

National Park Service
U.S. Department of the Interior



Natural Resource Program Center

War in the Pacific National Historical Park

Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory Digital Geologic Data
for War in the Pacific National Historical Park

wapa_geology.pdf

Version: 2/9/2011

Geologic Resources Inventory Map Document for War in the Pacific National Historical Park

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Geologic Resources Inventory Map Document



War in the Pacific National Historical Park, Guam

Document to Accompany Digital Geologic-GIS Data

[wapa_geology.pdf](#)

Version: 2/9/2011

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for War in the Pacific National Historical Park, Guam (WAPA)

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

National Park Service (NPS) Geologic Resources Inventory (GRI) Program staff have assembled the digital geologic-GIS data that accompanies this document.

For information about the status of GRI digital geologic-GIS data for a park contact:

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About the NPS Geologic Resources Inventory Program

Background

Recognizing the interrelationships between the physical (geology, air, and water) and biological (plants and animals) components of the Earth is vital to understanding, managing, and protecting natural resources. The Geologic Resources Inventory (GRI) helps make this connection by providing information on the role of geology and geologic resource management in parks.

Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The Geologic Resources Inventory aims to raise awareness of geology and the role it plays in the environment, and to provide natural resource managers and staff, park planners, interpreters, researchers, and other NPS personnel with information that can help them make informed management decisions.

The GRI team, working closely with the Colorado State University (CSU) Department of Geosciences and a variety of other partners, provides more than 270 parks with a geologic scoping meeting, digital geologic-GIS map data, and a park-specific geologic report.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: <http://science.nature.nps.gov/im/inventory/geology/GeologyGISDataModel.cfm>)

Geologic Reports: Park-specific geologic reports identify geologic resource management issues as well as features and processes that are important to park ecosystems. In addition, these reports present a brief geologic history of the park and address specific properties of geologic units present in the park.

For a complete listing of Geologic Resource Inventory products and direct links to the download site visit the GRI publications webpage <http://www.nature.nps.gov/geology/inventory/publications>.

GRI geologic-GIS data is also available online at the NPS Data Store site (<http://science.nature.nps.gov/nrdata/>). To find GRI data select "geology" as a Category, and use "GRI" as a Word Search term.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: <http://www.nature.nps.gov/geology/inventory>, or contact:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) program. For more information on the Inventory and Monitoring (I&M) program visit: <http://science.nature.nps.gov/im/index.cfm>

For more information on this and other Inventory and Monitoring (I&M) Natural Resource inventories visit: <http://science.nature.nps.gov/im/inventory/index.cfm>

Map Unit List

The geologic units present on digital geologic-GIS data produced for War in the Pacific National Historical Park, Guam (WAPA) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qal - Alluvium). Units are listed from youngest to oldest. No description for water is provided. Information about each geologic unit is also presented in the Geologic Unit Information (UNIT) table included with the GRI geology-GIS data.

Geologic Map Units

CENOZOIC ERA

Quaternary Period

- Qaf - Artificial fill ([Qaf](#))
- Qrb - Beach deposits ([Qrb](#))
- Qrm - Merizo Limestone ([Qrm](#))
- Qal - Alluvium ([Qal](#))

Quaternary-Tertiary Periods

- QTmr - Mariana Limestone, reef facies ([QTmr](#))
- QTmd - Mariana Limestone, detrital facies ([QTmd](#))
- QTmm - Mariana Limestone, molluscan facies ([QTmm](#))
- QTmf - Mariana Limestone, fore-reef facies ([QTmf](#))
- QTma - Mariana Limestone, Agana Argillaceous Member ([QTma](#))

Tertiary Period

- Tal - Alifan Limestone ([Tal](#))
- Tt - Alifan Limestone, Talisay Member ([Tt](#))
- Tj - Janum Formation ([Tj](#))
- Tbl - Barrigada Limestone ([Tbl](#))
- Tb - Bonya Limestone ([Tb](#))
- Tud - Umatac Formation, Dandan Flow Member ([Tud](#))
- Tub - Umatac Formation, Bolanos Pyroclastic Member ([Tub](#))
- Tum - Umatac Formation, Maemong Limestone Member ([Tum](#))
- Tuf - Umatac Formation, Facpi Volcanic Member ([Tuf](#))
- Tam - Alutom Formation, Mahlac Member ([Tam](#))
- Ta - Alutom Formation ([Ta](#))

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below.

Qaf - Artificial fill (Recent)

Shown only where extensive. *GRI Source Map ID 2952* ([PP-403-A](#)).

Qrb - Beach deposits (Recent)

Beach sand and gravel, beach rock in the intertidal zone, and patches of recently emerged detrital limestone. Sand generally is less than 15 feet above sea level, seldom as much as 30 feet above. *GRI Source Map ID 2952* ([PP-403-A](#)).

Qrm - Merizo Limestone (Recent)

Reef limestone, mostly 2 to 5 feet thick, capping present-day reef flats and platforms cut in basalt at sea level. *GRI Source Map ID 2952* ([PP-403-A](#)).

Qal - Alluvium (Recent)

Alluvial clay deposits, mostly 30 to 100 feet thick; muck and clay in marshy estuarine deposits on the west coast, and clay fill in large sinks in limestone areas. *GRI Source Map ID 2952* ([PP-403-A](#)).

QTmr - Mariana Limestone, reef facies (Pleistocene and Pliocene)

Massive, generally compact, porous, and cavernous white limestone of reef origin, especially along cliff faces, made up mostly of corals in position of growth in matrix of encrusting calcareous algae. *GRI Source Map ID 2952* ([PP-403-A](#)).

QTmd - Mariana Limestone, detrital facies (Pleistocene and Pliocene)

Friable to well-cemented coarse- to fine-grained generally porous and cavernous white detrital limestone, mostly of lagoonal origin. *GRI Source Map ID 2952* ([PP-403-A](#)).

QTmm - Mariana Limestone, molluscan facies (Pleistocene and Pliocene)

Fine-grained white to tan detrital limestone of lagoonal origin containing abundant casts and molds of mollusks, predominantly pelecypods. *GRI Source Map ID 2952* ([PP-403-A](#)).

QTmf - Mariana Limestone, fore-reef facies (Pleistocene and Pliocene)

Well-bedded friable to indurated white foraminiferal limestone deposited as fore-reef sand. *GRI Source Map ID 2952* ([PP-403-A](#)).

QTma - Mariana Limestone, Agana Argillaceous Member (Pleistocene and Pliocene)

Coarse- to fine-grained pale-yellow, tan, or brown fossiliferous detrital limestone containing 2 to 5 percent disseminated clay and as much as 20 percent clay in pockets and cavities; includes undifferentiated lenses of above facies. Formation typically unconformable upon underlying rocks. Maximum aggregate thickness of formation is as much as 500 feet in some cliffs. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tal - Alifan Limestone (Pliocene and Miocene)

Massive coarse- to fine-grained recrystallized limestone, generally pale pink, buff, or white but locally red, yellow, or brown. Characterized by dominance of stick-like *Porites* and *Acropora* and by lone calcite tubes formed by burrowing worms or gastropods. Locally argillaceous above base. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tt - Alifan Limestone, Talisay Member (Pliocene and Miocene)

Yellow, green, and red clay and lenticular clayey conglomerate and lignite; gray to green marl containing stick-like *Porites* and *Acropora*, and interbedded limestone lenses, 2 to 30 feet thick. Generally unconformable with the underlying Umatac or Alutom formations; locally overlies the Bonya limestone. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tj - Janum Formation (Pliocene and Miocene)

Well-bedded white, tan, and brown foraminiferal limestone containing abundant globigerinid Foraminifera. Overlies Bonya limestone in north Guam; generally unconformable with overlying Mariana limestone. Deposits are lenticular and tongue into Barrigada limestone; maximum thickness 70 feet. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tbl - Barrigada Limestone (Pliocene and Miocene)

Massive well-lithified to friable medium- to coarse-grained white foraminiferal limestone characterized by the Foraminifera *Operculina*, *Gypsina*, and *Cycloclypeus*. Corals and mollusks present at top of the formation where it locally grades upward into the Mariana limestone. Unconformable with the Mariana limestone in parts of north Guam. Maximum thickness unknown but exceeds 540 feet. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tb - Bonya Limestone (Miocene)

Pure to argillaceous limestone. In south Guam, generally well bedded coarse grained, and sandy; In north Guam, mainly massive, compact, white foraminiferal limestone. Maximum thickness about 120 feet. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tud - Umatac Formation, Dandan Flow Member (Miocene)

Compact medium- to coarse-grained porphyritic basalt flows separated from the underlying Bolanos pyroclastic member by a flow breccia approximately 10 feet thick; maximum thickness of member 50 feet. Aggregate thickness of formation about 2200 feet. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tub - Umatac Formation, Bolanos Pyroclastic Member (Miocene)

Basal part consists of massive reworked tuff breccia and volcanic conglomerate containing fragments of the Maemong limestone member; upper part consists of tuffaceous sandstone and shale interbedded with minor amounts of conglomerate. This member rests on the Facpi volcanic member in the vicinity of Umatac and interfingers with the Dandan flow member on the eastern slopes of Mount Almagosa. Maximum thickness about 750 feet. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tum - Umatac Formation, Maemong Limestone Member (Miocene)

Reef facies in central Guam consists of compact white recrystallized limestone containing larger Foraminifera and algae, and corals in position of growth; at some places overlain by the Bolanos pyroclastic member. Fore-reef facies in south Guam consists of conglomeratic lenses grading into calcareous tuffs and fine-grained limestone containing abundant globigerinid Foraminifera; forms lenses within the Facpi volcanic member. Maximum thickness 260 feet. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tuf - Umatac Formation, Facpi Volcanic Member (Miocene)

Basal 900 feet made up of pillow basalt with columnar jointed flows cut by dikes; upper 500 feet made up of flows interbedded with tuffaceous shale and sandstone containing lenses of the Maemong limestone member. *GRI Source Map ID 2952* ([PP-403-A](#)).

Tam - Alutom Formation, Mahlac Member (Oligocene and Eocene)

Thin-bedded to laminated friable buff to tan or yellow-tan calcareous foraminiferal shale; maximum known thickness 200 feet. *GRI Source Map ID 2952* ([PP-403-A](#)).

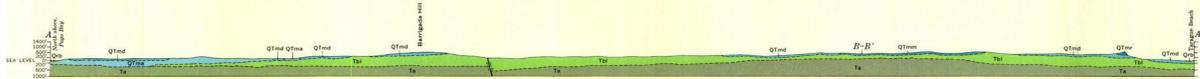
Ta - Alutom Formation (Oligocene and Eocene)

Well-bedded fine- to coarse-grained gray, green, and brown tuffaceous shale and sandstone; lenses of fine- to coarse-grained, tuffaceous foraminiferal limestone; pyroclastic conglomerate containing limestone fragments; interbedded lava flows. Maximum thickness exceeds 2000 feet. *GRI Source Map ID 2952* ([PP-403-A](#)).

Geologic Cross Sections

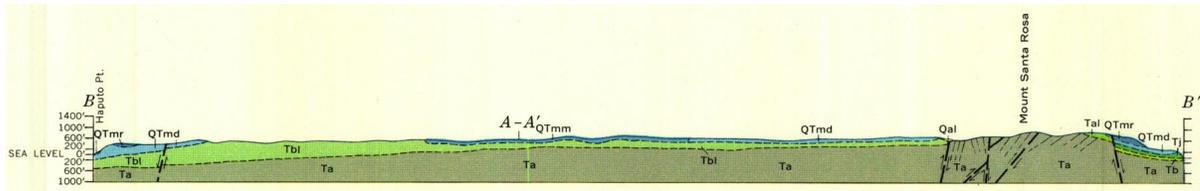
The geologic cross sections present in the GRI digital geologic-GIS data produced for War in the Pacific National Historical Park, Guam (WAPA) are presented below.

Cross Section A-A'



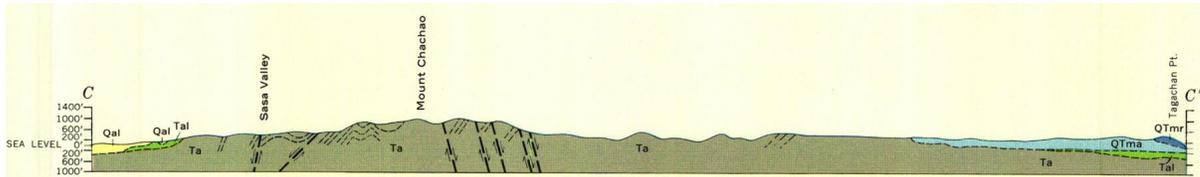
Extracted from: ([PP-403-A Plate 1](#)).

Cross Section B-B'



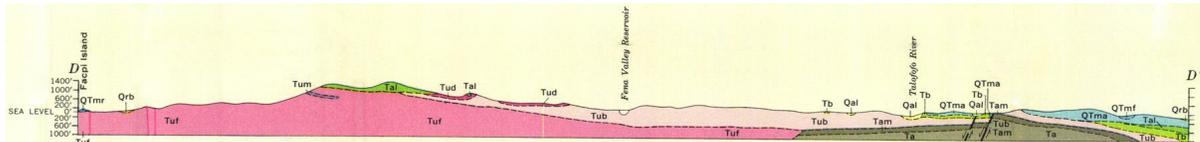
Extracted from: ([PP-403-A Plate 1](#)).

Cross Section C-C'



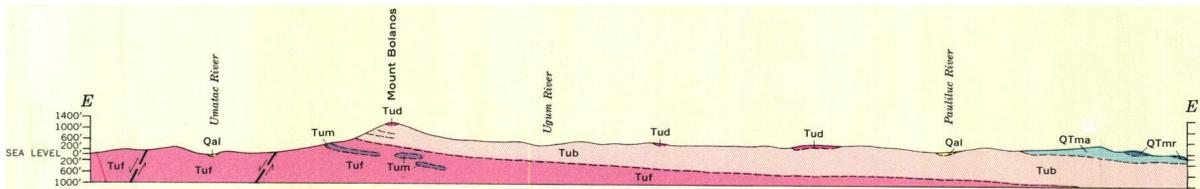
Extracted from: ([PP-403-A Plate 1](#)).

Cross Section D-D'



Extracted from: ([PP-403-A Plate 1](#)).

Cross Section E-E'



Extracted from: ([PP-403-A Plate 1](#)).

GRI Source Map Citations

The GRI digital geologic-GIS map for War in the Pacific National Historical Park, Guam (WAPA) was compiled from the following sources:

Tracey, J.I., Schlanger, S.O., Stark, J.T., Doan, D.B., and May, H.G., 1964, Geologic Map and Sections of Guam, Mariana Islands (plate 1/3) IN General Geology of Guam, U.S. Geological Survey, Professional Paper 403-A, plate 1/3, 1:50000 scale ([PP-403-A Plate 1](#)). (*GRI Source Map 2952*)

Tracey, J.I., Schlanger, S.O., Stark, J.T., Doan, D.B., and May, H.G., 1964, Sample Locality Map of Guam, Mariana Islands (plate 2/3) IN General Geology of Guam, U.S. Geological Survey, Professional Paper 403-A, plate 2/3, 1:50000 scale ([PP-403-A Plate 2](#)). (*GRI Source Map 75027*)

Additional information pertaining to each source map is presented in the Source Map Information (MAP) table included with the GRI geology-GIS data.

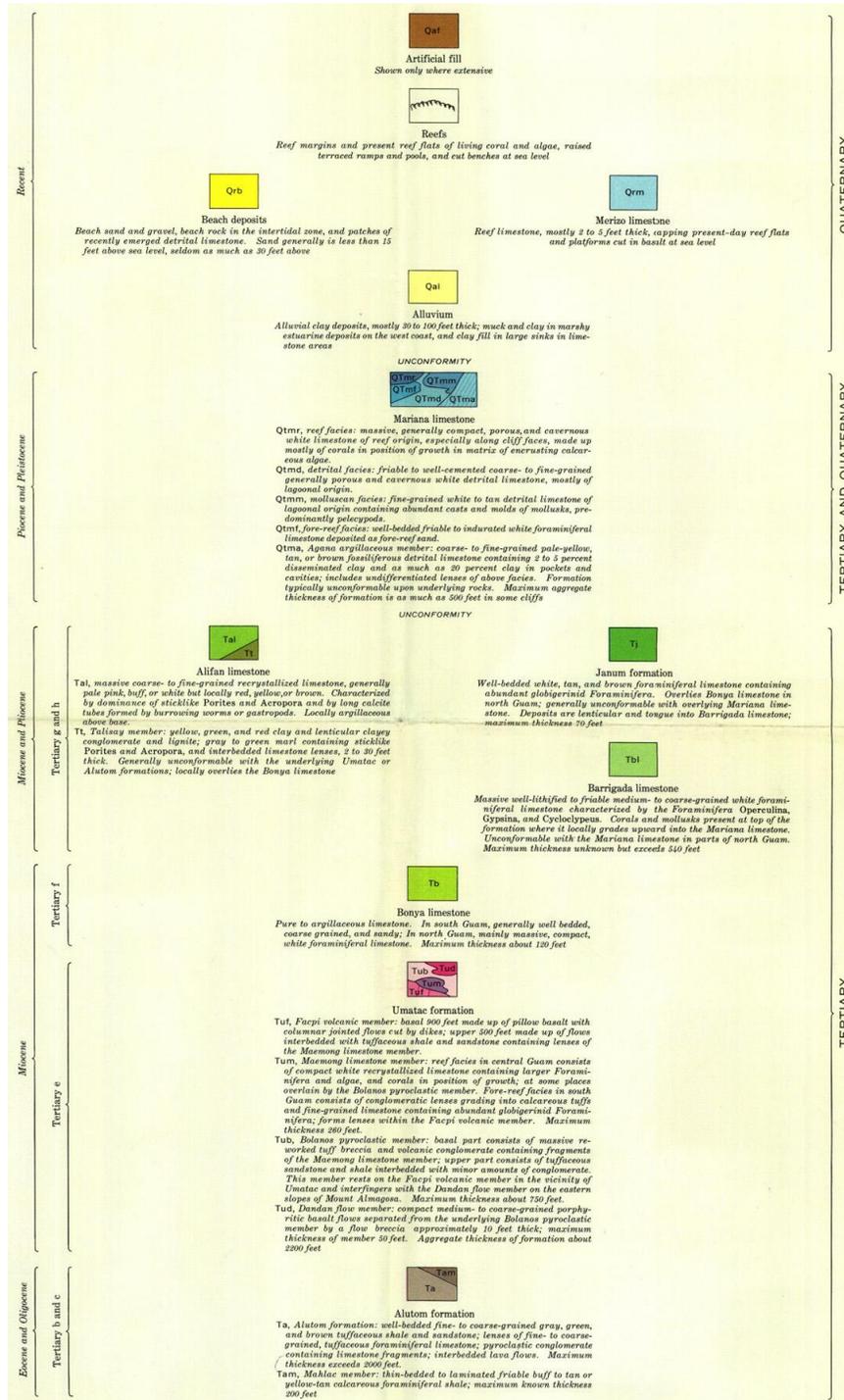
Tracey et al., 1964 (PP-403-A Plate 1)

Tracey, J.I., Schlanger, S.O., Stark, J.T., Doan, D.B., and May, H.G., 1964, Geologic Map and Sections of Guam, Mariana Islands (plate 1/3) IN General geology of Guam, U.S. Geological Survey, Professional Paper 403-A, plate 1/3, 1:50000 scale. (*GRI Source Map 2952*)

Geologic Report

Tracey, J.I., Schlanger, S.O., Stark, J.T., Doan, D.B., and May, H.G., 1964, General Geology of Guam, U.S. Geological Survey, Professional Paper 403-A (report not available in digital format).

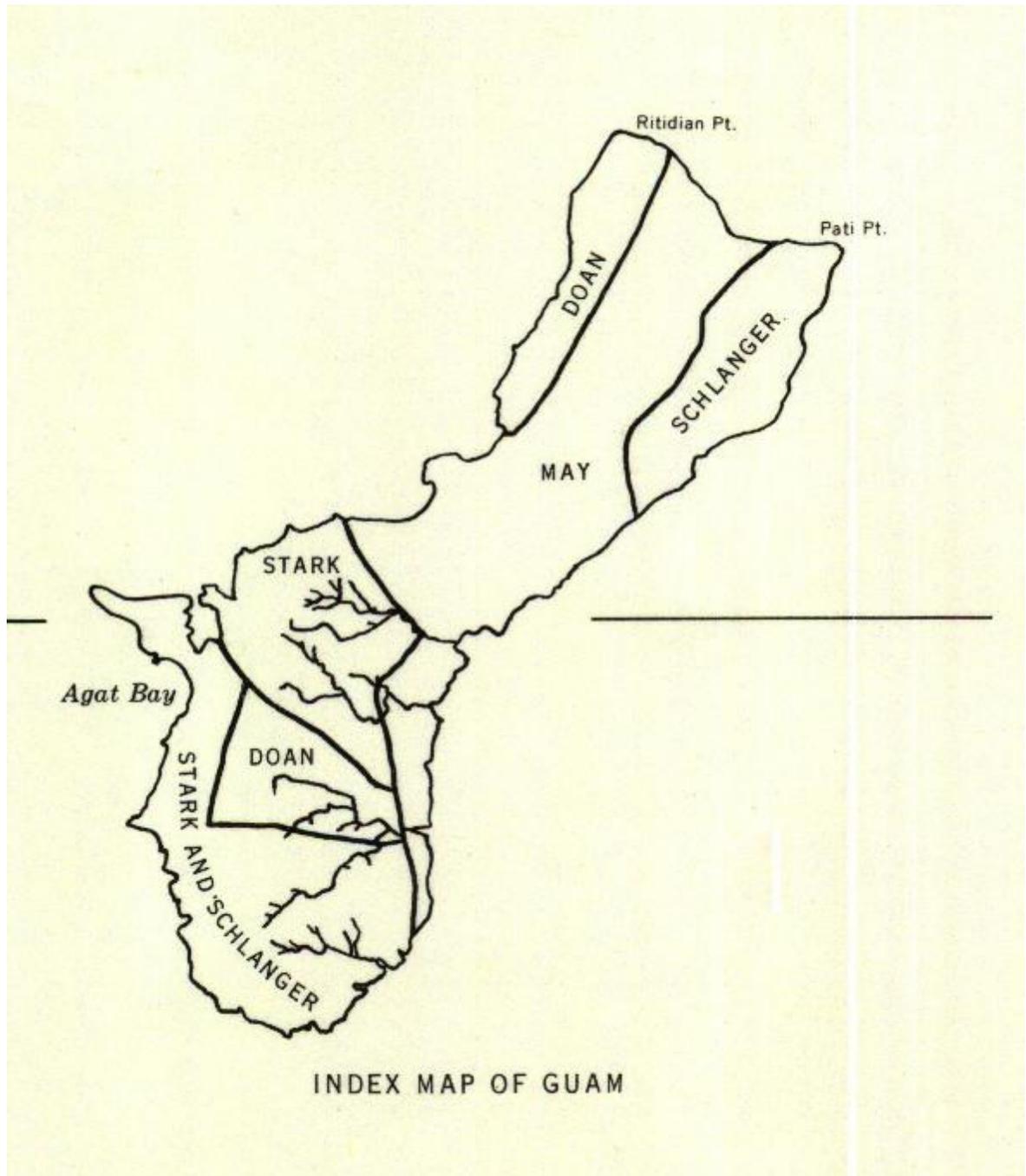
Correlation of Map Units



Extracted from: (PP-403-A Plate 1).

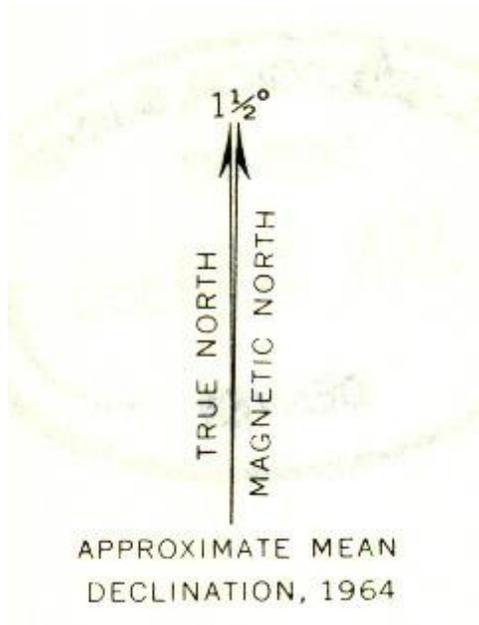
Note: In an effort to sort all geologic units from youngest to oldest, the order of the units presented in this document and in the accompanying GIS data and tables differs from the correlation of map units figure above. Specifically, the sorting is reversed for members of the Umatac and Alutom Formations.

Index Map



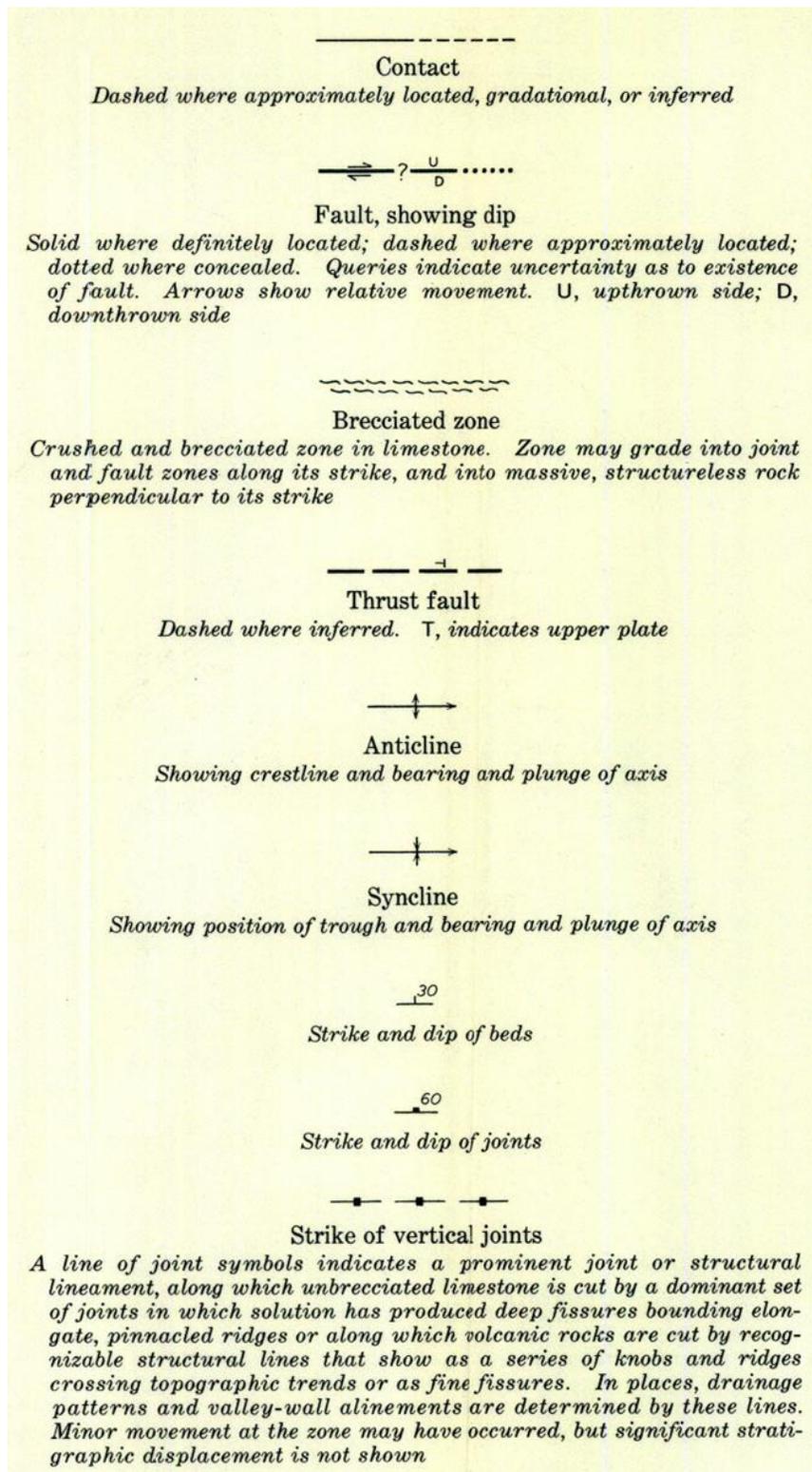
Extracted from: ([PP-403-A Plate 1](#)).

Map Declination



Extracted from: ([PP-403-A Plate 1](#)).

Map Legend



Extracted from: ([PP-403-A Plate 1](#)).

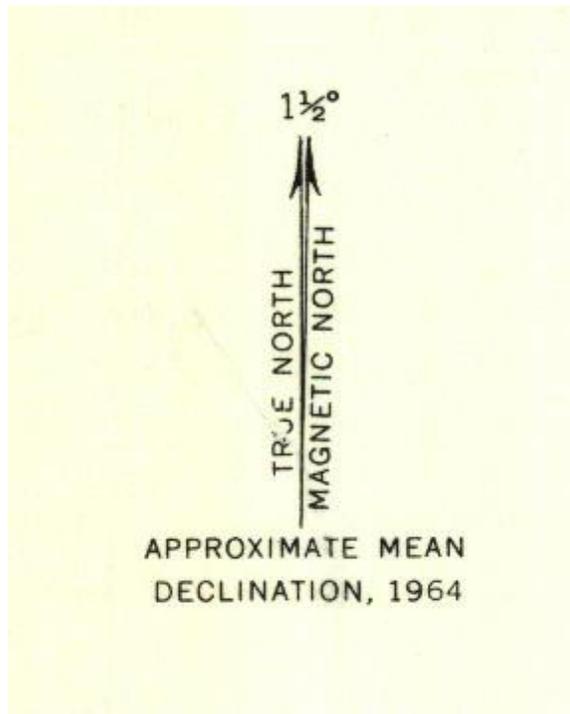
Tracey et al., 1964 (PP-403-A Plate 2)

Tracey, J.I., Schlanger, S.O., Stark, J.T., Doan, D.B., and May, H.G., 1964, Sample Locality Map of Guam, Mariana Islands (plate 2 / 3) IN General geology of Guam, U.S. Geological Survey, Professional Paper 403-A, plate 2/3, 1:50000 scale. (*GRI Source Map 75027*)

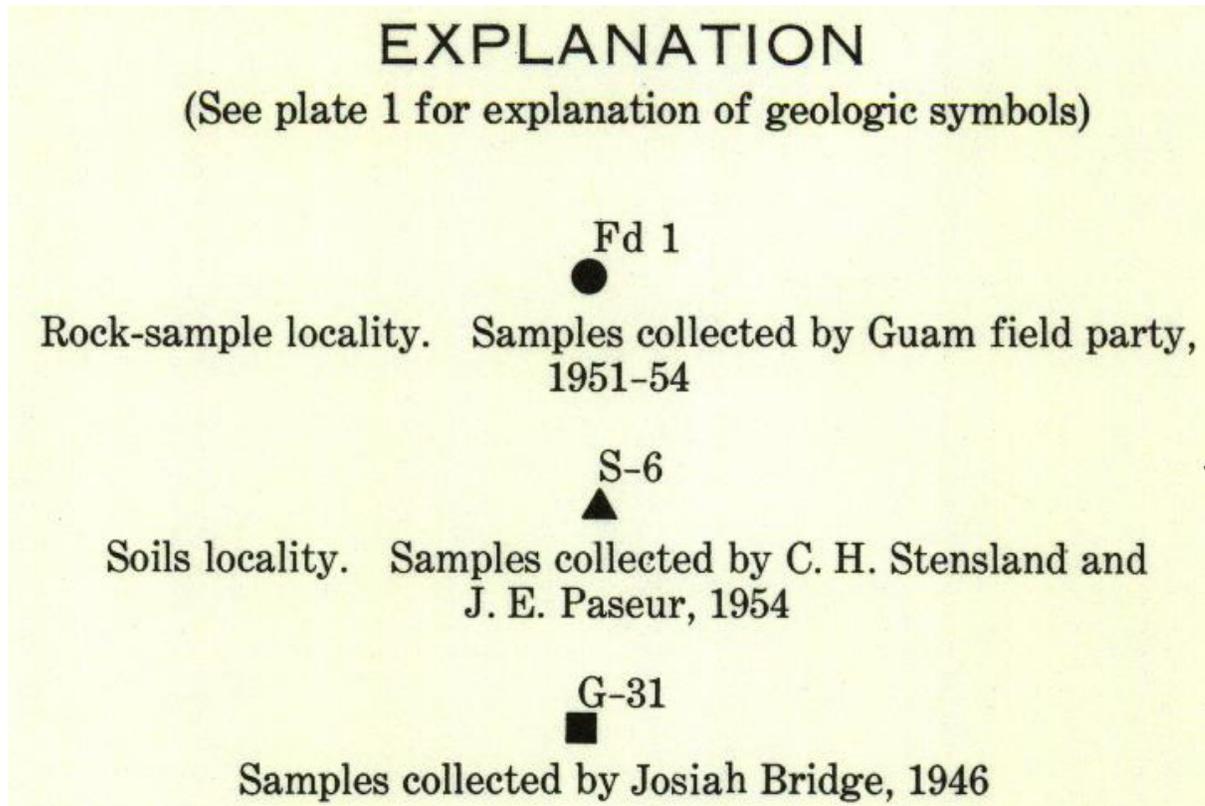
Geologic Report

Tracey, J.I., Schlanger, S.O., Stark, J.T., Doan, D.B., and May, H.G., 1964, General Geology of Guam, U.S. Geological Survey, Professional Paper 403-A (report not available in digital format).

Map Declination



Extracted from: ([PP-403-A Plate 2](#)).

Map Legend

Extracted from: ([PP-403-A Plate 2](#)).

Geologic Samples

SAMPLE LOCALITIES ON GUAM								
(Chapters refer to Professional Paper 403)								
SAMPLE	FORMATION	CHAPTER	SAMPLE	FORMATION	CHAPTER	SAMPLE	FORMATION	CHAPTER
Ch 3	Ta	F	Hi 12	Tum	E, G	Sx 1	QTrmr	D
Ch 4	Tuf	C, E	Hj 1	Ta	A, D, E	Sx 2	QTmd	D
Ch 8	Qmm	E	Hn 5	Ta	G	Ts 2	Tb	D, E
Cm 3	QTrmr	E	Hn 7	Ta	G	Ts 5	Tj	A, D, E, F
Cm 4	QTrmr	E	Id 2	Tum, Tub	E	Ts 9	Tal	D, E, F, G
Cn 1	Tal	A, E	Ie 2	Tuf	C, F	Ts 16	Tal	A, D, E, G
Df 2	Tuf	C, F	Ie 3	Tud	C, F	Tt 7	Tal	D, E, G
Df 9	Tum	A, D, F	If 6	Tud	A, C, F	Tw 7	QTrmr	D
Dh 6	Tuf	C, F	Ig 7	Tal	E	Tw 8	QTmd	D
Dh 11	Tum	A, D, E	Ig 8	Tal	A, E	Ue 6	Tb	D, F
Dh 12	Tal	D	Ig 9	Tal	E	Uu 1	Tj	A, D, G
Dh 13	Tal	D	Ig 10	QTma	A	Uu 3	QTrmf	A, D, E
Di 1	Ta, Tal	A, E	Ih 5	Tb	D, E, G	GMH 1	QTrmr	G
Di 2	Tal	A, D, E, F, G	Ih 10	Tb	D, E	GMH 3	QTrmr	G
Ed 1	Tum, Tub	D, F	Ih 11	Tal	E	GMH 7	QTrmr	G
Ed 3	Tum	D, E, G	Ih 12	Tal	A, E	GMH 11	QTrmr	G
Ed 4	Tum	D, E, G	Ih 14	Tb	D, E, G			
Ed 5	Tum	D, E, G	Ii 5	Tum	D, E, F			
Ed 6	Tum	D, E	Ii 6	Tum, Tub	D, E, G			
Ed 7	Tum	D, E	Ii 8	Ta, Tub	D, E			
Ee 2	Tum	D, F	Ii 9	Tum, Tub	E			
Ee 4	Tum, Tuf	A, C, D, E, F	Ij 2	QTma	A, D, F			
Ee 6	Tum	D	Im 1	QTma	A, E			
Ee 7	Tum	D, E	Jh 1	QTrmf	A, D, E			
Ee 8	Tum	D, E	Ji 1	QTrmf	A, E, G			
Ef 1	Tum, Tub	D, F	Jj 1	Tb	S-54-5			
Ef 2	Tum	A, D, E, G	Jj 3	Tb	S-54-6			
Eh 1	Tal, Tuf	A	Jj 5	Tb	S-54-10			
Eh 2	Tum, Tub	E	Jj 6	QTmd	S-54-12			
Eh 3	Tal	D, E, G	Jj 8	Tb, Tal	S-54-16			
Ej 1	Ta	A, E	Jj 9	Tb	S-54-17			
Ej 3	Tal	D	Jj 12	Ta, Tal	S-54-18			
Ej 4	Tal	D	Jj 13	Tal	S-54-19			
Ek 6	Tal	A	Jm 1	Ta	S-54-20			
Ek 7	Ta	A, D, E, G	Jm 1	Ta	S-54-21			
Fd 1	Tum, Tub	E, G	Kr 2	QTrmr	D			
Fd 2	Tal	A, C, F	Kr 3	QTrmr	A, F			
Fd 3	Tum	D	Np 1	Tbi	E			
Fd 4	Tum	D, E, G	Np 2	Tbi	E			
Fd 5	Tum	D	Nq 2	Tbi	E			
Ff 3	Tb	E, G	Nq 14	Tbi	E			
Ff 4	Tum, Tub	E	Nq 15	Tbi	A, F			
Ff 5	Tb, Tuf	A, D, E, G	Nr 1	Tbi	D, E			
Ff 6	Tum, Tub	E, G	Oq 1	Tbi	E, G			
Ff 7	Tum, Tub	E, G	Oq 2	Tbi	E			
Ff 8	Tal	A	Os 1	Tbi	E			
Ff 9	Tal	A, E	Os 1	Tbi	E			
Ff 10	Tal	A, F	Os 6	Tbi	E			
Ff 11	Ta	A, F	Ov 4	Tbi	D, E			
Ff 12	Ta	A, E	Ov 5	Tbi	E			
Ff 13	Ta	F	Ov 6	QTrmf	Tb			
Ff 14	Ta	A, E, F	Ov 7	QTrmf	A, D, E, G			
Ff 15	Ta	F	Po 1	QTmd	D			
Ff 16	Ta	C, F	Pr 2	Tbi	A, D, F			
Ff 17	Tal	E	Pr 3	QTmd	E			
Ff 18	Tum	E, G	Pv 7	Tbi	E			
Ff 19	Tb	D, E, G	Pv 9	Tbi	D, E			
Ff 20	Tb	A	Pv 10	Tbi	D, E			
Ff 21	Tb	D, E, G	Px 5	QTmm	A			
Ff 22	Tal	E	Qr 1	Tbi	E			
Ff 23	Tum	E, G	Qr 4	QTmm	A, D			
Ff 24	Tum, Tub	E, G	Qx 5	QTmd	A			
Ff 25	Tb	D, E	Rr 2	Tj	D			
Ff 26	Tb, Tal, Tat	A, D, E	Rr 3	Tj	D			
Ff 27	Tb	A, E	Rr 5	Tj	D, F			
Ff 28	Tal	A, E, G	Rr 8	Tj	D			
Ff 29	Tal	A, D, E, F	Rr 9	Tj	D			
Ff 30	Tum	A	Rr 13	Tb	A, D, E, F			
Ff 31	Tum	A	Rr 14	Tj	A, D			
Ff 32	Tum	A, D	Rr 15	Tj	A			
Ff 33	Tal	A	Rr 16	QTmm	D			
Ff 34	Tal	A	Rr 19	Tb	D			
Ff 35	Ta	C, F	Rr 20	Tb	D			
Ff 36	Ta	A, F	Rr 23	Tj	D, F			
Ff 37	Ta	F	Ra 1	Tal	A, E			
Ff 38	Ta	F	Ra 8	QTmd	D, F			
Ff 39	Ta	C, F	Ra 7	QTmd	D			
Ff 40	Ta	A, F	Ra 8	Tub	G			
Ff 41	Ta	C, F	Ra 17	QTmd	D			
Ff 42	Ta	C, F	Ra 18	QTrmr	D			
Ff 43	Ta	C, F	Ra 19	QTrmr	D			
Ff 44	Ta	A	Ra 20	QTrnr	D			
Ff 45	Ta	A	Ra 21	QTrnr	D			
Ff 46	Tud	A	Sa 9	Ta	C, F			
Ff 47	Tb	E	St 8	Tbi	D, E			
Ff 48	Tum	D, E, G	St 34	Tbi	E			
Ff 49	Tum	D, E	Sv 1	Tbi	E			
Ff 50	Tum	D, E, G	Sv 3	Tbi	E			
Ff 51	Ta	A, E	Sv 4	Tbi	E			
Ff 52	Tum	D	Sv 5	Tbi	A, D, E			
Ff 53	Tum	E, G	Sv 5	Tbi	A, D, E			
Ff 54	Tum	E	Sv 2	QTmd	D, F			

SOIL SAMPLES		
SAMPLE	MAP SYMBOL	CHAPTER
S-54-1	S-1	F
S-54-4	S-4	F
S-54-5	S-5	F, F
S-54-6	S-6	F
S-54-10	S-10	F
S-54-12	S-12	F
S-54-16	S-16	A, F
S-54-17	S-17	A, F
S-54-18	S-18	A, F
S-54-19	S-19	A, F
S-54-20	S-20	F
S-54-21	S-21	F
S-54-23	S-23	A, F
S-54-24	S-24	A, F
G-13		A
G-14		A
G-16		A
G-17		A
G-28		A
G-31		A

STRATIGRAPHIC DISTRIBUTION OF LOCALITIES	
Merizo limestone, Qrm	Ch 8
Mariana limestone, QTrmf	Jh 1, Ji 1, Ov 6, Uu 3
Mariana limestone, QTrmr	Cm 3, Cm 4, Kr 2, Kr 3, Rx 18, Rx 19, Rx 20, Rx 21, Sx 1, Tw 7, GMH 1, GMH 3, GMH 7, GMH 11
Mariana limestone, QTmd	Jj 6, Po 1, Pr 3, Qx 5, Ru 8, Rx 7, Rx 17, Sw 2, Sx 2, Tw 8
Mariana limestone, QTmm	Px 5, Qu 4, Rr 16
Mariana limestone, QTma	Ig 10 Ij 2
Barrigada limestone, Tbi	Np 1, Np 2, Nq 2, Nq 14, Nq 15, Nr 1, Oq 1, Oq 2, Os 1, Ot 1, Ov 4, Ov 5, Ov 7, Pr 2, Pv 7, Pv 9, Pv 10, Qr 1, St 8, St 34, Sv 1, Sv 3, Sv 4, Sv 5
Janum formation, Tj	Rr 2, Rr 3, Rr 5, Rr 8, Rr 9, Rr 14, Rr 15, Rr 23, Ts 5, Uu 1
Alifan limestone, Tal	Cn 1, Dh 12, Dh 13, Di 1, Di 2, Eh 1, Eh 3, Ej 3, Ej 4, Ek 6, Gj 2, Gj 8, Gj 10, Gj 11, Gj 12, Ig 7, Ig 8, Ig 9, Ih 11, Ih 12, Jj 8, Jj 2, Jj 3, Rs 1, Ts 9, Ts 16, Tt 7
Alifan formation, Tt	Fj 4, Fj 5, Fj 7, Gj 8
Bonya limestone, Tb	Fi 3, Fi 5, Gi 2, Gi 4, Gi 6, Gj 1, Gj 6, Gj 7, Gj 8, Gj 9, Hi 2, Ih 5, Ih 10, Ih 14, Jj 1, Jj 3, Jj 5, Jj 8, Jj 9, Rr 13, Rr 19, Rr 20, Ts 2, Ut 6
Umatac formation, Tud	Eh 1, Fi 5, Hf 3, Ie 3, If 6
Umatac formation, Tub	Ed 1, Ef 1, Eh 2, Fd 1, Fi 4, Fi 6, Fj 2, Gi 1, Gj 4, Id 2, Ii 6, Ii 8, Ii 9, Rx 8
Umatac formation, Tum	Df 9, Dh 11, Ed 1, Ed 3, Ed 4, Ed 5, Ed 6, Ed 7, Ee 2, Ee 4, Ee 6, Ee 7, Ee 8, Ef 1, Ef 2, Eh 2, Fd 1, Fd 3, Fd 4, Fd 5, Fi 4, Fi 6, Fj 2, Gi 1, Gj 3, Gj 4, Hi 3, Hi 4, Hi 5, Hi 7, Hi 10, Hi 11, Hi 12, Id 2, Ii 5, Ii 6, Ji 9
Umatac formation, Tuf	Ch 4, Df 2, Dh 6, Ee 4, Fd 2, Ie 2
Alutom formation, Te	Ch 3, Di 1, Ej 1, Ek 7, Fk 3, Fk 4, Fk 5, Fm 2, Fm 2, Fo 6, Fo 10, Gm 1, Gm 5, Gm 9, Gm 21, Gm 25, Gm 33, Go 6, Go 7, Go 10, Go 12, Hi 6, Hj 1, Hn 5, Hn 7, Hn 8, Im 1, Ji 2, Jm 1, Ss 9
Alutom formation, Tam	Gj 11, Gj 13, Gj 14, Gj 15

Extracted from: [\(PP-403-A Plate 2\)](#).

Note: In several instances, the formation listed in the sample locality table does not correspond with the unit that the locality falls within on the geologic map.

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This document was developed and completed by Ron Karpilo (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory (GRI) Program. Quality control (QC) of this document by Stephanie O'Meara (Colorado State University)

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