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Material Analysis Supporting Cement Industry Muara Dua Area South Oku Regency South Sumatera

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ABSTRACT

Material cement industry are mostly formed by carbonate and silica. Mineralogy of carbonate mostly formed by Calcium (Ca) contained on Calcite ($CaCO_3$), Dolomite ($CaMg(CO_3)_2$) while Silica, Alumina, Iron Oxide element found as SiO_2, Al_2O_3, Fe_2O_3, MgO on rock. Identification of the spread of this material on the surface is expected to provide accurate information for the implementation of further exploration activities. Three analysis method were conducted which are Surface Geological Mapping to describe macro petrology, Petrography analysis to determine mineralogy microscopic and Geochemical method using XRF to identified chemical mineralogy of rock. Research area mostly generated by tectonically complex where the sedimentation mostly controlled the existence of material using in cement industry Limestone is carbonate lithology unit that develop on research area where known as Packstone to Wackestone (Petrography) while "Calcitic Limestone" to "Marly Limestone" classification from Geochemical analysis (XRF). Another material such as Silica and trass material are also found on this research area to support cement industry.

Keyword: Carbonate, XRF, Trass, Packstone,Wackestone

SARI

Material industri semen sebagian besar dibentuk oleh bahan karbonat dan silika. Mineralogi karbonat sebagian besar dibentuk oleh Kalsium (Ca) yang terkandung pada Kalsit ($CaCO_3$), Dolomit ($CaMg(CO_3)_2$) sedangkan Silika, Alumina, dan unsur Iron Oxide ditemukan sebagai SiO_2, Al_2O_3, Fe_2O_3, MgO pada batuan. Identifikasi terhadap penyebaran material ini di permukaan diharapkan mampu memberikan infomarasi yang akurat untuk pelaksanaan kegiatan eksplorasi selanjutnya. Tiga metode analisa yang dilakukan yaitu Pemetaan Geologi Permukaan untuk mendeskripsikan batuan secara makro,

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Analisa Petrografi untuk menentukan mineralogi mikroskopik dan metode Geokimia menggunakan XRF untuk mengidentifikasi mineralogi kimia pada batuan. Daerah penelitian sebagian besar dihasilkan oleh kompleks tektonik dimana sedimentasi sebagian besar mengendalikan keberadaan bahan yang digunakan dalam industri semen. Limestone adalah unit litologi karbonat yang berkembang di daerah penelitian yang dikenal sebagai Packstone sampai Wackestone (Petrografi) sedangkan "Calcitic Limestone" sampai "Marly Limestone" dari analisis Geokimia (XRF). Bahan lain seperti Silika dan material trass juga ditemukan di sini. area penelitian untuk mendukung industri semen.

Kata kunci : *Karbonat, XRF, Trass, Packstone,Wackestone*

INTRODUCTION

Carbonate content founded on limestone is a sedimentary rock and formed by the accumulation of shells and shell fragments, or by direct crystallization of calcium carbonate from water. Most limestone are of marine origin, formed in shallow water, typically in depths of less than 20 m. A few were develop in lagoons or in fresh water (Agnello, 2005).

Two processes of diagenesis are important in the formation of limestone. One is cementation, in which calcium carbonate precipitates in the pore space between the loose grains of sediment and binds them together into a hard compacted rock. The other process involves the alteration of the minerals, such as the transformation of the crystal from aragonite to calcite (orthorhombic to trigonal), and the dolomitic of calcite by absorption of magnesium from surrounding water (Goldsmith and Newton, 1969). Geological analysis normally added early information prior taking any further decision for mining or exploration.

In the cement industry, Calcium (Ca) is a very important element that found largely in the limestone. Mineralogy of limestone closely associated with Ca-bearing minerals, e.g calcite and aragonite (CaCO), dolomite ($CaMg(CO_3)_2$) , magnesite ($MgCO_3$), Wollastonite ($CaSiO_3$), gypsum ($CaSO_4$), diopside, tremolite, epidote and scapolite. Ca has an economic value if their percentage greater than 36% on the rock. In addition to Ca, cement industry is also needed Si which can content on limestone as impurities material within carbonate rocks, such as Marl, Siliceous Clay and Marble. The presence of impurities such as Si and Fe in the limestone depend on certain depositional environment (Japanese Industrial Standard Committee,1992).

American Society for Testing and Materials (ASTM) C150 (Standard Specification for Portland Cement), C595 (Standard Specification for Blended Hydraulic Cement) or C1157 (Performance Specification for Hydraulic Cements) mentioned if mineral oxide such as SiO_2, CaO, Al_2O_3, Fe_2O_3, are mostly component for standard cement composition.

METHODS

Collecting sample was conducted on Geological Mapping for differentiate rock along research area. Geological description is the most method used to completed this journal, however geochemical and petrography were others method for conform and supporting the main description.

Insitu (non transported) rock which is predicted has contains those mineral are collected as geological sampling then conduct XRF analysis for 92 samples hopefully represent the distribution of primary mineralization target on this area research.

Petrography analysis method 11 samples were send to laboratory for microscopic mineralization of rock. The result will support geological interpretation that develop in this area.

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RESULT

Geological mapping for was conducted to identified lithology and mineralogy on research area. Lithology representative were collected and perform geological analysis to locate the carbonate potential.

Local Geology

Morphology on research area classified into Alluvial Plain 13.05 % of area, Undulating Plain 10.08% of area, Undulating Hill 76.87% of area. Alluvial plain consist of boulder basalt, chert and clay sedimentation material; Undulating plain consist of Tuff and Limestone; Undulating hill consist of metamorphic, granite, tuff, sandstone and limestone.

Figure 1. Geological Mapping

Based on investigate found if this research is really having complexity geological aspect follow by regional process around. Lithology units consist of Basement/metamorphic complex, Basalt Unit, Granite unit, Volcanic Breccia unit, Quartz Sandstone unit, Molasses Conglomerate unit, Limestone unit, Calcareous Sandstone, Tuff unit, Alluvial.

Area research basically showed complex geological structure. It is proved by present of oldest rock came along with youngest rock on top stratigraphic position. Regional structure on this area concession can be found by topography signature. Topography/elevation is the most parameter to recognized occurrence of force in this place. North of this research area founded shear joint at Granite and Granodiorite. On southern area of research area found spotty limestone at Granit unit, it means while granite intruded the lithology above, followed by depositional of limestone (maximum transgression). Due to intrusion faster than sedimentation

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rate of limestone sediment, that's way found spotty limestone on granite intruded (Darman and Sidi, 2000). Fault brecciating found at limestone on northern part of Concession Area with direction N 360° E. Particularly tectonic rock or rock accretion are clearly found on this block, they can present as local unit lithology (basalt and granite unit) or occurs as fragment material which are flowed by river activities.

Petrographic Analysis

11 rock chip samples were used for petrography analysis using Polarization Microscope Nikon. Typical carbonates rock which within the area are Pakcstone to Wackestone (Hill and Schluter,1993). While the rock which is non carbonate, consist of Radiolarian Chert, Crystal Tuff, Silicified, Andesite, Granite, Quartz Arenite

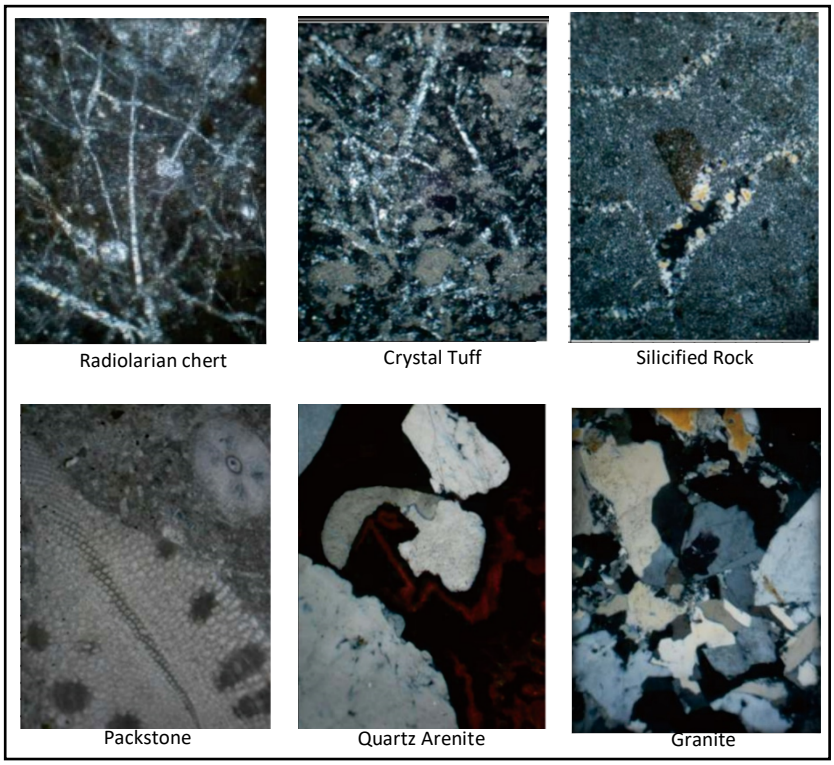

Figure 2. Petrography Analysis

XRF Analysis

Chemical and mineralogy analysis used XRF Brooker Puma 3 type. Those result were shown table below:

Table.1 Chemical result

Code Sample	LoI	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	K_2O	Na_2O	P_2O_5	Cl
ADP-01	39.58	5.00	1.25	0.97	52.20	0.60	0.00	0.21	0.00	0.15	0.01
ADP-02	41.34	2.90	0.68	0.42	53.88	0.58	0.00	0.05	0.00	0.11	0.01
ADP-11	40.16	5.07	1.36	0.53	52.01	0.57	0.00	0.18	0.00	0.06	0.01
ADP-25	41.03	3.45	0.73	0.53	53.59	0.52	0.00	0.06	0.00	0.06	0.01
ADP-26	36.08	12.07	2.46	1.26	46.96	0.61	0.01	0.35	0.00	0.07	0.01

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Code Sample	LoI	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	K_2O	Na_2O	P_2O_5	Cl
ADP-27	39.42	6.17	1.40	0.55	51.55	0.46	0.00	0.29	0.00	0.07	0.01
ADP-28	42.49	0.85	0.24	0.28	55.68	0.32	0.00	0.02	0.00	0.09	0.01
ADP-29	41.64	2.30	0.66	0.38	54.12	0.59	0.00	0.06	0.00	0.21	0.01
ADP-30	42.27	1.48	0.46	0.33	54.84	0.46	0.05	0.03	0.00	0.06	0.01
ADP-34	41.43	2.75	0.54	0.40	54.20	0.23	0.00	0.04	0.00	0.37	0.01
ADP-36	41.42	2.56	0.55	0.40	54.08	0.45	0.00	0.04	0.00	0.45	0.01
ADP-38	41.57	2.08	0.65	0.84	54.26	0.39	0.00	0.04	0.00	0.13	0.01
ADP-39	40.26	5.70	1.73	0.56	50.50	0.81	0.02	0.06	0.00	0.30	0.01
ADP-52	39.74	5.92	1.15	0.67	51.58	0.56	0.00	0.22	0.00	0.10	0.01
DPB-59	42.21	1.50	0.36	0.35	54.94	0.42	0.00	0.07	0.00	0.12	0.01
DPB-60	40.57	4.84	0.49	0.36	52.92	0.45	0.00	0.06	0.00	0.27	0.01
DPB-61	42.18	1.56	0.38	0.31	54.90	0.49	0.00	0.04	0.00	0.12	0.01
DPB-70	41.78	2.47	0.50	0.40	54.13	0.43	0.05	0.04	0.00	0.16	0.01
DPB-71	40.13	4.73	0.98	0.71	52.09	0.51	0.44	0.11	0.00	0.22	0.01
DPB-72	40.86	3.48	0.87	0.49	53.68	0.28	0.00	0.06	0.00	0.23	0.01
DPB-76	27.48	36.26	0.69	0.50	34.44	0.42	0.00	0.09	0.00	0.06	0.01
DPB-04	41.66	2.75	0.82	0.48	53.60	0.48	0.00	0.07	0.00	0.08	0.01
DPB-05	39.30	6.82	0.96	1.33	50.40	0.76	0.02	0.23	0.00	0.11	0.01
DPB-14	42.09	1.82	0.24	0.36	54.99	0.33	0.00	0.03	0.00	0.11	0.01
DPB-17	41.99	2.14	0.51	0.42	54.16	0.44	0.00	0.06	0.00	0.24	0.01
DPB-24	41.67	2.29	0.57	0.41	53.95	0.89	0.00	0.06	0.00	0.11	0.01
DPB-25	42.19	1.82	0.49	0.30	54.70	0.36	0.00	0.04	0.00	0.07	0.01
DPB-27	42.50	0.99	0.28	0.27	55.60	0.24	0.00	0.01	0.00	0.06	0.01
DPB-34	42.77	0.33	0.17	0.22	56.14	0.24	0.00	0.01	0.00	0.10	0.01
DPB-38	41.50	2.56	0.81	0.38	54.10	0.52	0.00	0.04	0.00	0.04	0.01
JML-39	39.30	6.53	1.40	0.72	50.51	0.97	0.32	0.09	0.00	0.07	0.01
JML-45	39.91	6.21	1.31	0.46	51.05	0.77	0.00	0.13	0.00	0.09	0.01
JML-49	40.42	4.38	1.06	1.58	51.49	0.73	0.02	0.10	0.00	0.13	0.01
JML-50	41.18	3.63	0.99	0.62	52.55	0.46	0.20	0.08	0.00	0.23	0.01
JML-53	29.31	23.88	7.31	2.92	33.20	1.52	0.08	0.91	0.00	0.22	0.01
JML-54	39.56	6.78	1.48	0.58	50.42	0.85	0.00	0.19	0.00	0.06	0.01
JML-56	34.74	17.48	2.78	1.03	42.54	0.87	0.00	0.36	0.00	0.05	0.01
JML-60	42.03	2.11	0.58	0.41	54.07	0.61	0.00	0.05	0.00	0.11	0.01
JML-62	39.90	6.84	0.26	0.27	52.09	0.57	0.00	0.02	0.00	0.05	0.01
JML-63	37.10	13.59	1.04	0.57	45.59	1.72	0.00	0.18	0.00	0.16	0.01
JML-64	42.57	1.46	0.29	0.34	54.50	0.58	0.12	0.03	0.00	0.09	0.01
JML-69	41.83	2.33	0.16	0.26	54.83	0.41	0.00	0.03	0.00	0.14	0.01
JML-70	38.48	8.65	1.48	1.11	49.10	0.54	0.00	0.50	0.00	0.06	0.01
JML-71	40.84	4.91	0.38	0.33	52.85	0.52	0.00	0.05	0.00	0.11	0.01
JML-72	41.13	2.90	0.73	1.05	53.63	0.38	0.00	0.10	0.00	0.04	0.01
JML-73	42.53	1.24	0.28	0.25	54.99	0.61	0.00	0.01	0.00	0.06	0.01
JML-74	42.05	1.88	0.37	0.31	54.85	0.45	0.00	0.02	0.00	0.04	0.01
JML-77	32.50	13.28	2.36	3.65	41.80	1.07	4.43	0.62	0.00	0.13	0.01
JML-78	39.76	6.16	0.94	0.50	51.90	0.48	0.00	0.15	0.00	0.05	0.01
JML-81	41.22	3.61	0.89	0.68	52.89	0.40	0.00	0.13	0.00	0.11	0.01
JML-82	41.09	3.76	0.87	0.72	52.79	0.37	0.03	0.17	0.00	0.12	0.01
JML-84	41.81	2.55	0.57	0.50	53.88	0.53	0.00	0.07	0.00	0.05	0.01
JML-89	42.52	1.39	0.30	0.37	54.92	0.41	0.00	0.01	0.00	0.05	0.01
JML-90	42.65	0.76	0.17	0.31	55.69	0.29	0.00	0.02	0.00	0.06	0.01
DPB-93	41.51	2.94	0.56	0.56	53.83	0.35	0.00	0.13	0.00	0.07	0.01
DPB-95	41.17	3.79	0.96	0.44	52.85	0.43	0.00	0.13	0.00	0.18	0.01
DPB-97	41.18	3.90	0.82	0.64	52.65	0.45	0.00	0.12	0.00	0.18	0.01
DPB-98	40.98	4.32	0.82	0.72	52.37	0.49	0.00	0.20	0.00	0.06	0.01

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Code Sample	LoI	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	K_2O	Na_2O	P_2O_5	Cl
FP-100	41.74	2.95	0.72	0.45	53.20	0.67	0.08	0.12	0.00	0.04	0.01
FP-101	42.10	2.18	0.42	0.45	54.36	0.37	0.00	0.06	0.00	0.03	0.01
FP-102	37.89	11.54	0.60	0.39	48.75	0.47	0.00	0.09	0.00	0.22	0.01
FP-105	42.74	0.86	0.10	0.26	55.67	0.30	0.00	0.01	0.00	0.05	0.01
FP-112	42.55	1.45	0.26	0.30	54.75	0.58	0.00	0.04	0.00	0.04	0.01
FP-113	41.00	4.43	1.14	0.45	52.03	0.72	0.00	0.12	0.00	0.05	0.01
FP-114	41.39	3.61	0.70	0.41	52.56	0.70	0.43	0.11	0.00	0.05	0.01
HR-115	34.57	20.44	0.86	0.41	42.89	0.63	0.00	0.08	0.00	0.10	0.01
DPB-01	41.91	2.56	0.87	0.33	53.44	0.74	0.00	0.05	0.00	0.06	0.01
DPB-02	41.71	2.70	0.81	0.50	53.49	0.60	0.00	0.08	0.00	0.06	0.01
DPB-02	39.92	5.96	1.05	0.69	51.25	0.71	0.00	0.15	0.00	0.21	0.01
DPB-05	40.89	4.85	0.93	0.46	51.90	0.68	0.00	0.17	0.00	0.08	0.01
DPB-06	36.98	13.38	0.78	0.62	46.65	1.22	0.00	0.10	0.00	0.21	0.01
FP-06	41.74	2.39	0.52	0.43	54.26	0.47	0.00	0.05	0.00	0.11	0.01
FP-03	40.57	4.90	1.33	0.48	51.63	0.71	0.00	0.24	0.00	0.07	0.01
FP-25	42.76	0.64	0.25	0.22	55.72	0.30	0.00	0.02	0.00	0.05	0.01
FP-40	40.28	5.24	1.13	0.56	50.03	1.87	0.68	0.08	0.00	0.05	0.01
FP-43	40.56	4.58	1.05	0.38	52.70	0.36	0.00	0.25	0.00	0.04	0.01
FP-44	41.81	2.23	0.52	0.28	54.80	0.23	0.00	0.05	0.00	0.06	0.01
FP-45	42.30	1.58	0.43	0.30	55.00	0.24	0.00	0.05	0.00	0.07	0.01
FP-47	42.62	1.07	0.39	0.26	55.15	0.37	0.00	0.04	0.00	0.07	0.01
FP-48	42.81	0.72	0.27	0.22	55.54	0.35	0.00	0.02	0.00	0.05	0.01

According to chemical analysis for limestone rock sample, lime contain can be classified based on $CaCO_3$, SiO_2, and MgO composition. Limestone on research area generally contain 52.5% CaO, 4.3% SiO_2, and 0.6% MgO. After used Terner chart for limestone classification found if limestone on this area include onto "Calcitic Limestone" to "Marly Limestone".

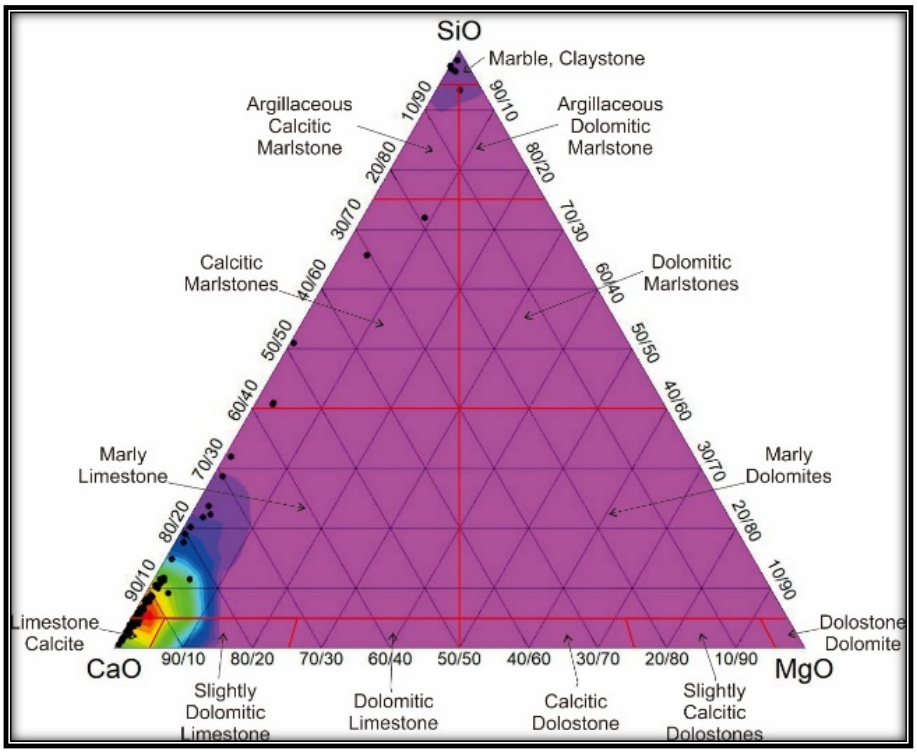

Figure 3. Terner Plot

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SUMMARY

Geological condition on research area are ready supported to conduct exploration or any further activity for cement industry. Sedimentation and volcanic and tectonic generally formed mineralogy rock on research area. There are 10 lithology unit were developed on research area and mostly content with element that can support for cement industry.

Carbonate, silica and trass element as primary material for cement industry develop on research area. Carbonate type was greatly growth where the fossil shell appears. Carbonate platform was appearing where the major regressive on Sumatra regional that happened on Miocene defined as Baturaja Formation (Geologi Regional Lembar Palembang). Composition of Silica and trass material were found on Volcanic and Igneous rock exactly on Tuff, Granite and Coarse Arenite. Silica material also found on Chert where the Carbonate material were not developing due to limitation of sun wave penetrate through that particular water depth.

Mineralogy on rock were analysis using Field description, Petrography and Geochemical (XRF). Based on these analysis carbonates rock type which within the area are Packstone to Wackestone (Petrography) while "Calcitic Limestone" to "Marly Limestone" classification from Geochemical analysis.

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