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Feldspar Beneficiation from Manisa Alaşehir Pegmatites

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ABSTRACT: Feldspar beneficiation on the samples from Manisa-Alaşehir pegmatites were investigated. Chemical analysis showed that the total alkali content of the samples was around 7-8% as the contents of Fe_2O_3 and TiOi were 0.4 and 0.5% respectively. The impurities of the ore were substantially reduced to 0. 15% for FejOj and 0.03% for TiO_2 with magnetic separation. Flotation was also applied to the samples and impurities were reduced to below 0.1% for both. It was seen from the mineralogical determinations that titanium found in the samples is mainly related to phlogopite which is a Ti-bearing biotite mineral. Therefore, removing of the mica minerals from the ore with magnetic separation cause an effective decrease in titanium content. Firing button tests were also carried out on the concentrates at 1250"C and satisfactory results were obtained.

1 INTRODUCTION

Feldspars are important raw materials for ceramic and glass industries and chemical compositions; especially alkali contents determine their quality and price (Bayraktar and Çakır. 2002). The main problem in these ores from the point of mineral processing is iron and titanium bearing minerals which decrease the worth of the ores. All beneficiation studies for feldspar ores based on the separation of these undesired impurities (Bayraktar et al, 2000).

Feldspar beneficiation studies from the various ore deposits have attracted increasing interest during the last a few decades in Turkey. Therefore, kinds of feldspar rocks such as pegmatites, granites, syenites have been investigated in detail by means of mineral processing methods. In general, using rare earth magnetic separators alone is enough to separate iron-bearing minerals usually with satisfactory results. On the other hand, for removing titanium bearing minerals such as rutile and sphene, the ore is subjected to flotation, because of the ore mineralogy (Bayraktar, et al. 1998: Çelik, et al., 2001).

In these study, a pegmatitic rock from Manisa-Alaşehir region was investigated. It was found that most of the iron and titanium bearing minerals in the ore were substantially decreased with only by magnetic separation because of the ore mineralogy. Flotation was also applied to the ore to obtain best concentrate for the industrial requirements.

2 MATERIAL AND METHODS

2. / *Mineralogy-Petrography*

Sample used in experimental studies was leucocratic granular textured coarse-grained pegmatitic rock from Manisa-Alaşehir region. It is composed of a group of fairly large euhedral-subhedral phenocrysts of orthoclase and microcline displaying cross-hatched twinning with 2.97-5.45 mm and 0.93-1.40 mm grain size respectively. The matrix mainly consists of fine-grained alkali feldspar (orthoclase and microcline), plagioclase, quartz, muscovite (0.024-0.4 mm grain size) and biotite (phlogopite) minerals with 0.020-0.600 mm grain size including accessory minerals such as garnet, chlorite, apatite, zircon, rutile thai has been slightly changed into leucoxene, rarely limonite and pyrite.

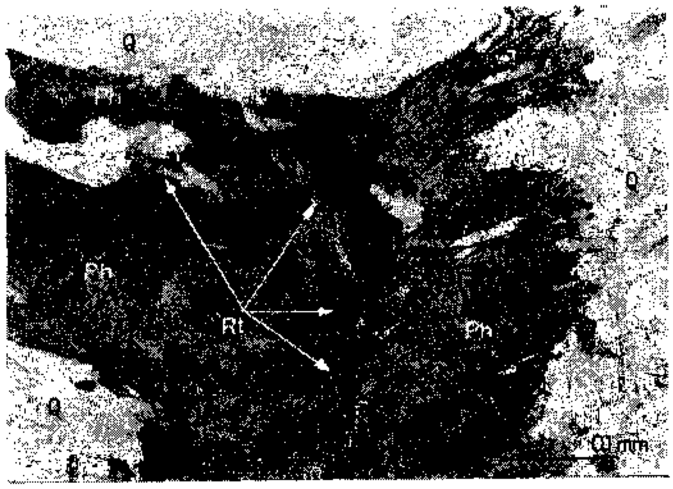

Figure I. Photomicrograph Showing Ti Rich Biotite (Phlogopite) and Rutile Needles Formed within the Phlogopite. Plane Polarized Nicol. Q-Quartz, Ph-Phlogopite and Rt-Rutile

Because of the low grade metamorphism of the pegmatitic rock, Ti bearing biotite (phlogopite) were rarely formed fine grained rutile needles with 20-24 |jm grain size and were slightly altered to chlorite minerals. Also, due to the same reason, micro folds and foliation planes improved weakly. In other words, biotites contain micro-rutile particles in its structure as inclusions (Fig 1).

Chemical composition of the sample determined by X-Ray Fluorescence (XRF) analysis is given in Table 1.

Table 1. Chemical Analysis of the Sample.

Compound	%
Sia	66.03
AI2O3	16.83
MnO	0.08
P2O,	0.21
MgO	1.10
Na,0	3.19
K;0	4.49
Fe,Oj	4.00
TİO.	0.48
CaO	1.98
L.O.I.	1.00

2.2 *Method*

The ore sample was crushed from 10-15 cm to 1 cm by a combination of jaw and cone crushers and its size was reduced down to -2 mm by a roll crusher.

Magnetic separation sample was prepared by screening in -600+75 urn size range. For the flotation test, a sample was ground down to its liberation size of-230 urn in a ceramic mill.

Magnetic separation tests were performed by using a rare earth permanent magnetic separator (permroll). Test samples were passed from permroll in two stages at the same conditions to achieve better separation of impurities.

In order to decrease the iron content of the ore to desired level, flotation was also applied to the samples. Experiments were performed as mica and oxide flotation separately. Amine type collector (tallow amine acetate) was used for mica. For oxide mineral flotation, petroleum sulphonate (cyanamid-R825) and Na-oleate were used separately. Before flotation experiments, slime (-25pm) was removed by a four-step décantation and its total amount was around 17-20 % in weight. Optimum flotation conditions were given below (Oktay and Saklar, 2002):

Mica flotation:

Pulp density (conditioning)	70 % by weight
Pulp density (flotation)	30 % by weight
Collector type and dosage	Armac T, 450 g/t
Conditioning time	3 min
pH	2.8
Frother type and dosage	MIBC, 40 g/t

Oxide flotation:

Pulp density (conditioning)	70 % by weight
Pulp density (flotation)	30 % by weight
Collector type I and dosage	Na-oleate, 500 g/t
Collector type2 and dosage	R825, 500 g/t
Conditioning time	5 min
PH	5
Frother type and dosage	MIBC, 70 g/t for only Na-oleate

3 RESULTS

Chemical composition of non-magnetic feldspar-quartz concentrate obtained with a permroll magnetic separator with 80% recovery by weight is given in Table-3 column A. The impurities of the ore were notably reduced to 0.15% for FciOi and 0.03% for TiOi. Firing button tests results of the concentrate at 1250"C confirmed the result of chemical analysis which gave white-light cream color.

Flotation test results were also satisfactory for R825 and Na-oleate presented in Table-3 column B and C respectively. Recovery values arc almost the same for these collectors; in mica and oxide notations are 20-21%, and 5-6% in weight, respectively. The recovery of best flotation concentrates obtained with Na-oleate was 70.96% as it was 69.01%. with R825. The firing button tests of concentrates were also similar in white-light cream colors but buttons of Na-oleate slightly better white color than R825's. It is known that range of titanium + iron level corresponds to color difference in firing buttons (Bayraktar et al.. 1997).

The results obtained showed that magnetic separation or flotation can be applied to the ore. But, magnetic separation seems to be more applicable for this ore because of its simplicity and low operating costs.

An interesting point for Manisa-Alaşehir pegmatitic rock was easiness of decreasing its TiOi content from 0.48% to 0.03% only by magnetic separation. Therefore, removing of the biotites from the ore with magnetic separation cause an effective decrease in titanium content.

Table 3. Chemical Analysis of the Magnetic Separation and Flotation Concentrates.

Compound	A (Permroll) %	B (Na-oleate) %	C (R825) %
SiO-	74.54	7.3.52	75.72
AHO,	14.5.3	13.69	14.13
MnO	0.01	0.01	0.01
P,Os	0.18	0.08	0.07
MgO	0.08	0.0.3	0.0.3
NmO	3.51	3.59	3.36
K,0	3.45	3.49	3.50
Fe,O,	0.15	0.05	0.08
TiO.	0.03	0.02	0.02
CaO	1.97	1.79	1.68
L.O.I.	0.85	2.90	0.55

4 CONCLUSIONS

1. It was shown that main titanium bearing mineral of the ore is Ti including biotite (phlogopite), which contains rutile needles as inclusion.
2. Quality feldspar concentrate from the Manisa-Alaşehir pegmatites can be obtained by magnetic separation or flotation methods. The impurities of the ore were reduced for *T\0->* from 0.48% down to 0.03%' and for Fe_20, from 4.0%. down to 0.15% by magnetic separation only.
3. It was found that Fe_20, and $TiO_:$ contents of the ore were reduced to 0.05% and 0.02% respectively with amine and Na-oleate flotation, which is slightly belter than amine and R825.
4. Firing buttons of the magnetic separation and flotation concentrates at 1250 °C gives satisfactory results and they confirmed the results of chemical analysis.

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