MT Bilimsel™
Yıl:5 | Sayı:10 | Temmuz 2016
Year:5 | Number:10 | July 2016
Yer Altı Kaynakları Dergisi | *Journal of Underground Resources* **www.mtbilimsel.com**

Makale Gönderim Tarihi: 3 Haziran 2016
Yayına Kabul Tarihi: 18 Haziran 2016

Derleme Makalesi

Economic Potential and Production of Gypsum Deposits in Turkey

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Abstract

To observe global trends in industrial raw material-minerals production, there is a need for significant data, providing information concerning investors and markets. Low value raw industrial material compare to metals, precise production figures are important as well, short-long term demand and investment. Turkey gypsum deposits have generally mined as a basin and there are no detailed petrographic and chemical studies related to these deposits. The graduate studies, carried out in a limited number, mostly are not for economical mining. In this study, evaluation of gypsum deposits in Turkey is given based on several reports, references and our geological prospection. The present data for Turkey and the world based on these statistics do not reflect the actual gypsum production in Turkey. Turkey gypsum statistical data is expressed as a low according to actual situation in the world statistics. To provide accurate data for the world statistical and to express gypsum deposits and potential of Turkey are aimed in this study.

***Key words*:** Gypsum Deposits, Turkısh Gypsum Industries, Plaster Production, Market, Statistical Data.

1. Introduction

World gypsum production statistical data of Turkey is not correct according to years and many references. Demand for gypsum principally construction industry, especially cement, manufacturing and building plasters.

Turkish manufacturer of Portland cement yearly production is over 70 x 10^6 tones. Form this point of the view the crude at least over 4.5 x 10^6 tones old years except plaster of Paris and its products. However, USGS information based on countries data is very low of Turkish production. Turkey has a large deposits and its reserves over 2 x 10^9 tones.

Table 1. Conflict of different statistical data of various sources.

Gypsum Production by Country (Thousand metric tons) * www.indexmundi.com 2013

Rank	Country	World Production, By Country (Thousand metric tons)
1	China	129,000
2	United States	15,500
3	Iran,	15,000
4	Turkey	8,300
5	Spain	6,400
6	Thailand	6,300
7	Japan	5,500
8	Russian Federation	5,100
9	Mexico	5,090.86
10	Italy	4,100
11	Brazil	3,750
12	India	3,538
13	Australia	3,500
14	Oman	2,785.13
15	Canada	2,654
16	Saudi Arabia	2,400
17	France	2,300
18	Germany	1,950
19	United Kingdom	1,700
20	Algeria	1,700
21	Argentina	1,443
22	Poland	1,270.13

*USGS 2012-2013

	Mine Production 2011	2012*
United States	8,900	9,900
Algeria	1,650	1,650
Argentina	1,340	1,200
Australia	3,500	3,000
Brazil	2,750	2,800
Canada	2,550	2,200
China	48,000	48,000
France	2,300	2,300
Germany	2,020	2,050
India	2,700	2,750
Iran	13,000	14,000
Italy	4,130	4,100
Japan	5,600	5,700
Mexico	3,840	3,850
Poland	1,200	1,200
Russia	3,000	3,100
Saudi Arabia	2,100	2,300
Spain	11,500	11,500
Thailand	9,900	10,000
Turkey	3,200	3,000
United Kingdom	1,700	1,700
Other Countries	14,500	14,900
World total (rounded)	149,000	150,000

Turkey gypsum deposits have been investigated by MTA (Mineral Research & Exploration General Directorate of Turkey) locally basins. There are no detailed studies from point of stratigraphy, sedimentology, geochemistry, structural geology, karstification and anhydride relationships (except in the province of Denizli).

2. Classification of Turkey Gypsum Deposits

In this study, the classification was carried out as follow on the basis of geological age, basin characteristics, quality of deposits (Alçiçek, 2007; Bingöl, 1997; Brennich, 1968; Çayırlı, 1991; Erdoğan, 1997; Gündoğan ve Helvacı, 2001; Gündoğan vd., 2008; Kulaksız vd., 1997a; Kulaksız vd., 1997b; Kulaksız vd., 2008; Görmüş ve Kulaksız, 1997 ; Kozacı ve Kulaksız, 2013; Yahşi ve Kulaksız, 2015; Kulaksız, 1999). The details of environmental conditions were excluded in this classification.. The basin conditions and main deposits are given in the Figure 1 and 2.

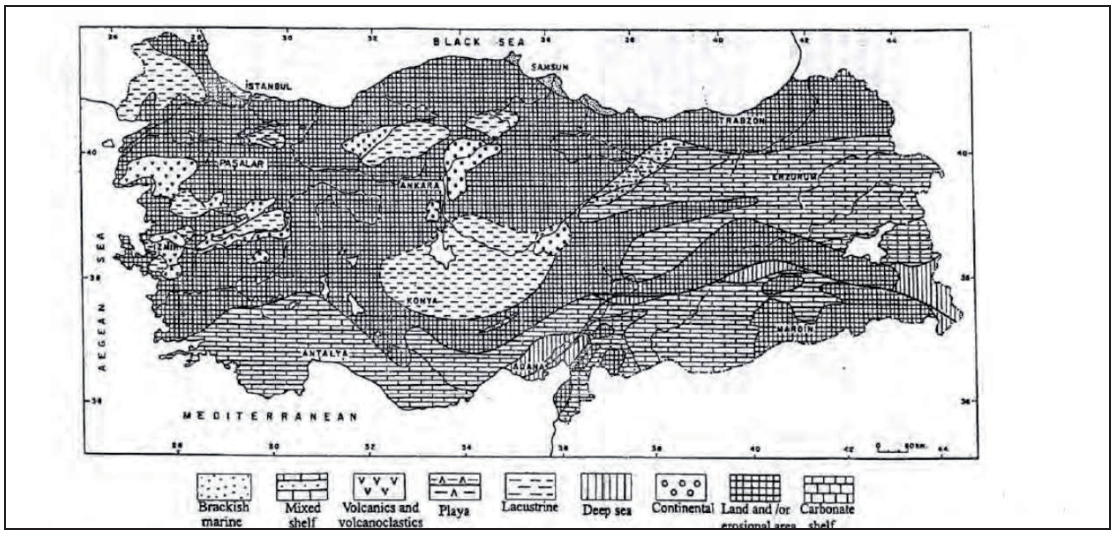

Figure 1. Turkey Lower Miocene Paleogeography (Gündoğan ve Helvacı, 2001)

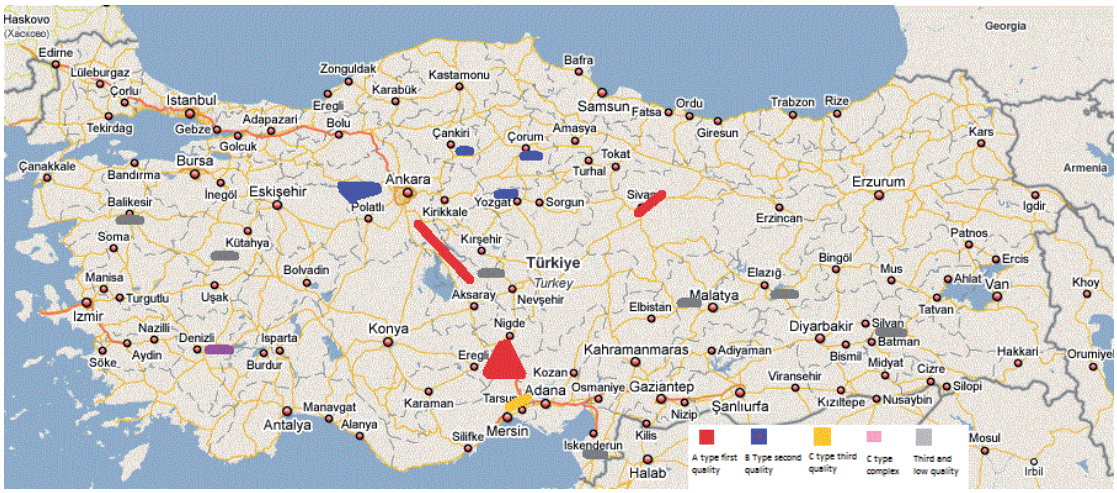

Figure 2. The main gypsum basen and gypsum quality map

According to Figure 1 and 2, important gypsum deposits are;

A- Bala (Ankara) - Aksaray-Ulukışla (Niğde) - Sivas gypsum deposits (generally massive and bedded with white color)
B- Ayas-Beypazarı-Sivrihisar gypsum deposits [bedded with gray color and clay (Messinian type)]
C- Tarsus gypsum deposits (selenite type)
D- Denizli-Honaz gypsum deposits (selenite, massive and bedded)
E- Uneconomical Eocene aged gypsum deposits are not subjected in this study

2.1. Bala-Aksaray-Ulukışla-Sivas Basin

The gypsum deposits of these regions are in white and consists of bedded structure at edges of basin according to environmental and palaeogeographical conditions. There is 1.5-2 m of selenite bed in Bala-Aladağ region according to environmental and palaeogeographical conditions. This structure is not visible in Bala region and the gypsum bed is changed to anhydrite bed after the 20-50 m thickness. The anhydride thickness has not been exactly determined. One of the exploration drilling was ended at 154 m in anhydride.

The thickness of 200-240 m in intercalation bed of gypsum+anhydrite+clay was determined in phase studies at Niğde-Bor-Ermenek. This situation was determined during Aksaray gas storage drilling.

Different researchers mentioned the thickness of 300-750 m in Ulukışla region. Sivas gypsum deposits are similar to the Bala area and has at least as a big as Bala reserve. The CaSO4.2H2O percentage varies between 90-98% in this type gypsum deposits. There are two dominant types of karst in these regions. The sink hole and groove type of karsts are dominated in dolines.

2.2. Beypazarı-Ayaş-Sivrihisar Gypsum Deposits

These deposits are bedded and in gray-white color, and contain clay and marl. The slopes of bed are between 0-15°. The CaSO4.2H2O percentage varies between 75-90%. Although there is massive white gypsum in the edges of basin. Çankırı, Çorum, Yozgat, Erzurum, Siirt, Batman regions are similar to the Beypazarı deposits. The most important problem in these regions is the laminated level of clay-marl.

2.3. Tarsus Selenite Gypsum Deposits

The massive-bedded white gypsums overlaps selenite gypsum level (80-90% CaSO4.2H2O) in Mersin-Tarsus deposits. The marl and clay content varies between 5-26% in selenite crystals. Similar deposits to these are İskenderun, Denizli-Yeşilyurt, Buldan deposits. These are more suitable to cement industry.

2.4. Denizli-Honaz Gypsum Deposit

Denizli-Honaz gypsum deposit is the Turkey's only Mesozoic gypsum deposit according to field investigations and scientific studies. It has not a homogeneous structure due to clay-marl content and tectonic structures. This deposit is not enough for gypsum industry in terms of reserves. The distribution of these deposits and quality are revised according to MTA data given in Table 2.

Table 2. Turkish main gypsum reserves and quality (Very good: $CaSO_4.2H_2O$ over 92 %, Good: 85-92 % $CaSO_4.2H_2O$, Average: 85-75% $CaSO_4.2H_2O$ content)

City	Proven (10^6 tones)	Probable (10^6 tones)	Quality
Kütahya	5	25	Average
Denizli	10	25	Average
Balıkesir	1	10	Average
Eskişehir	15	30	Good
Ankara	1.000	200	Very good
Aksaray	100	200	Very good
Niğde	500	300	Very good
Çankırı	150	100	Good
Çorum	30	100	Good
Sivas	150	500	Very good
Siirt	10	50	Good
Batman	20	20	Good
Total	1.991	1.560	

Meanwhile Bala-Koçhisar Eocene gypsum deposits are not economical due to the high overburden thickness.

2.5. Complex Type Gypsum Deposits

Other Turkish gypsum deposits are located to Bursa-Gemlik, Balıkesir-Susurluk, Kütahya, İskenderun, Malatya-Hekimhan, Kırşehir-Nevşehir. These deposits have a bedded-clayey and selenite structure.

3. Gypsum Production of Turkey

Gypsum was covered by the mining law since 2002 and production companies have been quickly started to establish their manufacturer plants for plaster and plaster products. The raw material guarantees and enlargement of construction industry in Turkey have provided this development. On the other hand, more reliable statistics for raw gypsum production has been provided.

The sixty-eight cement plants have been installed in Turkey. The 76 x 10^6 tons cement production per year is carried out from these plants. Gypsum production in Turkey is carried out in 18 private companies and 27 manufacturer plants.

The gypsum productions for the years 2004-2014 are given in Figure 3.

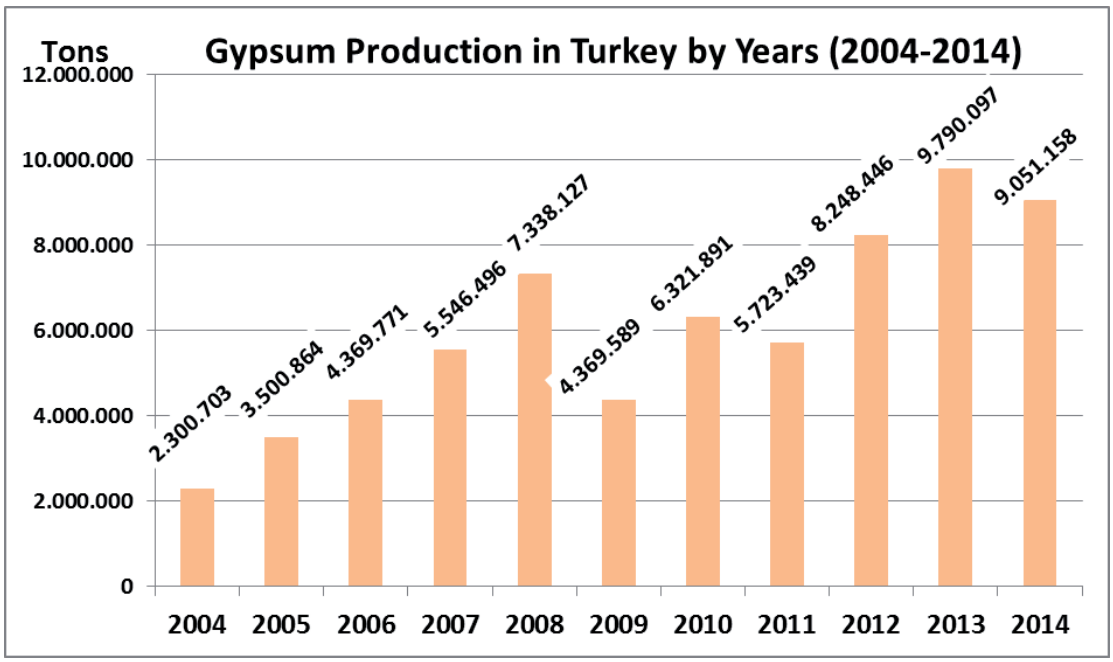

Figure 3. Turkish gypsum production between 2004 and 2014 (small scale mining companies' data are not included)

The 3.5 x 10^6 tons raw gypsum is mined annually from Middle Anatolia. The second region in terms of production is Ulukışla region and that annually production is 1 x 10^6 tons raw gypsum.

3.1. Producer Gypsum Private Companies

There are 26 private mining companies in Ankara-Aksaray regions. The annual productions of these each companies varies between 0.6 x 10^5 -1.8 x 10^6 tons/year.

The annual gypsum production (2004-2014) according to General Directorate of Mining Affairs (MİGEM) and Gypsum Producers Association of Turkey (ALÇIDER) is given in Table 2. Reliable statistics have been provided since 2006. It is considered that statistical data belongs to 2009 is not reliable due to economic crisis and unrecorded data. The cause of low production in years 2009, 2010 and 2011 is the lack of capacity of small scaled private producers in general gypsum production statistics.

Table 3. Production of gypsum plaster and gypsum products (2012-2015) (ALÇIDER)

2012 (Million Ton)	Raw Gypsum Production: 8.248		
	Domestic Production	Export	Total
Gypsum Plaster	3.150	700	3.850
Gypsum Panel	620	200	820
Total	3.770	900	4.670
2013 (Million Ton)	Raw Gypsum Production: 9.790		
	Domestic Production	Export	Total
Gypsum Plaster	3.400	800	4200
Gypsum Panel	700	210	910
Total	4.100	1.010	5.110
2014 (Million Ton)	Raw Gypsum Production: 9.051		
	Domestic Production	Export	Total
Gypsum Plaster	3.600	850	4.450
Gypsum Panel	750	250	1.000
Total	4.350	1.100	5.450
2015 (Million Ton)			
	Domestic Production	Export	Total
Gypsum Plaster	3.800	850	4.650
Gypsum Panel	800	280	1.080
Total	4.600	1.130	5.730
2016 (Million Ton)			
(Estimated)	Domestic Production	Export	Total
Gypsum Plaster	4.000	900	4.900
Gypsum Panel	850	300	1.150
Total	4.850	1.200	6.050

The number of mining licenses for gypsum in Turkey is given in Table 4 in terms of regions according to MIGEM data.

Table 4. The gypsum mining licenses figures according to province in Turkey

Province	Number of License	Number of License Non-Operated
Ankara Bala	54 34	8
Niğde	10	3
Aksaray	6	1
Erzurum	4	
Siirt	6	2
Batman	4	2
Denizli	13	6
Çorum	8	3
Çankırı	4	2
Kayseri	4	2
Kırıkkale	5	
Malatya	7	4
Tunceli	4	1

In Turkey, the number of operating license for gypsum is 394, the 166 of licenses of these operating licenses have operating permit and the number of licenses carried out actual production is 90.

4. Comments

Generally, in the world, the production of gypsum is accepted as a 1/5 to 1/3 of cement production. Accordingly, it is thought that the annual gypsum production of Turkey should be 12-20 x 10□ tons/year. In accordance with this aim, increments in the capacity of gypsum production plants should be planned. The use of gypsum plaster in all interiors must become standard and should be mandatory in construction industry. This should provide both decreasing the building loads and increasing the heat insulation.

The raw material social and fosterage guarantees should be spread to all regions, especially east regions of Turkey such as Kars, Erzurum, Tunceli and Sivas. These investments facilities will also reduce the haulage cost.

The construction activities in neighboring countries (Syria, Iraq) will increase in 2-3 years and Turkey, the closest country, will be a great advantage for gypsum investors in terms of competition.

5. Conclusions

1. Collection and evaluation of basic investment of project must include concerning technical, production and marketing data.
2. Statistical information frame work is very important and must be reliable.
3. Statistical data must be checked with various other references.
4. Turkish gypsum deposits are potential mining for regional tradable minerals for investors.
5. Our experiences the lack of statistical reserve and production are of outmost importance for regional estimates of short and long term domain and successful planning and policy.
6. Turkish gypsum industrial mineral is a big opportunity for foreigner investors for 3-4 years.

Acknowledgment

Sincerely thanks for the technical helps of Assoc. Prof. Dr. Fatih BAYRAM and Dr. Fırat ATALAY.

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