



OFFICE MEMORANDUM

DATE: October 21, 1983

TO: L. T. Oehler
Engineer of Research

FROM: R. W. Muethel

SUBJECT: Petrographic Analysis of Coarse Aggregate: Michigan Stone Co. Pit No. 58-3 (Testing Laboratory Sample No. 83 A-10073).
Research Project 78 TI-510, Research Report No. R-1234

On September 6, 1983, a sample of crushed stone coarse aggregate was submitted by G. H. Gallup to the Petrography and Hydrology Group for petrographic analysis and mineralogical identification. Information accompanying the sample stated that the material was obtained from a stockpile at the Michigan Stone Co. Quarry #1, Pit No. 58-3, location southeast of southeast Section 25, T8S, R6E, Monroe County. The material was produced for use as coarse aggregate in bituminous and portland cement concrete pavements.

Summary

Rock Class	Condition of Particles	Percent of Sample
Sedimentary	moderately hard, fresh, and finely porous to porous	100.0

Approximately 25 percent of the sample is composed of material identified as argillaceous dolomite. The argillaceous material is finely porous and contains physically weak particles.

Detailed Petrography

Petrographic examination was conducted in general conformance with ASTM C295, "Petrographic Examination of Aggregate for Concrete." Representative portions—300 particles—of the noted sieve fractions 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 C127, "Specific Gravity and Absorption of Coarse Aggregate." Determinations included all material of the rock types analyzed. Descriptions of the rock types are contained in the following pages.

Insoluble Residue Analysis

A portion of the argillaceous dolomite sample fraction was analyzed for acid insoluble content according to MTM 103-79, "Test Method for Determination of Insoluble

Residue in Carbonate Aggregate Materials." Approximately 100g of representative material from the sample was dissolved in 1:1 hydrochloric acid for determination of acid insoluble content. The insoluble residue was sieved for gradation information. Results of the analysis are included in the following pages.

Infrared Spectrum Analysis

A portion of the argillaceous dolomite sample fraction was submitted to the Spectrochemistry Group for mineralogical identification. Results of the analysis are included in the rock type descriptions.

TESTING AND RESEARCH DIVISION



Geologist, Petrography and Hydrology
Group

RWM:bt

Attachments

cc: K. A. Allemeier
M. L. O'Toole
D. F. Malott
G. H. Gallup
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TABLE 1
 PETROGRAPHIC COMPOSITION
 (Testing Laboratory Sample No. 83 A-10073)

Rock Type	Sieve Fraction Analyzed				Computed Sample Composition, percent
	1 to 3/4-in.	3/4 to 1/2-in.	1/2 to 3/8-in.	3/8 to No. 4	
Buff, and Mottled Dolomite	77.6	75.7	80.3	65.6	74.8
Argillaceous Dolomite (Mohs 3-1/2 to 4)	18.7	17.0	13.0	11.7	15.1
Argillaceous Dolomite (Mohs 3 to 3-1/2)	3.7	7.3	6.7	22.7	10.1
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. 83 A-10073)

Rock Type	Specific Gravity			Absorption, percent	Composition, percent by weight
	Bulk, dry	Bulk, ssd	Apparent		
Buff, and Mottled Dolomite	2.63	2.68	2.77	1.89	77.7
Argillaceous Dolomite (Mohs 3-1/2 to 4)	2.61	2.68	2.79	2.35	17.3
Argillaceous Dolomite (Mohs 3 to 3-1/2)	2.59	2.67	2.82	3.10	5.0
Total Sample	2.63	2.68	2.78	2.03	100.0

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

TABLE 3
 INSOLUBLE RESIDUE ANALYSIS DATA
 (Testing Laboratory Sample No. 83 A-10073)

Gradation of Insoluble Residue		Character of Insoluble Residue
Sieve Fraction	Retained Percent	
3/8-in. to No. 4	15.0	Soft, gray earthy fragments with pyrite and mica.
No. 4 to No. 8	18.4	Same.
No. 8 to No. 16	4.2	Same.
No. 16 to No. 30	0.6	Same. Few loose pyrite crystals.
No. 30 to No. 50	0.3	Same. Few loose pyrite and quartz crystals.
No. 50 to No. 100	0.1	Same. Many loose pyrite and quartz crystals.
No. 100 to No. 200	0.2	Same. Few loose pyrite, quartz and mica crystals.
Passing No. 200	7.4	Soft, gray argillaceous material. Few pyrite and mica crystals.
Total Insoluble Residue	46.2	

NOTE: Percentages are based upon the initial oven dry sample weight before treatment with acid.

SEDIMENTARY ROCKS

Rock Type	Buff and Mottled Dolomite	Argillaceous Dolomite	Gray Dolomite
Color	buff, and buff to gray	gray, and mottled light to dark gray	gray, and mottled light to dark gray
Texture	fine grained to microcrystalline	very fine grained to micro-crystalline	very fine grained to micro-crystalline
Luster	dull	dull to earthy	dull to earthy
Hardness	Mohs 3-1/2 to 4	Mohs 3-1/2 to 4	moderately hard, Mohs 3 to 3-1/2
Porosity	non-porous to finely porous	finely porous	finely porous
Particle Shape	angular	angular	angular
Particle Surface	fresh, rough to moderately smooth and dented to ridged	fresh, rough to moderately smooth and dented to ridged	fresh, moderately smooth to smooth, dented to ridged
Remarks	This category contains dolomite particles which vary in physical appearance from massive to bedded or brecciated. Some particles display stylolite structures, or pyrite inclusions. A few particles are oolitic.	Particles in this category contain exposures of abnormally soft dolomite which are physically weak. Particles contain very fine grained pyrite inclusions. Some particles readily break at microcracks. Infrared spectra indicate the presence of carbonate and clay minerals.	Particles in this category are physically weak, and display abnormally low hardness for dolomite. Particles contain very fine grained pyrite inclusions. Particles readily break at microcracks. Infrared spectra indicate the presence of carbonate and clay minerals.