

University of Wisconsin-Extension

GEOLOGICAL AND NATURAL HISTORY SURVEY
3817 Mineral Point Road
Madison, Wisconsin 53705

M.E. Ostrom, State Geologist and Director

THE HEAVY, NON-MAGNETIC RESIDUALS OF CERTAIN SAMPLES COLLECTED
BY THE WISCONSIN GEOLOGICAL SURVEY

by

E. Steidtmann

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Heavy Residuals
A study by Edward Steidtmann
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The heavy, non-magnetic residuals of certain samples
collected by the Wisconsin Geological Survey.

The samples were crushed with a Blake Crusher and then ground in a gyratory until all the pulp passed thru a 40 mesh. The pulp was then sized into four grades; namely, 60+, 80+, 100+, 100--.

Each size was first panned. From the concentrates the magnetite and iron was removed by means of a horse shoe magnet, after which the non-magnetic portion was concentrated in Thoulet solution. Three separations in Thoulet solution were necessary in most cases to separate the light minerals from the heavy ones. Finally the paramagnetic minerals were removed from the concentrate with an electro-magnet.

The highest percentage of concentrate was obtained from the 100+ size. A high concentrate in most cases was separated from 100--. The 80+ size gave less than the 100- size, and 60+ generally gave only a few grains. The average weight of the 80+ concentrate may have been about .02 grams, the heaviest about .2 grams. The separations were not quantitative and very few concentrates were actually weighed.

Apatite, zircon, and titanite were the three principal constituents of the heavy non-magnetic, concentrates. Galena and pyrite were generally present. A minor part of the sulphides may represent contamination from the crusher. Since a few samples had no sulphides, it seems improbable that a very large amount of the sulphides came from the crusher.

The heavy non-magnetic minerals found in rocks of the same type are very much alike. Most of the granites and gneisses have

MISCELLANEOUS
Residuals - Heavy - Steidtmann

no distinctive residuals. Zircon and titanite are less common than apatite. Some samples have neither zircon or titanite, some have one or the other, a few have both. ^{Benches 40p ✓} Numbers 26314 and 27022 ^{Newport Mine} seemed to have neither titanite or zircon. ^{Benches 40p ✓} Numbers 26315, 26316, 26317, ^{Per 40} 26817, ^{Per 40} 26248, ^{Per 40} 26854 had titanite but seemed to contain no zircon. ^{46-2E 45-3W 46-2E} Titanite was abundant in the residuals of ^{31-7W} 14690, 26854. The following had zircon but no titanite: 25298, 15089, 26256, 26849A, 26284A. Both zircon and titanite were present in 14690, 7977. Apatite was present in all samples.

It is impossible to group the samples on the basis of striking resemblances or differences of their heavy residuals.

The titanite grains were all broken and without crystal form. As a rule, the zircon grains were broken but showed sharp crystal outlines. Sharp crystals of apatite were common but most of the apatite grains were angular from breakage and had no crystal outline.

Some of the apatite grains were rounded and had a frosted appearance, as tho the rocks in which they occurred were of sedimentary origin. The rocks which showed rounded apatite grains were numbers 26314, 26316, and 14474. Number 14474 also contained zircon but the latter was angular and broken. The first two, numbers 26314 and 26316 are gneisses and therefore of doubtful origin, but number 14474 is a granite. In no case were the zircons rounded or of sedimentary aspect.

For details see the following tabulations.

Record of Heavy Residual Studies.

Sample No.		Wt. Total Pulp	Wt. #60+	% #60+	Wt. #80+	% #80+	Wt. #100+	% #100+	Wt. No. -100	% No. -100
26314	Gneiss	132.4	113.3	8.59	277.6	20.9	154.2	11.6	778.9	57.6
26315	Gneiss	622.6	84.7	13.6	80.1	12.8	76.4	12.2	381.4	61.2
26316	Gneiss	1000.3	116.9	11.6	242.9	24.2	146.3	14.6	494.2	49.4
26317	Gneiss	1256.4	92.2	7.34	158.3	12.6	155.8	12.4	850.1	67.6
✓ 26817	Dike	1041.4	110.2	10.5	239.3	22.9	203.	19.4	488.9	46.9
✓ 14690	Granite	686.3	77.3	11.2	179.9	26.2	95.4	13.9	333.7	49.
✓ 7977	Granite	331.8	57.2	17.2	67.9	20.4	31.1	9.4	135.6	41.0
✓ 27022	Granite	650.4	51.7	7.90	158.5	24.2	105.7	16.2	334.5	51.3
✓ 26248	Granite	1585.4	146.1	9.24	463.6	29.1	205.1	12.9	770.6	49.
✓ 26854	Granite	235.1	23.8	10.1	51.6	21.9	35.1	14.9	124.5	53.
✓ 25298	Gabbro	1141.5	122.	10.69	282.5	24.7	209.3	18.3	527.5	46.
✓ 15089	Granite	198.6	15.2	7.66	42.7	21.4	28.1	14.1	112.6	56.8
✓ 14474	Granite	415.7	39.	9.4	81.8	19.6	50.9	12.2	244.	58.7
✓ 26256	Granite	1489.5	129.3	8.6	344.2	22.4	265.6	17.8	750.4	50.6

Wt. #60 on H.S.M.	% #60 on H.S.M.	Wt. #80 on H.S.M.	% #80 on H.S.M.	Wt. #100 on H.S.M.	% #100 on H.S.M.	Wt. #-100 on H.S.M.	% #-100 on H.S.M.
.397	.35	.437	.15	.367	.23	3.312	.42
.587	.69	1.12	1.4	.604	.79	1.95	.51
.187	.11	.50	.06				
.02	.02	.024	V.L.			.147	.017
21.82		24.40		9.115		9.69	
None		V.L.		V.L.		.089	
None		V.L.					
.012		.044		.050		.067	
.354		.503		.90		.881	
None		None		None			
		.77		.47		.48	
V.L.		.11		.075		.051	
.247		.23		.177		.437	
.76		1.038		2.3		2.11	

H.S.M. = Horse Shoe Magnet.

V.L. = Very little.

No. Rock	Mesh.	Apatite	Titanite	Zircon	Pyrite	Galena	Amount of Residual.
26314	<i>quartz</i> 60+	One rounded, frosted, & broken grains.	--	--	Broken	Cubes	Few grains.
26314	" 80+	--	--	--	Broken grains	Cubes	" "
26314	" 100+	Broken apatite	--	--	"	"	Very little
26314	" 100-	Broken grains	--	--	Broken	Cubes	Very little
26315	<i>quartz</i> 60+	--	Broken	--	<u>Broken dominant</u>		" "
26315	" 80+	--	--	--	--	--	
26315	" 100+	Broken	Much broken	--	Broken	Cubes	Moderate
26315	" 100-	Colorless Broken	A few grains	--	Broken	Cubes	Very little
26316	<i>quartz</i> 60	--	--	--	--	--	
26316	" 80	Colorless, round and broken.	One grain.	--	Broken	Cubes	Very little
26316	" 100	Colorless D.	--	--	Broken	--	
26316	" -100	--	--	--	--	--	
26317	<i>quartz</i> 60	--	--	--	Broken	Cubes	
26317	" 80	One grain	--	--	--	--	
26317	" 100	Sharp prisms, yellow & green	Broken	--	Broken	Cubes	
26317	" -100	--	--	--	Broken	Cubes	
26817	<i>Dike</i> 60	One grain	--	--	Broken	Cubes	
26817	" 80	--	--	--	--	--	
26817	" +100	Broken, colorless	Broken	--	Broken	Cubes	
26817	" -100	--	--	--	--	--	
14690	60+	Colorless, broken	D, broken	--	--	--	
14690	<i>granite</i> 80+	Broken, colorless, sharp prisms, 50%	Broken, 50%	--	--	--	
14690	<i>granite</i> 100+	D, broken, colorless, sharp prisms, S.	Broken	Sharp prisms & unit pyr. colorless.			

Rock No.	Mesh.	Apatite	Titanite	Zircon	Pyrite	Galena	Amount of Residual.
Granite 14690	100-	Colorless, broken, and sharp prisms	Broken, 50	--	--	--	
Granite 7977	60+	Colorless, 90%		1 zircon	Broken	Cubes	
Granite 7977	80+	--	Broken	--	Broken	--	Very little
Granite 7977	100+	--	90%	Sharp prism, pyr. colorless	--	--	
Granite 7977	100-	--	--	--	--	--	
Granite 27022	60+	--	--	--	Broken	--	.01 gram
Granite 27022	80+	--	--	--	Broken	Cubes	.02
Granite 27022	100+	--	--	--	--	Cubes	
Granite 27022	100-	--	--	--	--	--	
Granite 26248	60+		One grain	--	Cubes & broken	--	
Granite 26248	80+	Broken, colorless	Broken	--	Broken	Cubes	
Granite 26248	100+	Colorless, broken	Broken	--	Broken	--	Only a few grains.
Granite 26248	100-	--	--	--	--	--	
Granite 26854	60	--	Titanite <u>D</u>	--	Broken	--	Only a few grains.
Granite 26854	80	--	--	--	--	--	
Granite 26854	100	Colorless, broken	Broken	--	--	--	
Granite 26854	100-	Broken, sharp prisms	Broken	--	Striated	--	A few grains
Granite 25298	60+	--	--	Brown, long prism. pyr.	Broken	Cubes	Very little
Granite 25298	80+	Broken, colorless	--	Prism & pyr. Sharp, brown & sphal-erite	Broken	Cubes	
Granite 25298	100+	--	--	About 70% Prismatic 100,111,001	1/3 pyrite		.1 gram
Granite 25298	100	--	--	--	--	--	
Granite 15089	60+	15 grains, colorless			10 grains		.02 grams
Granite 15089	80+	D, colorless			Broken		.071

Rock No.	Mesh.	Apatite	Titanite	Zircon	Pyrite	Galena	Amount of Residual.
<i>grain</i> 15089	100+	Broken, colorless	--	--	Few grains	--	
" 15089	100-	90% colorless, mostly broken, some prisms.	--	Colorless, zircon prisms & pyr ^z	--	--	Few grains
" 14474	60+	Round, nearly opaque apatite.	--	Few, broken	--	--	
" 14474	80+	Sharp prism and rounded. Semi-transparent grains.	--	--	--	--	
" 14474	100+	Ditto	--	--	--	--	
" 14474	100-	Colorless, broken	A few grains	--	--	--	
" 26256	60+	--	--	--	--	--	
" 26256	80+	--	--	Brown, prism. Pyr.	--	Cubes.	
" 26256	100+	--	--	Brown, prism. Pyr. Some with 2 pyr. of same order.	Broken	Cubes	
" 26256	100-	Colorless, sharp prisms, fragments	--	Brown, prism, pyr.	Broken	--	
26849A		Sharp prisms, broken, colorless	--	--	Broken, 95%	--	
26849A	80	--	--	--	All pyrite.	Cubes	
26284A	80	Sharp prism, & pyr. some broken.	--	2 colorless, 110, 111	95% pyrite broken	Cubes	.1 gram

D - Dominant.