



## OFFICE MEMORANDUM

DATE: January 21, 1981

TO: L. T. Oehler  
Engineer of Research

FROM: R. W. Muethel

SUBJECT: Petrographic Analysis of Coarse Aggregate: Salem Gr. Construction Co. Pit No. 63-56 (Testing Laboratory Sample Nos. 80 A-1089, 1090, 1092, and 1093). Research Report No. R-1159

This report presents the results of petrographic analysis conducted on four samples of combined crushed and natural gravel obtained from the Salem Gr. Construction Co. Pit No. 63-56, location east 1/2 of northeast, Section 2, T4N, R9E, Oakland County. The material was obtained by the Testing Laboratory Section for special freeze-thaw tests. The samples were prepared in the Testing Laboratory Section as follows:

80 A-1089 -- 1979 production as received

80 A-1090 -- 1979 production, chert and cherty carbonates removed

80 A-1092 -- 1979 production, chert removed

80 A-1093 -- 1980 production as received.

Chert and cherty carbonates reportedly were not removed from the 3/8-in. to No. 4 fraction of the two altered samples.

Petrographic analysis of a portion of each sample was requested by G. H. Gallup.

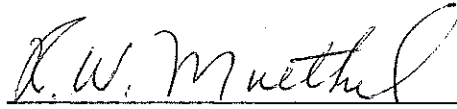
Detailed tabulations of petrographic composition, specific gravity, and absorption are included in Tables 1 through 8.

### Detailed Petrography

Petrographic examination was conducted in general conformance with ASTM C 295, "Petrographic Examination of Aggregates for Concrete." Representative portions—300 particles—of the noted fractions of each sample were identified megascopically along with acid testing and a scratch test for hardness, and microscopically with a stereomicroscope. Specific gravity and absorption determinations were performed in general accordance with ASTM C 127, "Specific Gravity and Absorption of Coarse Aggregate."

Determinations included all material of the rock types analyzed. Composite descriptions of the lithologies contained in the four samples are included in the pages following the tabulations.

TESTING AND RESEARCH DIVISION



Geologist - Petrography and Hydrology Group

RWM:bt

TABLE 1  
 PETROGRAPHIC COMPOSITION  
 Testing Laboratory Sample No. 80 A-1089

Rock Type	Sieve Fraction Analyzed				Computed Sample Composition
	1 to 3/4-in.	3/4 to 1/2-in.	1/2 to 3/8-in.	3/8 to No. 4	
Granite	10.3	7.7	7.7	8.3	8.5
Diorite	2.3	2.0	0.3	1.3	1.5
Gabbro	10.6	7.6	7.7	5.0	7.7
Basalt	1.7	3.0	3.7	2.0	2.6
Felsite	1.7	2.0	1.3	---	1.3
Quartzite	14.0	15.3	11.7	11.0	13.0
Metasediments	4.7	2.7	2.7	2.7	3.2
Tillite	2.0	3.3	3.3	2.7	2.8
Limestone	11.6	10.7	13.7	15.6	12.9
Argillaceous to Porous Limestone	1.7	2.7	1.0	0.7	1.5
Cherty Limestone	5.0	3.7	7.7	5.6	5.5
Dolomitic Limestone	2.7	2.3	1.3	1.7	2.0
Dolomite	19.0	24.4	23.7	19.3	21.6
Argillaceous to Porous Dolomite	2.3	2.3	2.0	1.7	2.1
Cherty Dolomite	3.0	4.3	2.3	5.3	3.7
Crag	---	---	0.3	0.7	0.2
Sandstone	1.3	1.7	2.3	2.0	1.8
Siltstone	2.7	1.3	2.3	2.7	2.2
Shale	---	---	0.3	---	0.1
Clay Ironstone	---	---	---	0.7	0.2
Porous Chert	2.7	2.7	4.4	8.0	4.5
Dense Chert	0.7	0.3	0.3	3.0	1.1
Totals, percent	100.0	100.0	100.0	100.0	100.0

NOTE: Computed sample composition is based upon counts of 300 particles contained in each of the sieve fractions noted.

TABLE 2  
 SPECIFIC GRAVITY AND ABSORPTION DATA  
 Testing Laboratory Sample No. 80 A-1089

Rock Type	Specific Gravity			Absorption, percent	Composition, percent by weight
	Bulk, dry	Bulk, ssd	Apparent		
Granite	2.66	2.67	2.68	0.35	8.8
Diorite	2.81	2.82	2.83	0.27	2.2
Gabbro	2.95	2.96	2.98	0.30	10.1
Basalt	2.90	2.91	2.92	0.18	3.0
Felsite	2.84	2.84	2.86	0.22	0.9
Quartzite	2.64	2.65	2.66	0.30	13.0
Metasediments	2.71	2.72	2.73	0.22	4.1
Tillite	2.74	2.74	2.75	0.12	2.7
Limestone	2.66	2.67	2.70	0.57	12.7
Argillaceous to Porous Limestone	2.58	2.62	2.70	1.70	1.8
Cherty Limestone	2.59	2.62	2.68	1.24	5.1
Dolomitic Limestone	2.63	2.68	2.76	1.84	2.6
Dolomite	2.75	2.77	2.81	0.74	21.7
Argillaceous to Porous Dolomite	2.58	2.63	2.71	1.91	1.9
Cherty Dolomite	2.59	2.63	2.71	1.76	3.2
Crag	2.55	2.61	2.70	2.14	0.1
Sandstone	2.50	2.55	2.65	2.34	1.4
Siltstone	2.23	2.41	2.71	7.95	1.8
Shale	2.50	2.54	2.61	1.74	TR
Clay Ironstone	2.74	2.95	3.47	7.69	TR
Porous Chert	2.40	2.49	2.63	3.68	2.4
Dense Chert	2.55	2.57	2.60	0.79	0.5
Total Sample	2.69	2.71	2.75	0.87	100.0

NOTE: Values are computed from determinations made on all sample material contained in the categories noted.

TABLE 3  
 PETROGRAPHIC COMPOSITION  
 Testing Laboratory Sample No. 80 A-1090

Rock Type	Sieve Fraction Analyzed				Computed Sample Composition
	1 to 3/4-in.	3/4 to 1/2-in.	1/2 to 3/8-in.	3/8 to No. 4	
Granite	9.3	5.4	8.3	6.3	7.3
Diorite	1.0	2.0	0.3	1.3	1.2
Gabbro	10.0	7.4	6.7	5.3	7.3
Basalt	5.0	3.0	3.0	1.3	3.1
Felsite	1.7	2.3	1.3	0.7	1.5
Quartzite	16.4	18.4	16.7	14.7	16.5
Metasediments	3.3	4.3	3.0	3.3	3.5
Tillite	2.7	3.3	2.3	1.7	2.5
Schist	---	---	0.3	0.3	0.2
Limestone	12.7	11.7	17.7	20.7	15.7
Argillaceous to Porous Limestone	2.0	1.7	2.3	0.7	1.7
Cherty Limestone	---	0.3	0.7	2.3	0.8
Dolomitic Limestone	3.0	4.3	2.7	1.7	2.9
Dolomite	25.0	26.7	25.3	20.4	24.3
Argillaceous to Porous Dolomite	4.3	2.3	1.7	2.7	2.8
Cherty Dolomite	---	---	1.0	3.0	1.0
Crag	---	0.3	---	---	0.1
Sandstone	2.3	2.7	3.7	3.7	3.1
Siltstone	1.0	3.3	2.0	2.3	2.1
Shale	---	---	0.7	---	0.2
Clay Ironstone	---	---	---	0.3	0.1
Porous Chert	---	---	---	5.3	1.3
Dense Chert	---	0.3	0.3	1.0	0.4
Siliceous Fossils	0.3	0.3	---	1.0	0.4
Totals, percent	100.0	100.0	100.0	100.0	100.0

NOTE: Computed sample composition is based upon counts of 300 particles contained in each of the sieve fractions noted.

TABLE 4  
 SPECIFIC GRAVITY AND ABSORPTION DATA  
 Testing Laboratory Sample No. 80 A-1090

Rock Type	Specific Gravity			Absorption, percent	Composition, percent by weight
	Bulk, dry	Bulk, ssd	Apparent		
Granite	2.64	2.65	2.67	0.30	7.2
Diorite	2.88	2.88	2.89	0.14	1.5
Gabbro	2.93	2.94	2.95	0.27	10.0
Basalt	2.90	2.91	2.92	0.15	4.2
Felsite	2.79	2.79	2.80	0.11	2.0
Quartzite	2.64	2.65	2.66	0.28	15.6
Metasediments	2.73	2.73	2.74	0.13	3.3
Tillite	2.74	2.74	2.75	0.09	2.5
Schist	2.76	2.79	2.86	1.33	TR
Limestone	2.65	2.67	2.70	0.68	12.9
Argillaceous to Porous Limestone	2.56	2.61	2.70	2.09	1.9
Cherty Limestone	2.54	2.59	2.67	1.96	0.2
Dolomitic Limestone	2.59	2.63	2.70	1.55	3.1
Dolomite	2.75	2.77	2.81	0.83	27.2
Argillaceous to Porous Dolomite	2.59	2.65	2.75	2.32	3.5
Cherty Dolomite	2.60	2.64	2.71	1.55	0.3
Crag	2.62	2.66	2.72	1.49	0.1
Sandstone	2.33	2.42	2.57	4.00	2.2
Siltstone	2.43	2.54	2.74	4.54	1.4
Shale	2.15	2.29	2.51	6.69	TR
Clay Ironstone	2.65	2.90	3.53	9.43	0.1
Porous Chert	2.32	2.43	2.62	5.03	0.2
Dense Chert	2.50	2.53	2.58	1.20	0.1
Siliceous Fossils	2.63	2.64	2.66	0.35	0.5
Total Sample	2.70	2.72	2.76	0.77	100.0

NOTE: Values are computed from determinations made on all sample material contained in the categories noted.

TABLE 5  
 PETROGRAPHIC COMPOSITION  
 Testing Laboratory Sample No. 80 A-1092

Rock Type	Sieve Fraction Analyzed				Computed Sample Composition
	1 to 3/4-in.	3/4 to 1/2-in.	1/2 to 3/8-in.	3/8 to No. 4	
Granite	9.7	6.7	6.7	7.0	7.5
Diorite	0.7	1.3	0.3	1.3	0.9
Gabbro	6.7	8.0	4.7	5.7	6.3
Basalt	2.0	3.3	2.3	2.0	2.4
Felsite	2.0	1.3	0.3	1.7	1.3
Quartzite	18.3	13.3	13.3	11.4	14.1
Metasediments	5.3	4.0	2.0	1.0	3.1
Tillite	3.7	1.7	2.3	2.3	2.5
Schist	---	---	0.7	0.3	0.2
Limestone	10.0	9.3	15.0	12.4	11.6
Argillaceous to Porous Limestone	2.7	2.0	1.7	4.3	2.7
Cherty Limestone	5.0	3.0	5.3	6.0	4.8
Dolomitic Limestone	2.0	2.3	2.3	1.7	2.1
Dolomite	20.6	26.7	23.0	18.0	22.1
Argillaceous to Porous Dolomite	3.3	4.0	5.3	5.0	4.4
Cherty Dolomite	4.3	5.7	6.7	6.0	5.7
Sandstone	2.7	4.0	4.0	4.0	3.6
Siltstone	1.0	2.0	1.7	1.3	1.5
Shale	---	---	0.3	---	0.1
Clay Ironstone	---	---	---	0.3	0.1
Porous Chert	---	---	0.7	7.3	2.0
Dense Chert	---	0.7	0.7	1.0	0.6
Siliceous Fossils	---	0.7	0.7	---	0.4
Totals, percent	100.0	100.0	100.0	100.0	100.0

NOTE: Computed sample composition is based upon counts of 300 particles contained in each of the sieve fractions noted.

TABLE 6  
 SPECIFIC GRAVITY AND ABSORPTION DATA  
 Testing Laboratory Sample No. 80 A-1092

Rock Type	Specific Gravity			Absorption, percent	Composition, percent by weight
	Bulk, dry	Bulk, ssd	Apparent		
Granite	2.66	2.67	2.69	0.39	8.2
Diorite	2.86	2.87	2.89	0.35	0.8
Gabbro	2.96	2.97	2.98	0.29	7.5
Basalt	2.94	2.95	2.96	0.29	2.6
Felsite	2.80	2.81	2.82	0.33	1.6
Quartzite	2.64	2.65	2.66	0.28	15.5
Metasediments	2.71	2.72	2.74	0.37	4.6
Tillite	2.73	2.73	2.74	0.14	2.8
Schist	2.65	2.66	2.67	0.22	0.1
Limestone	2.67	2.68	2.70	0.49	10.4
Argillaceous to Porous Limestone	2.61	2.65	2.70	1.28	2.6
Cherty Limestone	2.57	2.61	2.68	1.63	5.0
Dolomitic Limestone	2.55	2.62	2.73	2.65	1.7
Dolomite	2.76	2.78	2.82	0.73	24.0
Argillaceous to Porous Dolomite	2.60	2.66	2.77	2.40	3.4
Cherty Dolomite	2.52	2.60	2.72	2.89	4.6
Sandstone	2.38	2.47	2.62	3.89	2.8
Siltstone	2.22	2.41	2.75	8.66	1.1
Shale	2.22	2.34	2.52	5.26	TR
Clay Ironstone	2.58	2.78	3.22	7.77	TR
Porous Chert	2.39	2.48	2.63	3.87	0.3
Dense Chert	2.58	2.59	2.62	0.59	0.2
Siliceous Fossils	2.54	2.57	2.63	1.38	0.2
Total Sample	2.68	2.71	2.75	0.96	100.0

NOTE: Values are computed from determinations made on all sample material contained in the categories noted.



TABLE 7  
 PETROGRAPHIC COMPOSITION  
 Testing Laboratory Sample No. 80 A-1093

Rock Type	Sieve Fraction Analyzed				Computed Sample Composition
	1 to 3/4-in.	3/4 to 1/2-in.	1/2 to 3/8-in.	3/8 to No. 4	
Granite	9.6	4.4	6.0	9.0	7.2
Diorite	2.7	1.0	1.7	2.3	1.9
Gabbro	12.0	8.0	6.0	5.0	7.8
Basalt	4.3	1.7	3.3	3.3	3.2
Felsite	2.7	0.7	1.0	1.7	1.5
Quartzite	15.0	14.7	13.0	11.6	13.6
Metasediments	3.0	4.3	1.7	4.7	3.4
Tillite	2.0	3.3	4.7	1.7	2.9
Schist	0.3	---	---	---	0.1
Limestone	8.0	12.0	15.7	14.3	12.5
Argillaceous to Porous Limestone	1.0	4.0	2.0	2.3	2.3
Cherty Limestone	1.3	5.0	2.3	4.3	3.2
Dolomitic Limestone	1.3	3.0	2.3	2.0	2.2
Dolomite	20.3	23.3	21.4	17.3	20.5
Argillaceous to Porous Dolomite	3.7	4.3	5.3	4.0	4.3
Cherty Dolomite	5.7	2.0	2.3	2.3	3.1
Sandstone	1.7	3.0	2.3	0.7	1.9
Siltstone	2.0	1.3	1.0	1.3	1.4
Shale	---	---	0.3	0.3	0.2
Porous Chert	2.7	3.0	5.7	9.3	5.2
Dense Chert	0.7	0.3	2.0	1.7	1.2
Siliceous Fossils	---	0.7	---	0.7	0.4
Totals, percent	100.0	100.0	100.0	100.0	100.0

NOTE: Computed sample composition is based upon counts of 300 particles contained in each of the sieve fractions noted.

TABLE 8  
 SPECIFIC GRAVITY AND ABSORPTION DATA  
 Testing Laboratory Sample No. 80 A-1093

Rock Type	Specific Gravity			Absorption, percent	Composition, percent by weight
	Bulk, dry	Bulk, ssd	Apparent		
Granite	2.64	2.65	2.66	0.30	7.2
Diorite	2.88	2.88	2.89	0.19	1.9
Gabbro	2.95	2.96	2.97	0.21	7.8
Basalt	2.85	2.86	2.87	0.15	3.2
Felsite	2.78	2.79	2.80	0.16	1.5
Quartzite	2.64	2.65	2.66	0.26	13.6
Metasediments	2.70	2.71	2.72	0.21	3.4
Tillite	2.73	2.73	2.74	0.11	2.9
Schist	2.74	2.74	2.76	0.31	0.1
Limestone	2.67	2.69	2.71	0.44	12.5
Argillaceous to Porous Limestone	2.60	2.64	2.72	1.72	2.3
Cherty Limestone	2.61	2.64	2.69	1.09	3.2
Dolomitic Limestone	2.64	2.69	2.78	1.89	2.2
Dolomite	2.77	2.78	2.82	0.65	20.5
Argillaceous to Porous Dolomite	2.64	2.69	2.78	1.90	4.3
Cherty Dolomite	2.58	2.63	2.72	1.91	3.1
Sandstone	2.43	2.51	2.65	3.50	1.9
Siltstone	2.42	2.55	2.79	5.48	1.4
Shale	2.22	2.36	2.58	6.21	0.2
Porous Chert	2.46	2.53	2.64	2.70	5.2
Dense Chert	2.59	2.61	2.63	0.54	1.2
Siliceous Fossils	2.68	2.69	2.72	0.57	0.4
Total Sample	2.70	2.72	2.76	0.79	100.0

NOTE: Values are computed from determinations made on all sample material contained in the categories noted.

IGNEOUS ROCKS

Rock Type	Granite	Diorite	Gabbro
Color	mottled pink, buff to white, and dark green to black; mottled buff to white and black; and mottled buff and white	mottled buff to white, and dark green to black	mottled white to gray, and dark green to black; and mottled white, yellowish brown, and black
Texture	medium to very fine grained	medium to very fine grained	medium to very fine grained
Luster	dull to subvitreous	dull	dull
Hardness	Mohs 6 to 7	Mohs 5-1/2 to 7	Mohs 5-1/2 to 6
Porosity	non-porous to slightly porous on weathered surfaces	non-porous	non-porous to slightly porous on weathered surfaces
Particle Shape	angular to subvitreous	angular to subrounded	angular to subrounded
Particle Surface	fresh to slightly weathered, rough to moderately smooth, dented to ridged	fresh to slightly weathered, rough to moderately smooth, dented to ridged	fresh to moderately weathered, rough to moderately smooth, dented or pitted to ridged
Remarks	A few particles have small lime incrustations.		A few particles have small lime incrustations.

IGNEOUS ROCKS (Cont.)

Rock Type	Basalt	Felsite
Color	dark gray or green to black; and mottled gray and dark green to black	medium gray to green, and mottled pink or buff and gray to green
Texture	very fine grained to micro-crystalline	very fine grained to micro-crystalline
Luster	dull	dull
Hardness	Mohs 5-1/2 to 6	Mohs 6 to 7
Porosity	non-porous to slightly porous on weathered surfaces	non-porous
Particle Shape	angular to subrounded	angular to subrounded
Particle Surface	fresh to slightly weathered, rough to smooth, dented to ridged	fresh to slightly weathered, rough to smooth, dented to ridged
Remarks	A few particles have small to moderate lime incrustations.	A few particles have small lime incrustations.

METAMORPHIC ROCKS

Type	Quartzite	Metasediments
Color	white; buff; pink; gray; green; purple; and mottled white to buff or pink and gray to green	dark gray to green; purple; and banded to mottled buff, brown, gray, or green
Texture	medium to very fine grained, and massive	very fine grained to micro-crystalline
Luster	dull to vitreous	dull
Hardness	Mohs 7	Mohs 4-1/2 to 7
Porosity	non-porous	non-porous to slightly porous
Particle Shape	angular to rounded	angular to rounded
Particle Surface	fresh to slightly weathered, rough to smooth, dented to ridged	fresh to slightly weathered, rough to smooth, dented or pitted to ridged
Remarks	A few particles have small lime incrustations.	A few particles have small to moderate lime incrustations.

METAMORPHIC ROCKS (Cont.)

Rock Type	Tillite	Schist
Color	medium gray to green	mottled buff to gray and black
Texture	microcrystalline ground mass with a porphyritic appearance	fine grained to microcrystalline
Luster	dull	dull to silky
Hardness	Mohs 4-1/2 to 7	Mohs 4-1/2 to 6
Porosity	non-porous	non-porous to slightly porous
Particle Shape	angular to rounded	angular to tabular
Particle Surface	fresh to slightly weathered, rough to moderately smooth, dented to ridged	fresh to slightly weathered, rough to moderately smooth, dented to ridged
Remarks	A few particles have small lime incrustations.	

SEDIMENTARY ROCKS

Rock Type	Limestone	Argillaceous and Porous Limestone	Cherty Limestone
Color	buff to gray; brown; and mottled buff and brown	buff; gray; and mottled buff, to gray and brown to yellowish brown	buff; gray; and mottled buff to gray and brown
Texture	medium grained to micro-crystalline	fine grained to microcrystalline	fine grained to micro-crystalline
Luster	dull	dull to earthy	dull
Hardness	Mohs 3	Mohs 2-1/2 to 3	Mohs 3 to 7
Porosity	non-porous to slightly porous	non-porous to finely porous	finely porous
Particle Shape	angular to rounded	angular to rounded	angular to rounded
Particle Surface	fresh to slightly weathered, rough to smooth, dented to ridged	fresh to highly weathered, rough to smooth, dented or pitted to ridged	fresh to moderately weathered, rough to smooth, dented to ridged
Remarks	A few particles have small lime incrustations.	Particles included in this category contain argillaceous exposures or porous zones.	Most particles in this category contain microcrystalline siliceous material which causes a metal mark when scratched with a file tang. A few particles contain chert exposures. A few particles have small lime incrustations.

SEDIMENTARY ROCKS (Cont.)

Rock Type	Dolomitic Limestone	Dolomite	Argillaceous and Porous Dolomite
Color	buff; and mottled buff and gray	gray; white; buff; and mottled buff to white and gray	buff; gray; and mottled buff and gray
Texture	very fine grained to micro-crystalline	medium grained to micro-crystalline	fine grained to micro-crystalline
Luster	dull to earthy	dull	dull to earthy
Hardness	Mohs 3 to 3-1/2	Mohs 3-1/2 to 4	Mohs 2-1/2 to 4
Porosity	finely porous	non-porous to slightly porous on weathered surfaces	finely porous
Particle Shape	angular to rounded	angular to rounded	angular to rounded
Particle Surface	fresh to moderately weathered, rough to smooth, dented to ridged	fresh to slightly weathered, rough to smooth, dented or pitted to ridged	fresh to moderately weathered, rough to smooth, dented or pitted to ridged
Remarks	A few particles have small lime incrustations.	A number of particles have small solution cavities. A few particles have small lime incrustations.	Particles included in this category contain argillaceous exposures or porous zones. A few particles contain small solution cavities. A few particles have small lime incrustations.



SEDIMENTARY ROCKS (Cont.)

Rock Type	Cherty Dolomite	Siltstone	Shale
Color	buff; gray; and mottled buff and gray	tan; yellowish to reddish brown; and gray	dark brown to black
Texture	fine grained to microcrystalline	very fine grained to microcrystalline	very fine grained to microcrystalline
Luster	dull	dull to earthy	dull
Hardness	Mohs 3-1/2 to 7	Mohs 2-1/2 to 3	Mohs 2-1/2
Porosity	non-porous to finely porous	finely porous	finely porous
Particle Shape	angular to subrounded	subangular to rounded	angular to subrounded
Particle Surface	fresh to slightly weathered, rough to smooth, dented to ridged	fresh to highly weathered, moderately smooth to smooth	fresh to slightly weathered, moderately smooth to smooth, dented to ridged
Remarks	Most particles in this category contain microcrystalline siliceous material which causes a metal mark when scratched with a file tang. A few particles contain chert exposures.	Many particles contain argillaceous, ferruginous, or calcareous material. A few particles have small lime incrustations.	

SEDIMENTARY ROCKS (Cont.)

Rock Type	Crag	Sandstone	Clay Ironstone
Color	mottled gray, and white	buff; reddish to yellowish brown; tan; and gray to greenish gray	yellowish brown to dark brown
Texture	pebbly appearance	medium to very fine grained	very fine grained to micro-crystalline
Luster	dull	dull	dull
Hardness	cementiceous lime, Mohs 3; pebbles, Mohs 3 to 7	Mohs 4 to 7	Mohs 4 to 4-1/2
Porosity	non-porous to porous	finely porous to porous	finely porous
Particle Shape	rounded	angular to rounded	angular
Particle Surface	slightly weathered, rough to smooth	fresh to highly weathered, rough to moderately smooth, dented or pitted to ridged	fresh to slightly weathered, rough to smooth, dented to ridged
Remarks	Particles in this category are composed of lime-cemented gravel and coarse sand.	Many particles contain argillaceous, ferruginous, or calcareous material. Most particles are moderately to strongly cemented and non-friable. Some particles have small lime incrustations.	Particles are fragments of clay ironstone concretions.

SEDIMENTARY ROCKS (Cont.)

Rock Type	Porous Chert	Dense Chert	Siliceous Fossils
Color	buff to white; and mottled buff to white and gray to brown	medium to dark gray or brown; and mottled buff to white and gray to brown	mottled white to buff and gray
Texture	very fine grained to micro-crystalline	very fine grained to micro-crystalline	fine grained to micro-crystalline
Luster	dull	dull to vitreous	dull
Hardness	Mohs 7	Mohs 7	variable from Mohs 3 to 7
Porosity	finely porous to non-porous	non-porous to slightly porous	non-porous to slightly porous
Particle Shape	angular to subrounded	angular to subangular	angular to subangular
Particle Surface	fresh to moderately weathered, rough to smooth, dented to ridged	fresh to slightly weathered, rough to smooth, dented to ridged	fresh to slightly weathered, rough to moderately smooth, dented to ridged
Remarks	Particles are nodules or fragments of nodules. A few particles contain silicified fossil fragments. Some particles have calcareous zones.	Particles are nodules or fragments of nodules.	Most particles in this category are fragments of silicified coral fossils. Most particles have exposures of limestone or dolomite.