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# Gypsum in Mauritania: Resources, Uses, and Investment Opportunities



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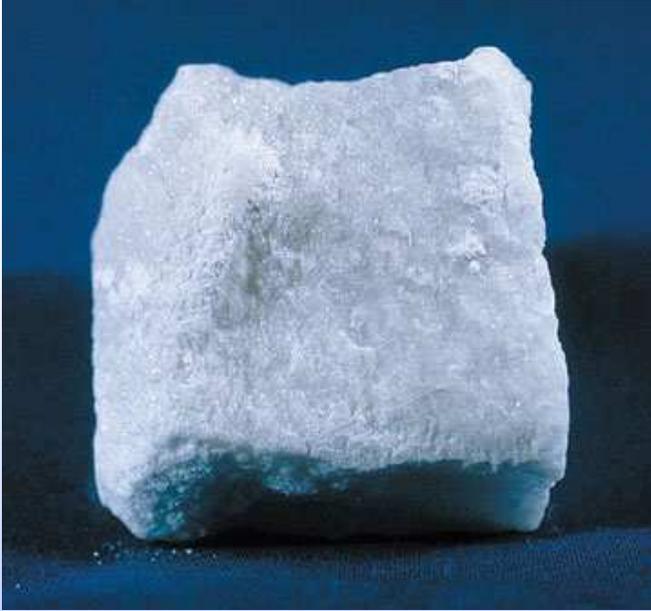
# Gypsum

- ❖ The word gypsum is derived from the Greek word γύψος (gypsos), "chalk" or "plaster".
- ❖ It is a soft sulfate mineral composed of calcium sulfate dihydrate, with the chemical formula  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- ❖ It is one of the most naturally occurring sulphate minerals and one of the most widely used industrial minerals in the world.
- ❖ Gypsum is deposited from lake and sea water, as well as in hot springs, from volcanic vapors, and sulfate solutions in veins.
- ❖ Pure gypsum is white, but other substances found as impurities may give a wide range of colors to local deposits. Impurities include  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{K}_2\text{O}$ ,  $\text{Na}_2\text{O}$ , etc...

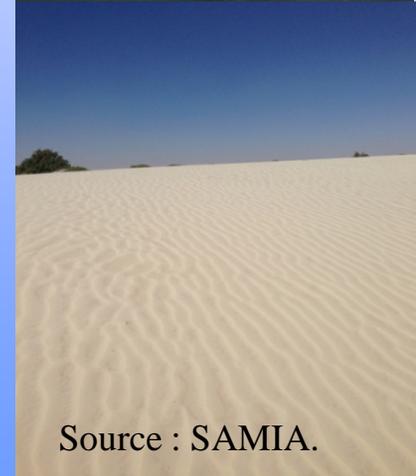
# Gypsum

- ❖ Gypsum can naturally occur in different forms :
  - ❖ massive, dense form (alabaster),
  - ❖ fibrous form (satin spar)
  - ❖ transparent crystals (selenite).
- ❖ Gypsum can also be found in the form of sand (very rare ) :
  - ❖ the White Sands National Monument in the US state of New Mexico
  - ❖ The Nadaghmecha marine sebkha near Nouakchott in Mauritania
- ❖ Gypsum is also formed as an industrial by-product :
  - ❖ **Phospogypsum** – Major by-product of phosphoric acid production
    - phosphate + sulfuric acid --> fertilizer + gypsum**
  - ❖ **Desulfogypsum** – Obtained from the desulfurization of combustion gases in coal burning power plants (Harmful SO<sub>2</sub> gas is turned into CaSO<sub>4</sub>.2H<sub>2</sub>O)

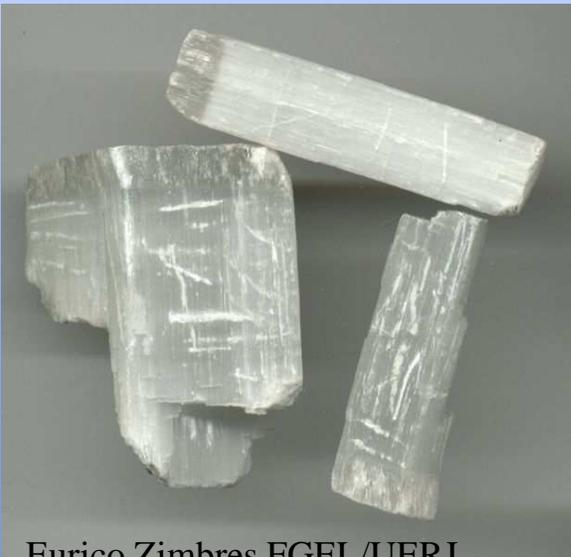
# Forms of Gypsum



Source : SAMIA.



Source : SAMIA.



Eurico Zimbres FGEL/UERJ



**Natural gypsum is extracted from open-pit quarries or from underground mines**



Source : SAMIA

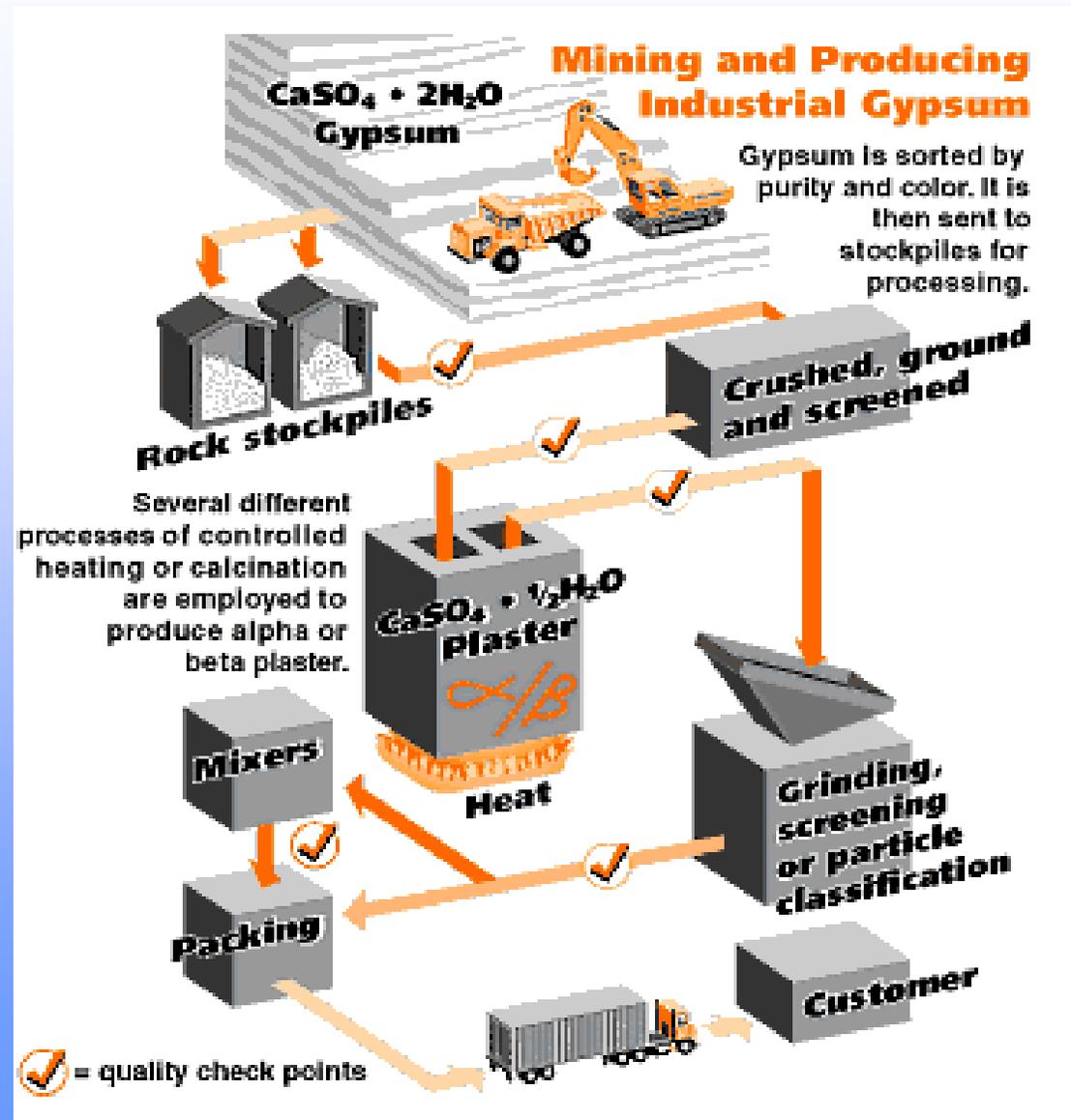
## **Gypsum uses:**

- ❖ Manufacture of plaster and wallboard.
- ❖ Set controlling agent in portland cement .
- ❖ Fertilizer and soil conditioner in agriculture.
- ❖ Higher value uses for gypsum include :
  - ❖ building and industrial plasters;
  - ❖ fillers in food, pharmaceutical, plastic and paper products;
  - ❖ set control agents for oil well cements;
  - ❖ dental plasters;
  - ❖ and a host of specialist applications in industrial processes.

**Gypsum is used in a wide range of applications**

# Manufacture of gypsum products

- ❖ Excavating
- ❖ Crushing (~25 mm diameter)
- ❖ Grinding
- ❖ Heating (calcining)
- ❖ Cooling and Pulverizing
- ❖ Marketing in Bags



# CALCINATION

- ❖ **Incomplete Calcination:** Gypsum is heated to 100-190°C, it loses  $\frac{3}{4}$  of its water.



Gypsum → **Plaster of Paris (POP) or  $\beta$  hemihydrate**

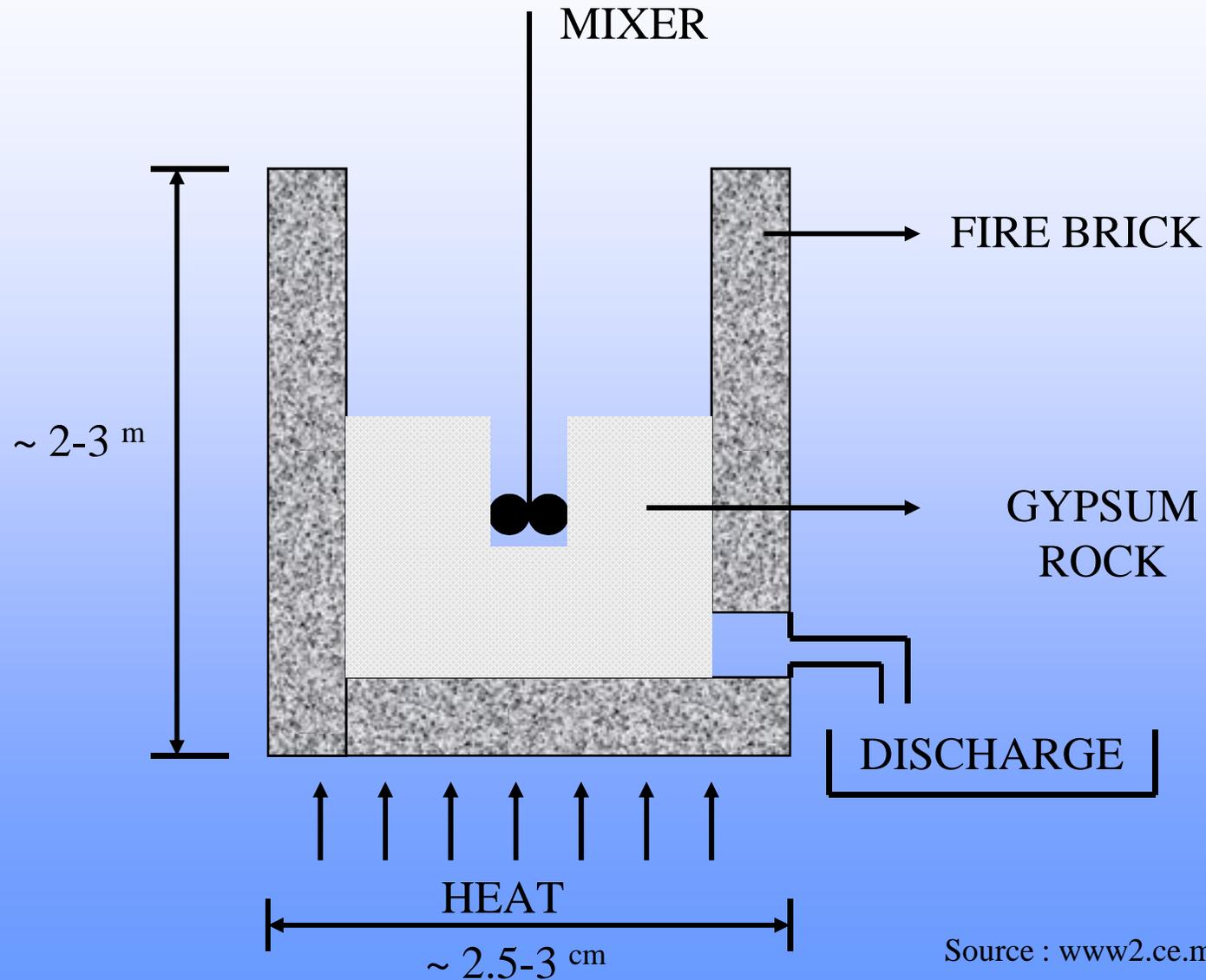
- ❖ **Complete calcination:** Gypsum is heated to T above 190°C. All water is removed.



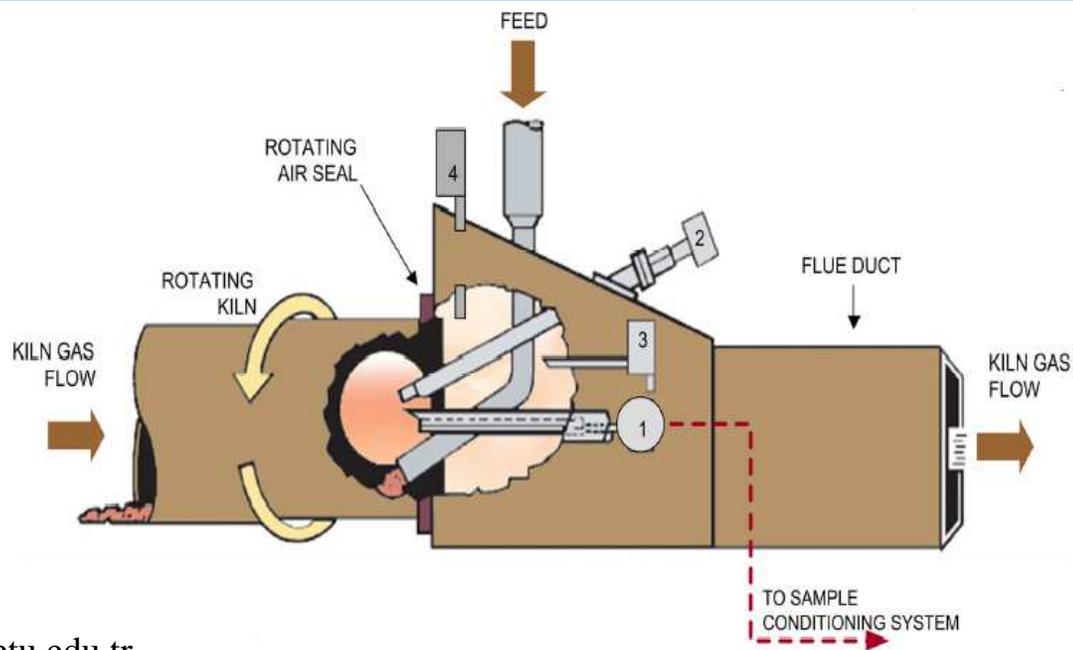
Gypsum → **Anhydrite**

- ❖ Both POP and anhydrite form gypsum by recombining with water.
- ❖ **Calcination process** is carried out in two types of kilns : Kettle Kilns and Rotary Kilns

# KETTLE KILN



# ROTARY KILN



# Calcination

- ❖ The calcination reaction is sensitive to the amount of heat and the partial pressure of water encountered in processing.
- ❖ If the reaction is conducted at **atmospheric pressure** and there is no saturated steam present, **a beta plaster** is produced.
- ❖ If the reaction is conducted in **the presence of water** (in an autoclave), an **alpha plaster** is produced.
- ❖ Both alpha and beta plasters are calcium sulphate hemihydrates ( $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ ) but they differ by:
  - ❖ the method of manufacture,
  - ❖ particle size and shape,
  - ❖ water-powder ratio,
  - ❖ the physical and mechanical properties of set material, and
  - ❖ their use.

# Properties of gypsum products

The uses of gypsum and plaster are based on the following properties :

- ❖ Setting time : ability to readily absorb water and revert to the dehydrate form and harden;
- ❖ Expansion;
- ❖ Strength;
- ❖ fire proofing material, and
- ❖ neutral pH.

Rank	Country	World Production, By Country (million MT)	
1	<u>China</u>	46	
2	<u>USA</u>	14,4	
3	<u>Iran</u>	12	
4	<u>Spain</u>	11,5	
5	<u>Thailand</u>	8	
6	<u>Japan</u>	5,8	
7	<u>Canada</u>	5,7	
8	<u>Italy</u>	5,4	
9	<u>Mexico</u>	5,1	
10	<u>France</u>	4,8	
11	<u>Australia</u>	4	
12	<u>Turkey</u>	3	
13	<u>India</u>	2,5	
14	<u>Russia</u>	2,3	
15	<u>Saudi Arabia</u>	2,3	
16	<u>Brazil</u>	2,1	
17	<u>Egypt</u>	2	
18	<u>Germany</u>	1,9	
19	<u>UK</u>	1,7	
20	<u>Algeria</u>	1,7	

# Worldwide Gypsum Market to Reach \$2.4 Billion by 2018

- ❖ In 2013, **252 million tons of gypsum** were consumed, with **31.9% and 62.5% being consumed in the plasterboard and cement industries respectively.**
- ❖ A large portion of the world's gypsum is produced from a very large number of small operations in developing countries. For examples, there are as many as 400 mines in Iran and probably more in China.
- ❖ The gypsum market is forecast to grow at a CAGR of 9.9% to reach approximately \$2.4 billion by 2018, and \$3.8 billion by 2023.
- ❖ One of the major factors driving gypsum consumption is population growth, particularly in India and China.

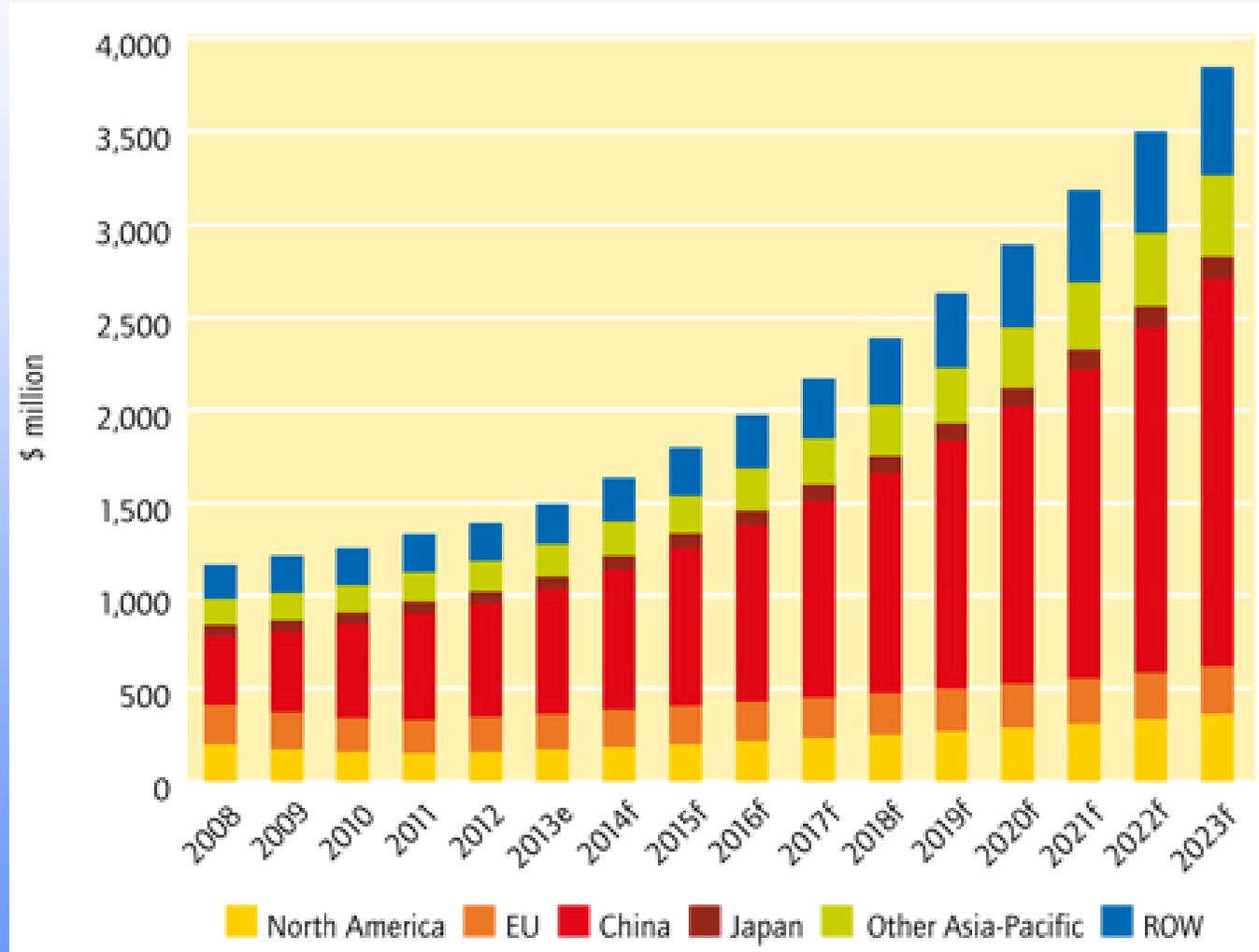
Source : Smithers Apex: [“The Future of Gypsum: Market Forecasts to 2023 “](#)

# Factors driving gypsum consumption

- ❖ Subsequent large-scale industrialization creates a need for rapid improvements in infrastructure, and increasingly prosperous populations demand higher quality housing and better living conditions.
- ❖ Developing countries are also moving away from traditional wet construction techniques and towards dry construction using prefabricated drywall. Countries such as China are also gravitating towards drywall construction, encouraged by government policies.
- ❖ The global financial crisis saw demand for gypsum drop in the construction industry by around 20% in 2008. This decline slowed between 2009 and 2010, stabilising in 2011 and establishing a strong recovery period in the US and other parts of the world in 2012 .

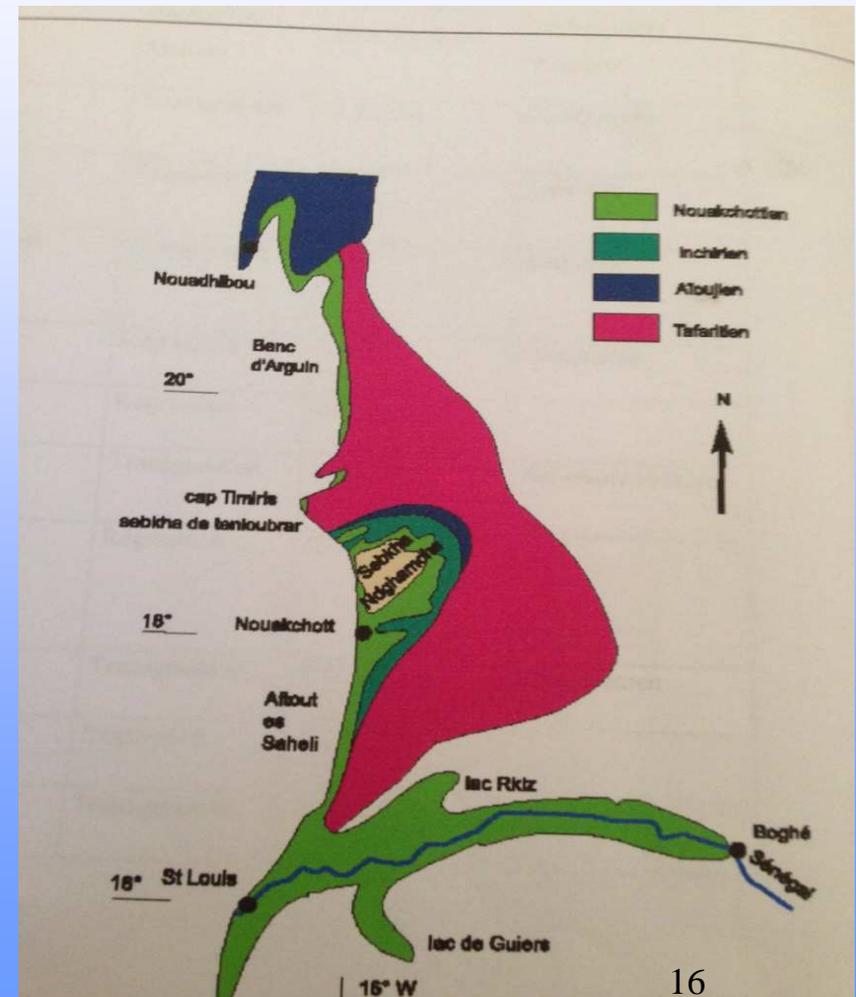
(Source : [www.smithersapex.com](http://www.smithersapex.com) and [Global Gypsum News](#) ).

# Forecast worldwide gypsum consumption by region 2008-2023



# Gypsum in Mauritania: Resources

- ❖ Discovered in the 1960s, 50 km Northeast of Nouakchott in a saline basin called Sebkhia Ndagmecha
- ❖ Gypsum occurs over an area approx. 80 km long and 50 km wide.
- ❖ In this Sebkhia, gypsum is found :
  - ❖ **on the surface** : as a form of sand dunes or selenite crystals (size: 1-15cm)
  - ❖ **below the surface** as a form of varved or banded gypsum with some impurities mostly clay.



Source : Ould Wessat. 1997

# Gypsum in Mauritania: Resources

- ❖ Exploitation started in the 80s by SAMIA.
- ❖ Varved gypsum deposits estim. to about 1.7 billion tons. Purity: 70 to 92 %.
- ❖ Sand dune gypsum deposits are approxi. 50 million tons. Purity: 80 to 95 %.
- ❖ The highly pure crystalline gypsum deposits are about 7 million tons. Purity: above 99 %.

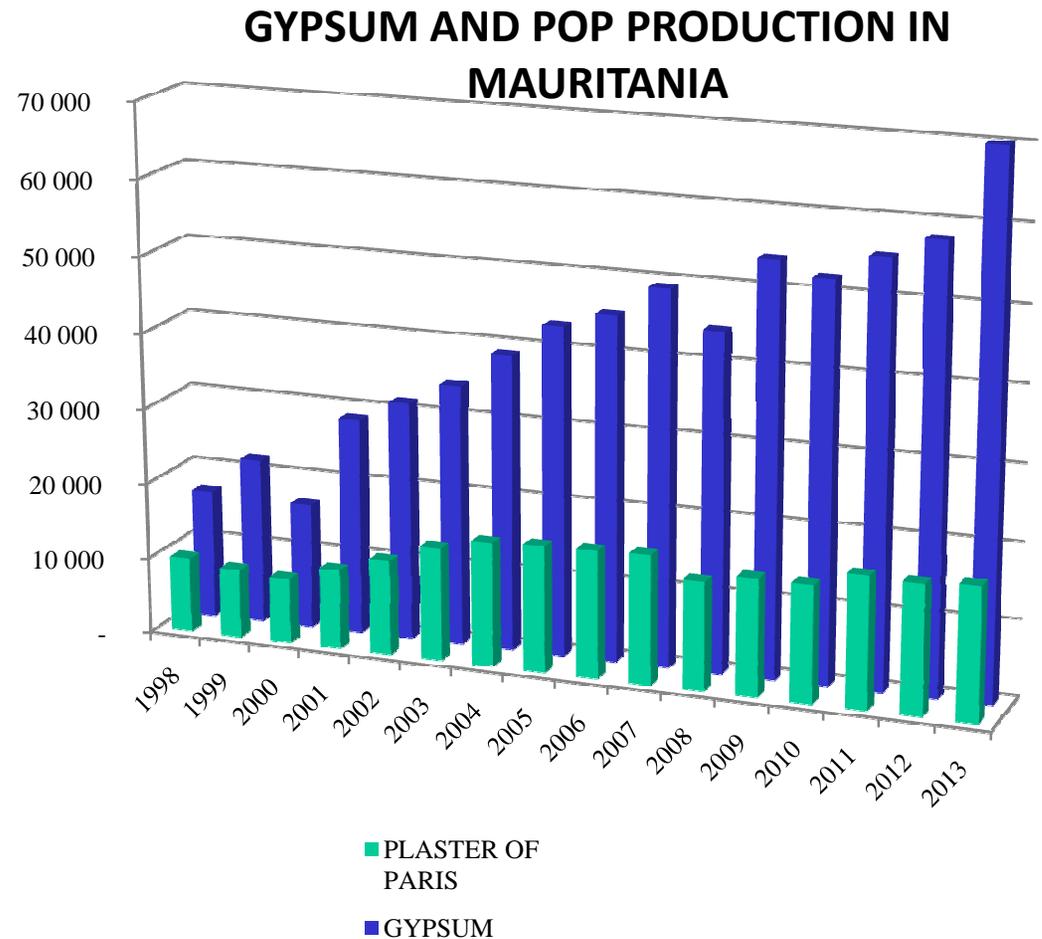


Source : Ould Wessat. 1997

Source : SAMIA.

# Gypsum in Mauritania: Uses

- Production of Plaster of Paris (1/3 of production).
- Cement additive (2/3 of production)
- Current gypsum production amounts to approx. 70 000 tons per annum.
- About 10 000 MT is exported by trucks to MALI



Source : SAMIA.

# Gypsum in Mauritania: Markets

## **GYPSUM**

- ❖ Market : Cement industry : 4 Cement Grinding Units (3 in Nouakchott and 1 in Nouadhibou)
- ❖ Market size : 40 000 MT
- ❖ Market growth rate : 8-10%
- ❖ Players : 1 (SAMIA)

## **PLASTER OF PARIS (POP)**

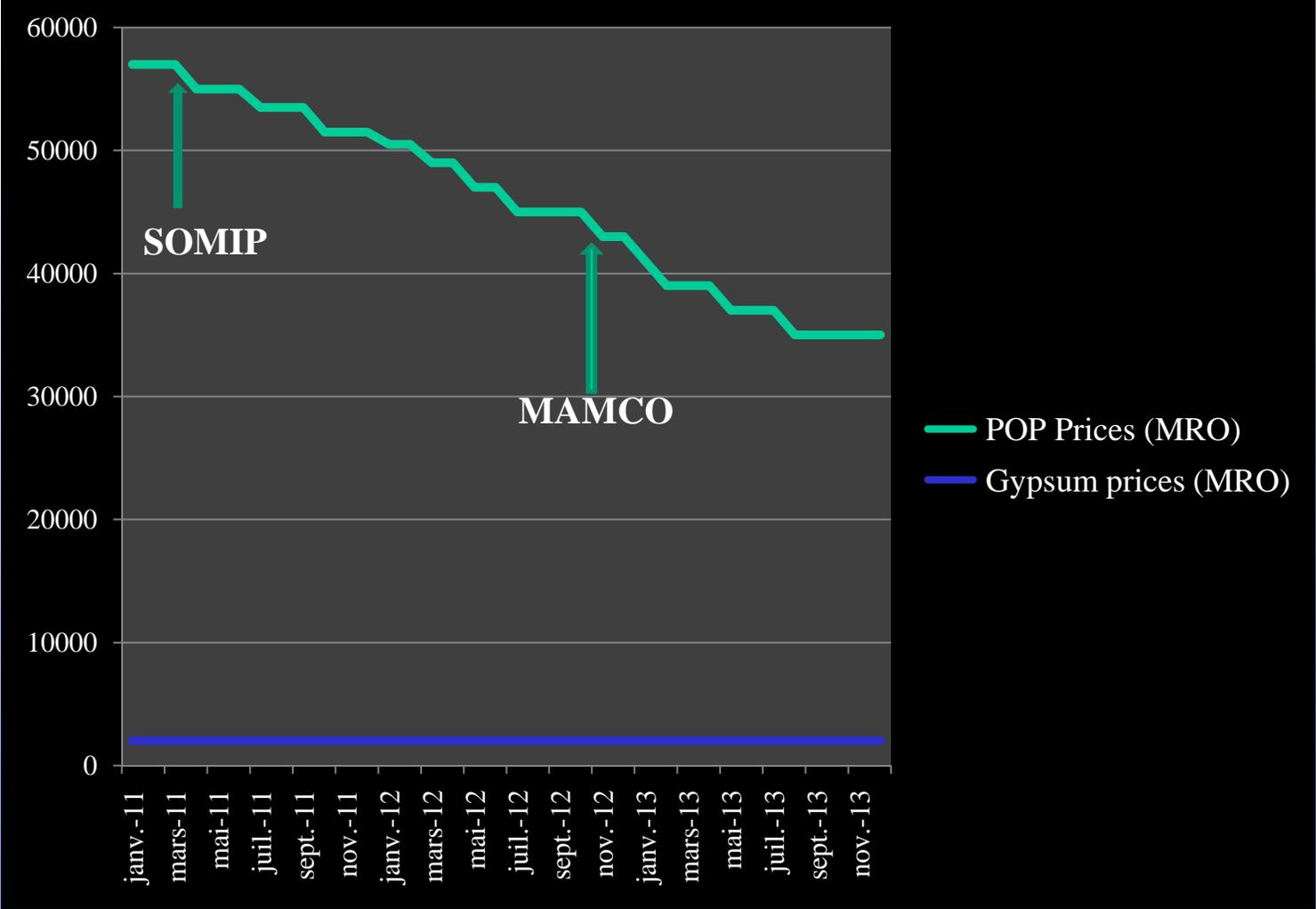
- ❖ Market : Construction industry.
- ❖ Market size : 15000 MT
- ❖ Market growth rate : 4-6%
- ❖ Players : 3 (SAMIA, SOMIP, and MAMCO)

# Gypsum in Mauritania: Products made in Mauritania

- Plaster of Paris
- Coatings for interior walls
- Coatings for external walls
- School chalk
- Plaster bricks



**Sharp and continuous decrease in POP prices because of new entrants and unfair competition;  
Gypsum prices remained stable.**



Source : SAMIA.

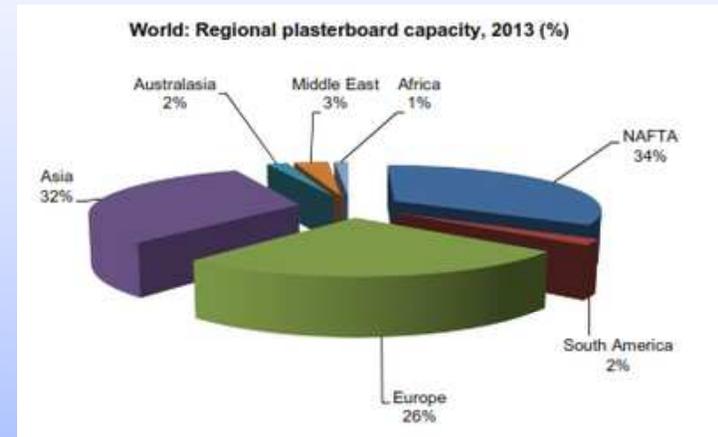
# Gypsum in Mauritania: Investment Opportunities.

## Opportunity 1. Mass production and sales of building products made from gypsum for the domestic and the West African markets.

Factors driving gypsum consumption in West Africa :

- Population growth.
- Increase of industrialization and urbanization.
- GDP growth: prosperous populations demand higher quality housing and better living conditions.
- World Trend : developing countries are moving away from traditional wet construction techniques towards dry construction using prefabricated drywall.

Source : Global Gypsum News.



# Gypsum in Mauritania: Investment Opportunities.

## Opportunity 2: Export of raw gypsum to the Cement industry in West Africa

- Cement consumption in West Africa is growing fast: in 2013 demand is around 40 million MT
- **Demand on gypsum = 2 million tons.**
- No substitute for gypsum as a cement additive
- No gypsum deposits exist in this region. So, gypsum has to be imported (mostly from Spain)
- Geographical location.
- Port infrastructure and facilities constitute a challenge.



# Gypsum in Mauritania: Investment Opportunities.

## Opportunity 3: Mass production and sales of agricultural gypsum for the domestic and the West African markets.

- Gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) is a good source of **calcium** and **sulfur**.
- It can be used for direct application on soil as a soil conditioner or secondary nutrient.
- It help in reclaiming the saline and alkali soils.
- It plays an important role to increase the crop production in the field.
- It is compatible with chemical fertilizers.
- It can be applied on all crops at any stage.
- Examples of local crops where gypsum can be used : rice, sorghum, wheat, peanut, tomato, potato, sugar beet, cotton.



# CONCLUSION

- ❖ Mauritania holds enormous deposits of highly pure gypsum that are still largely underexploited.
- ❖ The nature and location of the gypsum quarries make it an ideal place to supply crude gypsum to the cement industry in West Africa, where there is a growing demand.
- ❖ Other promising opportunities include the industrial production and sales of wallboard and building products from gypsum for the domestic market and those of West African countries.
- ❖ Gypsum granules could also be produced and exported in huge quantities to the emerging agricultural sector in these countries.
- ❖ The development of these new markets opportunities will require a strong support from the Mauritanian government and a solid partnership between a current gypsum producer like SAMIA and a leading company with strong technical, financial, marketing, and distribution resources and skills.

# Warren Buffett is investing in the Gypsum Industry Right Now. How about you?

- ❖ Warren Buffett is considered to be one of the world's most successful long-term investors. His company, Berkshire Hathaway, maintains large positions in several well-known North American companies, such as Heinz and Coca-Cola.
- ❖ In January 2014, Berkshire Hathaway acquired more shares in USG Corporation. It is now the largest single shareholder in USG.
- ❖ USG Corporation, formerly known as United States Gypsum Company, is the largest producer of gypsum plasterboard in North America, and the producer of several other homebuilding products.

Source : PR Newswire, LONDON, Feb 6, 2014,

**THANK YOU !**