Calcite gets its name from the Greek word “Chalix”, which means lime. It is one of the most common minerals in the world. In fact 4% of weight of the world is calcite. There is no certain information about when it is first found, so that it must have been found far before.

**Where and How it is Found in The World?**

It is a very common material and can be found in many places. It's found in most low temperature geologic settings. Even, it is found in most cave formations. However, there is no certain knowledge of all places calcite is being found (since its very common); we have knowledge of some most important places it's found. Carrara in Italy is one of these places. Other important places that calcite exist are Pugh Quarry, Ohio; Rosiclare, Illinois; Franklin, New Jersey; Elmwood, Tennessee; Brush Creek and other Missouri, Wisconsin, Kansas and Oklahoma, USA; Andreasburg, Harz Mountains and Saxony, Germany; Brazil; Guanajuato, Mexico; Cornwall, Durham and Lancashire, England; Bombay area of India; Eskifjord, Iceland.

It can be found in several colors, is mostly white, but also blue, green, red and yellow; transparent and semi-transparent. Also it is found in several forms. One important specimen is Iceland Spar, which was first found in Iceland. It's a transparent and has optical use (like double refraction which will be explained). But today, most of Iceland Spar comes from New Mexico. Another specimen is Mexican Onyx, which is used for ornamental purposes. Figures can be carved into it (like onyx animals etc.).

General forms that Calcite is being found are:

1. Crystallized CaCO₃
2. Marbles with 95% CaCO₃
3. Limes

**Where and How it is Found in Turkey?**

In Turkey, calcite is found widely all around the country. Most establishments are in İstanbul and Marmara Region, İzmir and Aegean Region, and Niğde/Aksaray in Middle Anatolia. The Reason for establishments being dense in these areas is because of nearness to raw material sources and market. Especially in last 5 years, calcite industry developed together with other industries and with that production capacity in Turkey is far beyond industry's requirement to calcite. Moreover, Turkey is rich for high quality, pure calcite.

A special place that calcite is found is Sisak Çermik, Sivas. There are Giant spongy calcite crystals in Sisak Çerçik, larger than 2 meters.

Figure 1. Two meter crystals [2]

Furthermore, travertines in Pamukkale are rich of calcite.

Figure 2. A closer shot to calcite in Sivas [2]
Usage of Calcite

One early and scientific use of calcite was first found by Rasmus Bartholin (1625-1698), a Danish scientist. He discovered the double refraction of light in Calcite (Iceland Spar). He described it, but physical knowledge about light did not let anyone to explain it before Thomas Young. Physical explanation is as follows: when a light ray enters, it splits into two beams, fast and slow. These two beams leave the crystal with different angles, since the angle of refraction depends also on speed of the beam. So when we look through it, we see two images as in Figure 3.

Calcite is widely used in industry too. It is grinded easily and it is used in many sectors, because of its property that gives resistance against abrasion. Main industries it is used in are:

- Paper
- Paint
- Plastic
- Construction (plaster, cement etc.)
- Adhesive
- Food
- Ceramic

How is it produced?

There are several ways to produce calcite gem, depending on the quality of how it is found in the nature. Main methods for production are as follows:

A) PCC Production

Calcite is not always pure and white enough in the nature. So, limestone with low silica is burned and CaO is obtained. Then it’s mixed with water, some chemicals are added and under high pressure, CO₂ is given. This process results with 1-3 micron artificial and pure calcite, whose shape can be controlled. Its cost is much higher than other methods, but its quality is very high. This method is, expectably, mostly used in USA. Also in Europe, establishments for PCC Production are increasing.

B) Naturally Grinded Calcite

1. **Dry Production:** Calcite is first broken and reduced, then grinded in mills, resized and packed and given to market. This method results with calcite size of 40 microns, which is used in paint, plastic, paper and chemistry.

2. **Watery Production:** To use calcite for coating in paper industry and for new techniques to produce paints it must be grinded to 2 microns or less. However, to grind calcite to that size reveals much heat. Therefore, after it is grinded to 20-30 microns, it’s mixed with water and grinded again. Resulting calcite is 75% water and 25% solid material.

Up to here, we have discussed the general properties of Calcite; now we skip into the technical details, firstly reviewing its physical properties.

Calcite has a vitreous (shiny) luster (the visual property of something that shines with reflected light).

Since almost all pure –free of dislocations- crystals are brittle, it also shows brittleness. It fractures irregularly creating step-like surfaces.
Its hardness is “3” in Mohs’ Hardness Scale. According to Mohs’ test (1824) ten minerals were proposed in increasing order of scratch hardness. Each mineral will scratch the one on the scale below it but will not scratch the one above it. (See Figure 4)

![Figure 4. Relation between Mohs’ Hardness Numbers and indentation hardness values. [12]](image)

Calcite has a calculated density of 2.7110 g/cm$^3$ which is in correlation with the measured value 2.7102 g/cm$^3$.

**Chemically**, Calcite is very reactive even with the weak acids. But there is no specific data on health dangers or toxicity for this mineral.

Its chemical formula is Ca(CO$_3$) which is known to be the Calcium Carbonate. In fact, Calcite is the crystal form of the commercial *Kireç Taşı*. Mn, Fe, Zn, Co, Ba, Sr, Pb, Mg, Cu, Al, Ni, V, Cr, Mo are the common impurities usually found in its crystal sets.

**Crystallography of Calcite**

Calcite is in the trigonal crystal system. It is found to be in the **hexagonal closed pack** form, which is the densest packing form of crystals with face centered cubic structure. The structure of Calcite is sometimes described as a "modified NaCl" structure. In Figure 5, on the left is the structure of NaCl, with sodium atoms purple and chlorine atoms green (although since both have the same atomic arrangement, it hardly matters.) On the right is calcite, with calcium yellow, oxygen blue and carbon gray. We can see that there are rows of alternating Ca and CO$_3$ units, just like Na and Cl alternate in halite.

![Figure 5. NaCl on the right and Ca(CO$_3$)$_3$ [10]](image)
Figure 6 shows the complete unit cell with all carbonate radicals. Carbonate radicals centered on the front edges are lightest, those on the rear edges darkest. This is the cleavage unit cell, but is not a true *Bravais lattice cell*, since not all the radicals point in the same direction.

![Figure 6. Complete unit cell of CaCO$_3$ [10]](image)

So far, over 800 different morphological forms of CaCO$_3$ have been described in literature. Most commonly as acute Rhombohedral or prismatic with Scalenohedral terminations, or combinations of the two exist. Within trigonal family, Ca(CO$_3$)$_2$ is specifically under the Scalenohedral group which is shown below in Figure 7.

![Figure 7. Color shaded figure of a Scalenohedral [11]](image)

Finally, we want to mention about the results of an X-ray diffraction experiment done with Calcite. Results inform us about the cell parameters as follows: the typical geometric parameters given by the *hcp* figure in *Introduction to Solid State Physics* by Kittel (Figure 23, pp18), as $a = 4.9896$, $c = 17.061$.

- REFERENCES –