.

To the writer's knowledge, little or no economic ore has been shipped from Stansbury Island. Further subsurface prospecting may yet yield some economic metals, but as present, Stansbury Island is economically unimportant as a metal producer.

Non-metals

Small deposits of gravel are present on the southern end of the mapped area and have been quarried for local use. The gravel deposits are neither extensive nor of high quality.

Some of the cleaner sands of the Stansbury Formation have possible economic value as silica brick. In addition, parts of the formation could be quarried for flagstone and building rock. The light-grey to white sandstone might be of economic value when crushed and used for decorative purposes.

Oil and Gas Possibilities

Reservoir characteristics and source rock potential appear poor in the Lower and Middle Paleozoic rocks on Stansbury Island. Without exception the sandstones are tightly cemented and the limestones appear nearly impermeable. Parts of the Stansbury Formation have high porosity and permeability at the surface but this may be due to deep weathering and removal of iron oxide cement. A possible source rock is the unexposed shale of the lower Deseret Formation and the organic limestones of the associated formations.

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