Mineral contents characterization of limestone of Jayapura-Papua

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Abstract. The research about the characterization of limestone mineral content from Jayapura using XRF, XRD, and SEM-EDS had been done. The purpose of the research is to find the mineral content, determine the phase and determine the morphology of particles in limestone. From the results of XRF testing there is one main element that has the most chemical elements in the sample of limestone origin of Jayapura at Tanah Hitam i.e. Ca (calcium) with weight percentage of 99.57 and then followed by Sr (Strontium), Cu (copper), Fe (Iron) and Mo (Molibden). The phase identification in FIG. 1 is 100% Dolomite (CaMg $(CO_3)_2$) according to ref. Code 01-075-1655, the XRD pattern shows the highest diffraction peak at a 2θ angle is 30.9700 corresponding to the fraction (h k l): (1 0 4). XRD results are also supported from characterization with EDS where the dominant element of the sample is O, Ca and Mg. Then based on SEM Analysis, the morphology of Ca (CO3) resembles a cube but its particle size is uneven and irregular due to impurity factor.

1. Introduction

The limestone mountains in Indonesia spread from west to east from the mountains of Central Java to East Java, Madura, Sumatra and Irian Jaya [1]. One of the natural resources produced is limestone with a large content of calcium carbonate ($CaCO_3$) [2]. The potential for limestone production in Indonesia is very large and almost evenly distributed throughout Indonesia mainly used as industrial minerals. [3] Limestone is widely used for Portland cement, steel purification, paper industry, building materials, paint and so on. In general, minerals contained in limestone are calcium carbonate ($CaCO_3$) of 95%, dolomite ($CaMg(CO_3)_2$) of 3%, and the remainder are mineral clay [4], Limestone has a density of 2,6-2, 8 g / cm 3 and in a pure crystalline state the calcite comprises $CaCO_3$ [5]. The main content of limestone is the mineral calcium carbonate ($CaCO_3$) which occurs due to chemical and or organic processes. In general, minerals contained in limestone are calcium carbonate calcite 95%, dolomite as much as 3%, and the remainder is mineral clay [6].

Experiment with XRF (X-Ray Fluorescence) to test the elemental content of the material, it is known that limestone in one of the limestone mountains in Guwo Terus Village, Montong district of Tuban contain calcium element reach 98,13% [7]. X-ray diffraction results of natural materials (rocks and sand) taken as samples from the Bawean-Gresik, Batu 1 (Onyx) and Tulungagung, Batu 2 (white) areas can be proposed as high-purity oxide Calcite (CaCO3) 98.230% [8]. The availability of abundant limestone rock is a great potential for the development of material sources [9]. In this research will be conducted the initial study Characterization of Mineral Limestone Origin of Jayapura-Papua.

2. Method

2.1. Tools and Materials

The tools used in this study are Mortar, measuring cylinder, 200 mesh sieve, Ohaus analytical balance, XRD (X-Ray Diffraction), XRF (X-Ray Fluorescence) and SEM (Scanning Electron Microscope). The materials used in this study were water, limestone originating from the city of Jayapura taken at the location of Tanah Hitam at point 140, 69036° BT and 2,619371° LS at an altitude of 33 feet above sea level.

2.2. Samples Preparation and Testing

Samples of limestone that have been taken washed first with water then in the sun in the sun. The dried limestone in the puree by subsequent mortar is sieved using a 100 mesh sieve. The limestone powder obtained in weighing using Ohaus analytical balance is then transferred to the samples provided for testing using XRF, XRD, and SEM to determine the characterization of limestone.

3. Results and Discussion

3.1. Samples Preparation and Testing

Testing with XRF can be used to determine the composition of the elements of a material. From table 1. XRF test results data on limestone samples are presented in the table below.

Table 1. XRF testing value.

Compound	Conc (%) Tanah Hitam	Oxides	Conc (%) Tanah Hitam
Ca	99.5	CaO	99.57
Fe	0.11	Fe_2O_3	0.11
Cu	0.16	CuO	0.13
Sr	0.185	SrO	0.14
Mo	0.045	MoO_3	0.045

From the value of XRF test result, there is one main element which has the most chemical element content in black limestone sample from Jayapura city at Tanah Hitam i.e. Ca with weight percent 99.5 and then followed by Sr, Cu, Fe, and Mo.

3.2. Results of XRD Testing

Limestone powder was taken from Jayapura city at Tanah Hitam location at point 140, 69036° BT and 2,619371° LS at 33 feet above sea level. characterized XRD to see mineral phases present in limestone. The limestone XRD phase is shown in Figure 1.
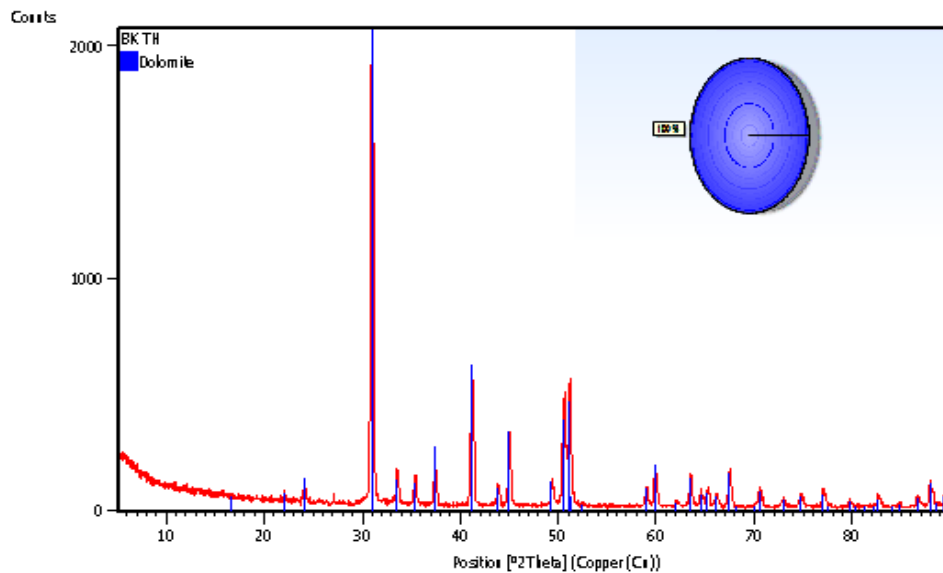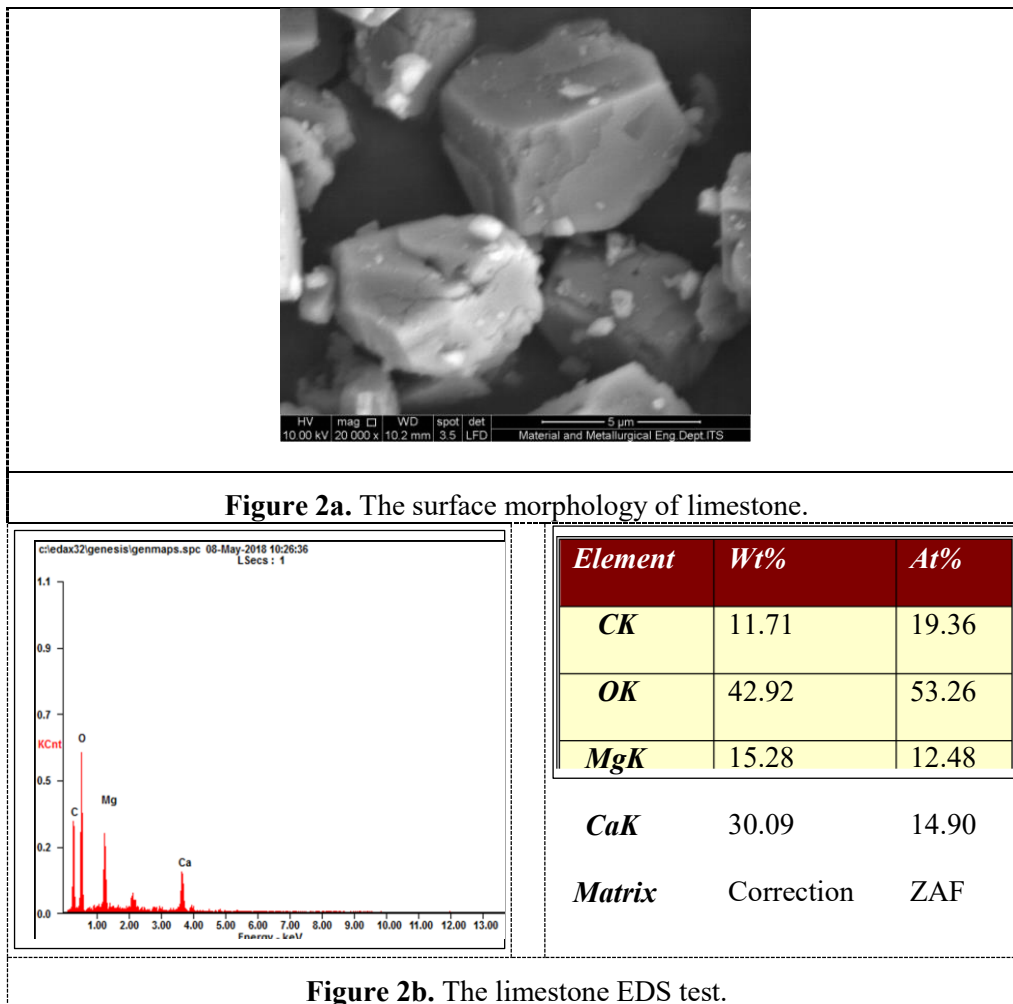
Figure 1. XRD phase limestone samples.

The phase identification in fig.1 is 100% Dolomite (CaMg $(CO_3)_2$), the XRD pattern shows the diffraction peaks (CaMg $(CO_3)_2$) at an angle of 2θ: 16.5930; 22.0530; 24.0830; 30.9700; 33.5470; 35.3340; 37.4010; 41.1710; 43.8430; 44.9790; 49.3200; 50.5540; 51.1090 and 51.3030 corresponding to the fraction (h k l) field: (0 0 3), (1 0 1), (0 1 2), (1 0 4), (0 0 6), (0 1 5), (1 1 0), (1 1 -3), (0 2 1), (2 0 2), (0 2 4), (0 1 8), (1 1 -6) and (0 0 9). The angles at the peak of the diffraction are peak (CaMg $(CO_3)_2$) anatese corresponding to the data reference 01-075-1655 (ICSD 31210) [10].

The crystals contained in calcium carbonate (CaCO3) consist of three polymorphic: calcite, aragonite, and vaterite. Each of the crystals has a diffraction angle (2θ) and miller index is different. Calcite crystals have the main peak Miller index (1 0 4), aroganite with peak primary miller index (2 2 1) and vaterite (1 1 0) [11]. of the image 1 is clearly visible at the diffraction angle 2θ = 30.9700 has a miller index (1 0 4) the crystalline form is calcite, at the diffraction angle 2θ = 37.4010 has a miller index (1 1 0) of the crystalline form of Vaterite.

3.3. Results of XRD Testing
Characterization using scanning electron microscope (SEM) was performed to determine the morphology of precipitation. Sample observation results with SEM are observed on the surface of the plate which can be seen in Figure 2 with 20,000x magnification. The particle size of limestone on SEM characterization was obtained from the comparison of cross-sectional photographs of limestone samples to scale scanning magnification.

Figure 2a. The surface morphology of limestone.

Element	Wt%	At%
CK	11.71	19.36
OK	42.92	53.26
MgK	15.28	12.48
CaK	30.09	14.90
Matrix	Correction	ZAF

Figure 2b. The limestone EDS test.

From Figure 2a, it can be seen that the limestone origin Jayapura City at Tanah Hitam with SEM test is described by the morphology of $Ca(CO_3)$ resembling cubic but its particle size is uneven and irregular due to impurity factor. The dominant elements of the EDS test results in the sample are Oxygen (0), Calcium (Ca), Magnesium (Mg) and Carbon (C). Calcite has a rhombohedral crystal form, a scalenohedral and prismatic cube. Argonite is a cluster and discrete needle-like, while the vein is round (Sphere) [12].

4. Conclusions

Based on the results of the discussion in this research, it can be concluded that limestone derived from Jayapura city at Tanah Hitam has Ca mineral content with a weight percentage of 99.5 and CaO percentage weigh 99.57. The XRD test results show the identification of limestone phase is 100% Dolomite (CaMg (CO3) 2) this corresponds to the reference data 01-075-1655 (ICSD 31210). SEM test results depicted morphology of Ca (CO3) resembles a cube but its particle size is uneven and irregular due to impurity factor.

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