The Geological study of the conditions of ore formation of Non-combustible Kaolinite in Jirandeh,Guilan province with a special focus on its use in industry

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Abstract

The area under the study is located in Guilan Province. Mineralization has occur-ed in the upper part of Drood formation. Outcropping of the non-combustible minerals in this area is the result of the folding of Jurassic-Triassic sediments. Kaolin and Bauxite in the study area are have limestone bedding. the surface of limestone was covered with shale, sand stone and Shemshak conglomerate which can yet be seen in this area. This layer has then supplied the aluminium for Bauxite formation. Bauxite has a rich Laterite Gossan in its upper zone showing enrichment of iron in the upper zone. The thickness of Iron zone on the surface non-combustible zone varies from 0 to 2 meters. Regarding 31%assay of Iron and the existence of calcite and kaolinite, It's very appropriate for the use of the cement industry. Kaolinite and Bauxite samples have a high degree of non-combustibility above 1170 centigrade and as a result of Siger Cone test, they have 30 or above PCE and can be used to produce non-combustible bricks and other non-combustible products.

Interdiction

Fire Clays (Refractory clays),basically contain water bearing alumina silicate minerals with amounts of other minerals like Bauxite, Diaspore, Boehmite, Gibbsite. From the chemical viewpoint, fire Clays can comprise from 20% to 45% Alumina, less than 3% Iron Oxide and less than 3% Alkaline Oxides(Na_2O+K_2O)The more the amount of Alumina increases as the amounts of Iron Oxide and Alkaline Oxides decreases, the more desirable fire Clays will be The Fire Clays used for the production of Re-factory products, have more than 45% Alumina in their chemical formulae. The common names used for fire Clays include: Fire clay, Flint clay-hard clay, Plastic-Ball clay.

Geographical location

The area under the study is located in the south eastern part of Guilan Province of which the biggest population centre is the city of Jirandeh, the centre of Amarlou, borough of Roodbar. (Figure 1)

Geology of the study area

The area of study is located in the central part of Jirandeh geology map with scale of 1: 100 000. In this study, the geology map with the scale of 1: 25 000 was prepared for more in-depth investigation (figure 2).

The obvious geological characteristics of this area are the lack of outcrop Precambrian and also early & middle Palaeozoic rocks. The late Palaeozoic rocks include Rooteh formation with the age of late Permian which can be seen in same places in this area. The main part of the area include Mesozoic rocks (Elika Formation) with the age of middle & early Triassic and particularly late Triassic-early Jurassic (Shemshak Formation). Cenozoic rocks (Miocene Conglomerate and volcanic and Sedimentary rocks of Eocene) are highly widespread.

Geology & Economic geology

Mineralization has occur-ed in the upper part of Drood formation(sub Permian)In Pakdeh mine, because of the layers Inversion, the outcrop of these layers are laid beneath white quartzite-bright grey related to the sub part of Drood formation. Mineralization has occurred on the direction of a bedding slop cut out by a fault zone with a relatively steep slope. It seems that the limes and Dolomite on the upper side of Elika formation(Triassic)on sedimentary basin, haring formed out of the water for along period of time, have been eroded. The existence of numerous karstic cavities and also the numerous calcite veins and formation uplifted the shallow sea of Triassic effected by the atmospheric factors and penetration of surface waters for along time. As a result of the process limes were karstified by waters. then the non-combustible Argillite affected by the physical and chemical factors of erosion from the mother-rock including external and internal igneous acidic rock.

It is carried by the water movement and deposited on the down throws and uplifts of the middle Triassic. The wary state of middle Triassic surface is obviously on outcrops of these limes And the thickness of non-combustible Argillite is greater on the gown throws and less on uplifts. In the places where the uplifts are high, non-combustible Argillite is either basically not formed or if formed, it is eroded and destroyed. The age of non-combustible Argillite is explored area of the latest Triassic.

The experimental studies done on the non-combustible Argillite shows that the fire Clay mine of Pakdeh like the other mines in the region, contains Kaolinite. In someplace where the percentage of Alumina increases, The fire Clay loses its soapy luster and softness, as a result, it's colour is changed from Grey and buff colour. These non-combustible samples contain largely Diaspore and Bohimite minerals recognized in the bauxite groups. These samples have a rough luster, in addition to their bright colour, usually containing up to 52% Alumin (table 1).

Outcropping of the non-combustible minerals in this area is the result of the folding of Jurassic-Triassic sediments. In most places this out-cropping of fire Clay on the western side of Pakdeh village confirm our claim. The syncline axial surface has eastern-western whereas syncline plunge is on the direction of east. The result of experimented samples show that while on the non-combustible black clay, the percentage of Titanium Oxide is high, but it seems that the colour darkness of the parts of granulite or pisolite is related to the organic materials. beneath the the pisolitic layer, Usually a relatively pure layer of fire Clay, whose thickness is variable. under the pure non-combustible, there is a layer of pyrite & Marcasite minerals. Pyrite and Marcasite can most be seen near the joints. The Iron sulphurs must have been formed though decomposition and corrosion of organic materials available in the coal sediment of Klariz formation(upper Triassic)and then formed as a secondary sediment beneath the non-combustible layer.

On some parts, an Iron zone was observed along with the non-combustible argillites which appeared on the surface in the form of limonite and Hematite(in Pakdeh mine)and on the footwall of the layer in the form of sulphur and Pyrite and Marcasite. Iron Oxide zone varies in different locations and most of timed appears in the surface, but it also appears in the middle part and foot-walls of the layer.

Conclusion

Kaolin and Bauxite in the study area are have limestone bedding. Therefore they are classified in Karstic Bauxite deposit category. Comparing genesis of Pakdeh mines with that of other mines tends to suggest an autochthon deposit similar to Komer model (1974).

At first, the surface of limestone was covered with shale, sand stone and Shemshak conglomerate which can yet be seen in this area. This layer has then supplied the aluminium for Bauxite formation. Eilka karstic surface has also provided the conditions for high vertical washing together with surface erosion suitable for the formation of Bauxite and Laterite deposits. In addition, their formation through high chemical weathering in the long period of time is facilitated.

Bauxite has a rich Laterite Gossan in its upper zone showing enrichment of iron in the upper zone and aluminium in the lower zone. The relative aluminium enrichment by the extraction of iron from Laterite suggests a revival condition.

Microscopic laminate from seen indicates a change from the oxidation to revival condition at the time of formation. Goethite and pyrite belonging to the revival condition indicates the initial formation of the minerals in the saturated zone. Next, as the result of static surface lowering, there has been an increase of oxygen leading to oxidant condition. Therefore, Hematite and limonite are formed.

The thickness of Iron zone on the surface non-combustible zone varies from 0 to 2 meters. Regarding 31%assay of Iron and the existence of calcite and kaolinite, It's very appropriate for the use of the cement industry. According to the needs of cement production factories(for the mixture has been imported in the province).It is proposed that further studies are required to be conducted on this layer with the focus on the large scale exploration in the region.

In the study of the quality of non-combustible kaolinites, all the samples have a high degree of non-combustibility above 1170 centigrade and as a result of Siger Cone test, they have 30 or above PCE. Non-combustible clay samples having a high plasticity with an iron oxide less than 2 percent, can be used in Non-combustible products. Their baking color is white and white cream whereas the rate of contraction is about 5 percent. The temperature of non-combustibility of the samples ranges from 1300 to 1400 degrees centigrade. The foregoing suggests that the ore body can be used to produce non-combustible bricks.

According to the experiment done on the fire Clays of this region, the results suggest that the fire Clays have high percentage of Titanium Oxide TiO2being about 5.7 percent. Regarding the strategic importance of the ore, it is proposed that with constructing a mineral processing acting for producing the non-combustible products in the region-this valuable mineral be studied as a secondary aim.

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Attachment

Figure 1 : location of study area

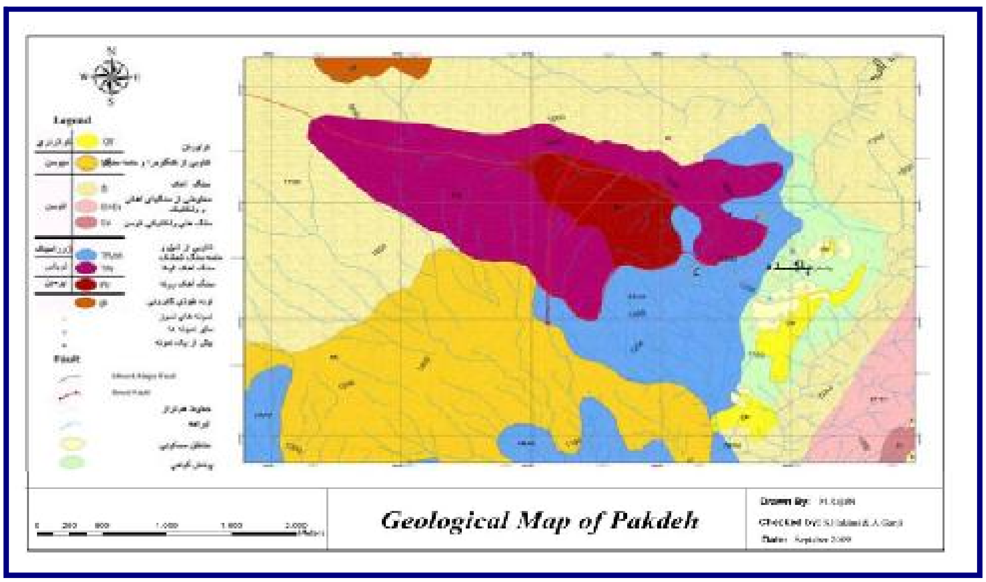

Figure 2: geological Map of study area

Table 1 : XRF Analyses Results

زمین افزار
شرکت تحقیقات زمین شناسی

شماره ۸۶۴۵۹
تاریخ ۸۶/۱۲/۵

نتایج آنالیزات ICP.XRF.XRD

نتایج آنالیز XRF

Sample	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	CaO %	Na_2O %	MgO %	K_2O %	MnO %	P_2O_5 %	TiO_2 %	L.O.I %	SO_3 %
J-S-1	45.62	33.12	1.16	0.25	0.12	0.59	3.61	0.001	0.041	1.235	14.09	0.001
J-S-2	45.58	33.09	1.15	0.21	0.14	0.64	3.58	0.001	0.046	1.237	13.66	0.001
J-S-3	45.66	33.14	1.21	0.28	0.12	0.61	3.55	0.001	0.043	1.241	14.04	0.001
J-S-4	49.87	33.15	1.19	0.23	0.16	0.67	3.57	0.001	0.042	1.239	13.71	0.001
J-S-5	37.12	40.80	0.75	0.10	0.01	0.15	0.09	0.002	0.065	5.708	14.82	0.001
J-S-6	37.18	40.92	0.65	0.12	0.04	0.13	0.07	0.003	0.073	5.718	14.97	0.001
J-S-7	1.64	0.95	31.43	21.88	0.01	7.85	0.06	0.302	0.064	0.200	35.03	0.145
J-S-8	1.72	0.88	31.64	21.95	0.01	7.76	0.07	0.311	0.063	0.213	35.19	0.132
J-S-9	2.29	1.65	27.19	21.27	0.01	10.43	0.07	0.294	0.020	0.124	35.97	0.158
J-S-10	2.32	1.61	27.21	21.32	0.01	10.32	0.06	0.287	0.021	0.119	36.45	0.163
J-S-11	22.83	58.25	0.51	0.04	0.01	0.81	0.13	0.001	0.132	5.101	12.08	0.001
J-S-12	23.11	58.37	0.49	0.03	0.01	0.13	0.12	0.001	0.125	4.886	12.69	0.001
J-S-13	22.95	58.32	0.42	0.03	0.01	0.16	0.13	0.001	0.136	4.903	12.58	0.001
J-S-14	22.78	58.41	0.74	0.06	0.01	0.16	0.15	0.001	0.121	5.011	12.51	0.001
J-S-15	62.01	13.67	3.29	5.34	1.92	1.89	3.51	0.101	0.086	0.324	6.92	0.355
J-S-16	62.12	13.82	3.35	5.28	1.87	1.91	3.54	0.103	0.083	0.331	7.26	0.376
J-S-17	43.20	37.56	0.88	0.07	0.01	0.12	0.14	0.001	0.055	3.155	14.42	0.025
J-S-18	42.35	33.92	4.78	0.14	0.01	0.17	0.68	0.001	0.132	3.175	14.20	0.003
J-S-19	44.02	34.02	3.21	0.02	0.01	0.02	0.01	0.001	0.030	3.734	14.72	0.001
J-S-20	44.11	34.05	3.17	0.07	0.01	0.04	0.02	0.001	0.024	3.856	14.50	0.001
J-S-21	69.92	22.04	0.35	0.09	0.01	0.05	0.14	0.001	0.012	0.321	6.92	0.001
J-S-22	40.29	31.45	10.81	0.08	0.01	0.10	0.34	0.001	0.082	2.715	13.55	0.025
J-S-23	72.09	19.76	0.11	0.08	0.01	0.10	0.01	0.001	0.032	0.603	9.89	0.001
J-S-24	70.15	18.19	4.33	0.47	0.01	0.22	0.41	0.033	0.154	0.556	5.76	0.001
J-S-25	63.98	18.72	1.91	0.09	0.01	0.79	0.09	0.091	0.329	0.409	5.55	0.001
J-S-26	74.47	13.69	3.74	0.12	0.37	0.10	0.06	0.001	0.122	0.516	6.52	0.001
J-S-27	2.07	0.68	0.06	53.45	0.01	0.44	0.02	0.016	0.051	0.077	42.05	0.001
J-S-28	65.92	18.76	1.50	2.44	0.02	0.27	0.56	0.083	0.101	0.646	5.45	0.001
J-S-29	74.82	18.73	0.12	0.06	0.02	0.06	0.01	0.001	0.067	0.748	5.12	0.001
J-S-30	67.02	20.50	3.31	0.07	0.19	0.07	0.20	0.001	0.143	0.621	7.65	0.001
J-S-31	68.03	19.85	2.86	0.16	0.01	0.08	0.01	0.001	0.162	0.832	7.63	0.001
J-S-32	73.93	18.84	0.24	0.10	0.01	0.09	0.03	0.001	0.025	0.782	5.79	0.002
J-S-33	71.43	19.79	0.28	0.22	0.01	0.06	0.01	0.001	0.094	0.799	7.11	0.003
J-S-34	75.42	17.19	0.30	0.21	0.01	0.09	0.01	0.001	0.037	0.888	5.83	0.001
J-S-35	52.83	16.52	5.24	9.03	0.05	0.45	0.85	0.048	0.076	0.743	13.85	0.001
J-S-36	10.10	0.50	0.37	50.39	0.01	1.28	0.01	0.026	0.035	0.047	35.58	0.003
J-S-37	71.46	21.19	0.41	0.05	0.01	0.03	0.01	0.001	0.050	0.889	5.61	0.001
J-S-38	74.37	15.28	1.48	0.49	0.06	0.23	0.39	0.032	0.232	0.736	5.13	0.002
J-S-39	74.11	17.53	0.59	0.42	0.03	0.19	0.38	0.020	0.217	0.790	5.11	0.001
J-S-40	52.81	16.54	5.25	9.06	0.05	0.51	0.83	0.053	0.032	0.693	14.01	0.001

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