

GARNET
 April 1966 Progress Report
 Minerals Research Laboratory
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 by
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Object

The object of this report is to bring together the work done to date on a project involving garnet deposit location and garnet beneficiation. The project has two goals. The first is to locate and evaluate all known garnet deposits and occurrences in North Carolina; the second is to work out an economical method of beneficiating the garnet from the most promising of the deposits examined.

Procedure I

Procedure I involves ore taken from near Park Gap, Clay County, North Carolina, and samples of the Barton Mines (N. Y.) garnet concentrate. A sample of flotation head feed crushed from the Park Gap ore (T-5 of Lab. No. 2010) was examined mineralogically. The mineral composition is reported in Table 1. Petrographic studies were carried out to determine the refractive index of both the Park Gap garnet and the Barton garnet. In addition, careful specific gravity measurements were made on both garnet samples. This data is entered in Table 2.

ResultsTable 1Mineral Composition of Flotation Feed (2010, T-5)

Hornblende	-	52% \pm 2%
Garnet	-	13% \pm 2%
Plagioclase (36-40% Anorthite)	-	35% \pm 2%

Table 2

Refractive Indices and Specific Gravity of Garnet

	<u>Barton Mines</u>	(Lab. No. 3041) <u>Park Gap, N. C.</u>
Index of refraction	1.7742 ± 0.0005	1.7975 ± 0.0005
Specific gravity:		
test 1	3.927(semi-hand picked)	3.899(unhand picked)
test 2	3.916(hand picked)	4.016 (hand picked)
test 3	3.914(re-hand picked)	3.985 (re-hand picked)

Table 3

Composition of Garnet

(Ref.: Winchell and Winchell, 1961, pp. 488, 485)

	<u>Barton Mines</u>	(Lab. No. 3041) <u>Park Gap, N. C.</u>
test 1	% Andradite	6
	% Almandite	48
	% Pyrope	46
test 2	% Andradite	6
	% Almandite	47
	% Pyrope	47
test 3	% Andradite	6
	% Almandite	47
	% Pyrope	47
		24 } erroneous 36 } 40 }

Conclusions

The garnet from Park Gap, North Carolina has a well-developed chisel-edge fracture pattern and a deep red color, the deepness of color caused probably by the higher almandite content than the lighter red Barton Mines garnet. If almandite is the garnet desired for abrasive purposes, the Park Gap garnet meets this requirement as well as, or better than, the Barton product. No abrasive tests have been attempted on the Park Gap material; all correspondence with pertinent testing laboratories indicates that there is no standard method for the abrasive testing of garnet.

Procedure II

Ore from the Park Gap locality (Lab. No. 3041) was stage-crushed through a series of rolls settings in a series of tests to determine the optimum liberation size for the garnet. The results are presented in Table 4.

Results

Table 4

Rolls Crushing of Garnet

<u>T-1 (fresh ore): +6 mesh → ½" rolls → 3/8" rolls → ¼" rolls</u>			
	<u>% of Total</u>	<u>% Garnet Liberation</u>	<u>% Hornblende Spar Liberation</u>
+6 mesh	55.6	0	0
-6+20	22.7	45-50	~ 5
-20+35	8.2	95	80-85
-35+48	3.9	~ 100	95
-48+65	2.9	} ~100	} ~100
-65+100	2.3		
-100	5.0		
	100.0		
<u>T-2 (weathered ore): ¾" rolls → ½" rolls → 3/8" rolls → ¼" rolls</u>			
	<u>% of Total</u>	<u>% Garnet Liberation</u>	<u>% Hornblende Spar Liberation</u>
+6 mesh	28.0	20-25	0
-6+20	37.6	90-95	~ 5
-20+35	14.2	95-100	70
-35+48	5.4	~ 100	95
-48+65	4.2	} ~100	} ~100
-65+100	3.2		
-100	7.4		
	100.0		
<u>T-3: +6 mesh → ½" rolls → 3/8" rolls → 3/16" rolls</u>			
	<u>% of Total</u>	<u>% Garnet Liberation</u>	<u>% Hornblende Spar Liberation</u>
+6 mesh	14.7	0	0
-6+10	29.1	25	0
-10+14	8.6	50-55	5
-14+20	8.2	75-80	25-30
-20+28	7.5	90-95	~ 60
-28+35	7.2	95-100	~ 85
-35	24.8	95-100	95-100
	100.1		

Tests 4 and 5 involved final rolls crushing to minus 1/8" and minus 1/16" respectively. In both tests the distribution of degree of liberation was as in test 3, but the amount of fines (-35 mesh) increased to 32.9 percent in test 4 and to 50.7 percent in test 5.

Procedure III

Three series of tests have been carried out to date to derive a method for beneficiating the garnet from the Park Gap, North Carolina locality (Lab. No. 3041). Test series No. 6 involved the use of Geigy-Amine-0, a cyclic amine, as the collector to remove feldspar from the feed in a basic float (pH 7.2-10.7). This test series will not be mentioned further since the five tests performed, varying the pH and amine level, yielded no selectivity whatsoever in the feldspar float. Test series 7 and 8 involved the use of Morco-70 to float garnet directly in an acid circuit. The conditions were as follows: 5 minute scrub at 70 percent solids with 0.1 pound per ton of NaOH, 5-10 minute conditioning at 70 percent solids with 5-8 pound per ton of H₂SO₄ and 0.1-0.5 pound per ton of Morco-70. Conditioning pH varied from 2.0 to 1.0 and rougher garnet flotation pH from 3.6 to 1.7. Two cleaner floats were usually performed. Test 8-A involved 0.25 pound per ton of fuel oil No. 2 in the conditioning step. The results are reported in Table 5. Similar tests are recorded in Lab. Notebook No. 2010, 1965 by I. H. Redeker.

Results

Table 5

<u>Test No.</u>	<u>% Ro-Tails</u>	<u>% Garnet</u>	<u>% #1 Cl.Tails</u>	<u>% Garnet</u>	<u>% #2 Cl.Tails</u>	<u>% Garnet</u>	<u>% Conc.</u>	<u>% Garnet</u>
7-A	70.0	0.0	3.6	1.0			24.4	21.0
7-B	75.6	0.5	8.0	1.5	3.4	4.0	11.4	43.0
7-C	78.4	0.5	9.0	1.0	2.8	7.0	8.2	63.0
7-D	85.0	0.5	5.6	4.0	1.8	7.0	5.8	71.0
7-E	90.2	0.5	2.0	8.0	1.2	40.0	5.0	85.0
8-A	94.0	1.5	1.1	35.0			3.7	86.0

Conclusions

Efforts to locate and evaluate deposits of abrasive-suited garnet and to beneficiate the ores are continuing and will be reported periodically.