

1	Engineering Geology Lab Tarbiat Modares University	<b>Chemical Properties of Jolbar Serpentine</b>	
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## **Chemical properties of Jolbar Serpentine**

**Company that required the test:**

**M. Stone**

**Prepared by:**

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### Chemical composition (XRD test)

XRD test were done In order to determine the mineralogical content. Chips of stone were crushed into a fine powder and sieved through a sieve of 60  $\mu\text{m}$  size. The powder was analyzed under XRD tester.



**Figure 1** XRD tester

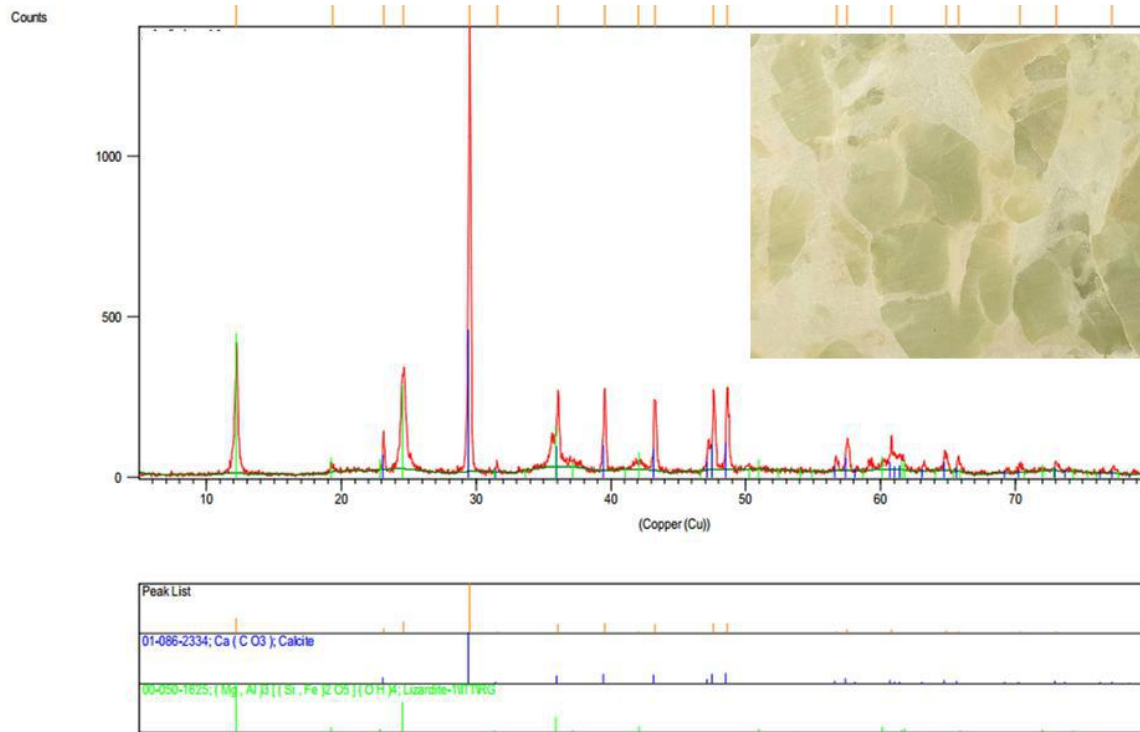
### XRD Results

The results of XRD test showed that Jolbar serpentine is mainly composed of phyllosilicate serpentine subgroup (namely, Lizardite  $((\text{Mg}, \text{Al})_3 (\text{Si}, \text{Fe})_2 \text{O}_5)(\text{OH})_4$ ), antigorite  $((\text{Mg})_3 \text{Si}_2\text{O}_5 (\text{OH})_4$ ) and calcite ( $\text{CaCO}_3$ ).

Lizardite is a magnesium silicate hydroxide mineral and a member of the serpentine family. The color of this mineral is mainly light to dark lime green. Antigorite belongs to the group of trioctahedral 1:1 layered silicates with an ideal formula of  $\text{Mg}_6\text{Si}_4\text{O}_{10}(\text{OH})_8$ .

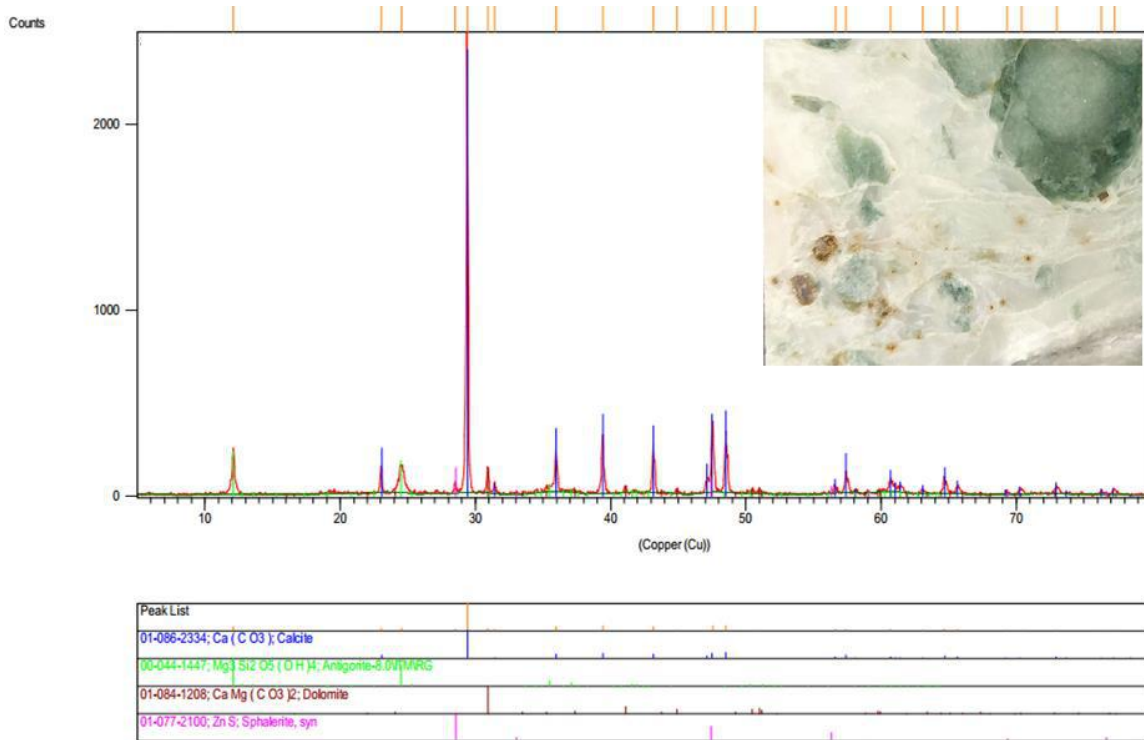
Among serpentine family, chrysotile is hazardous to human health, as it can cause cancer and other diseases. Chrysotile was not detected in the samples.

XRD results of green paradise serpentine showed that the calcite and lizardite are two main compounds of this samples (**Figure 2**).



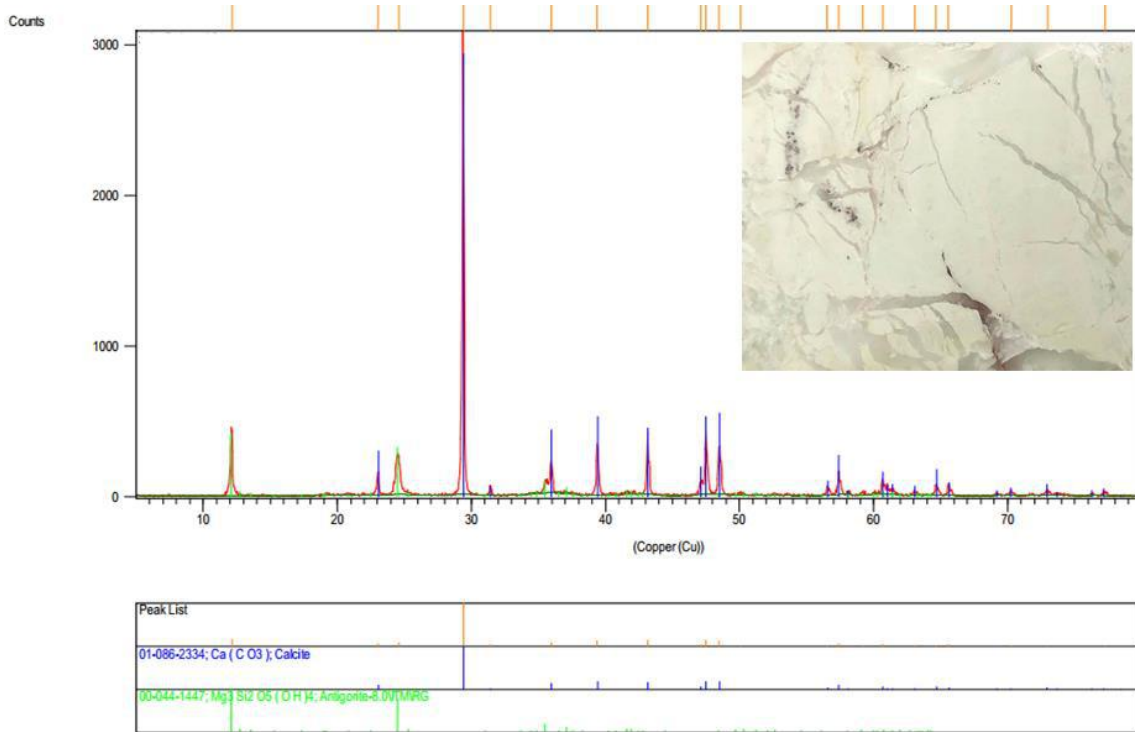
**Figure 2** XRD results of green paradise serpentine

XRD results of green paradise serpentine showed that the calcite is the major compound of the sample. Antigorite is other compound with a low amount of dolomite and sphalerite (**Figure 3**).



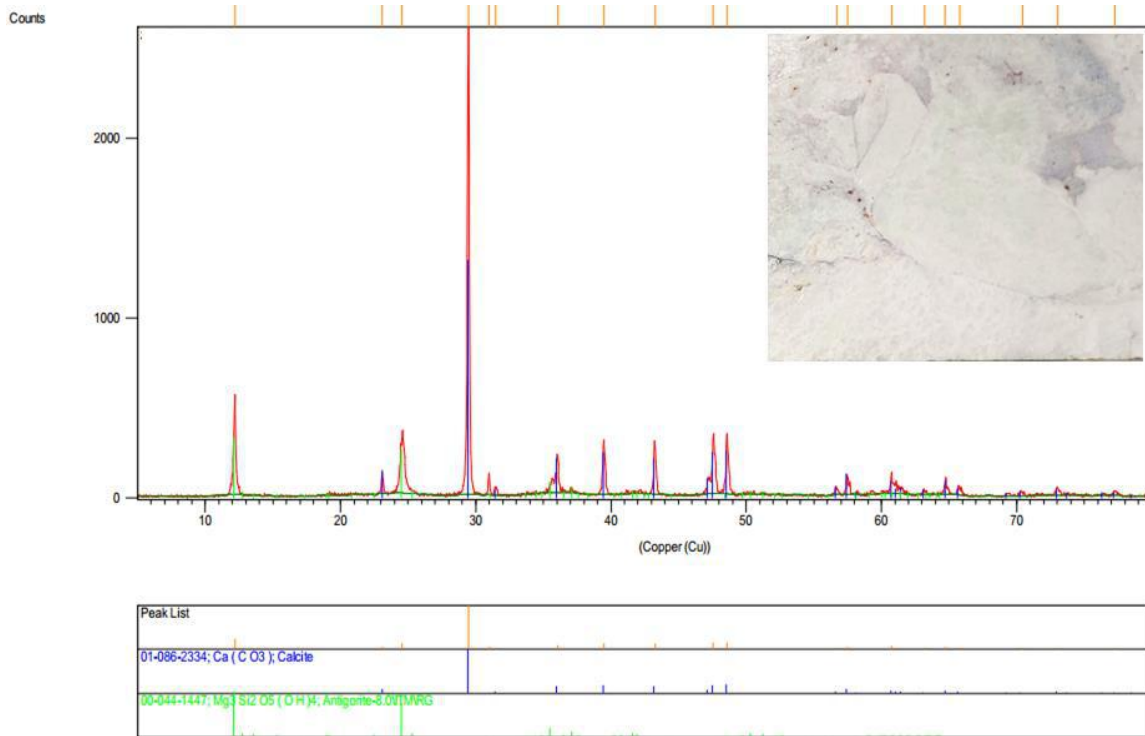
**Figure 3** XRD results of dark green paradise serpentine

XRD results of amazing green serpentine showed that the calcite is the major compound of the sample. Antigorite is other compound (**Figure 4**).



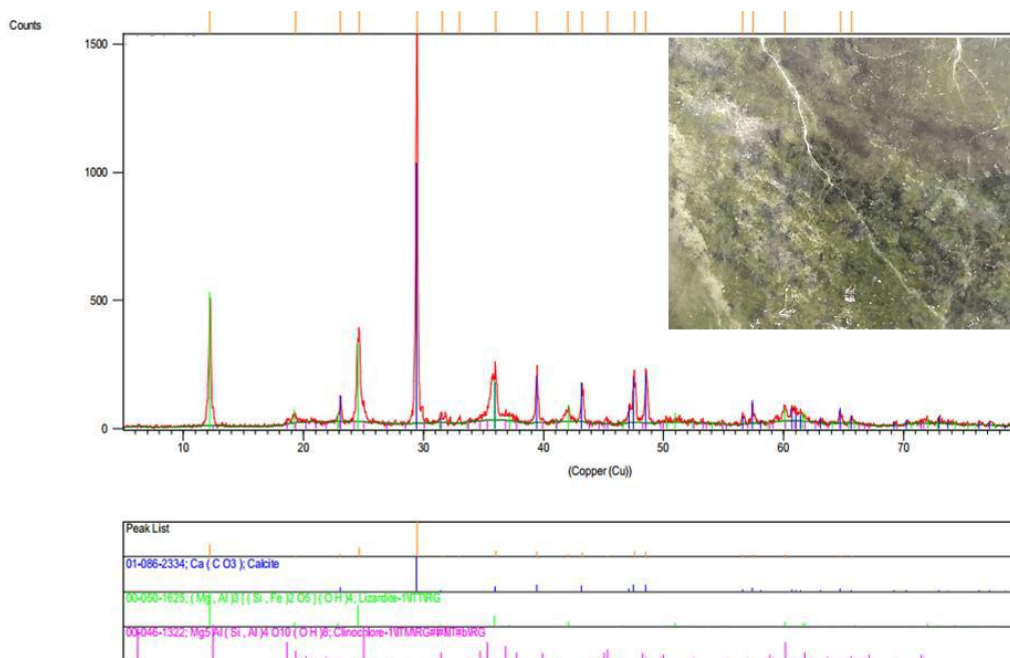
**Figure 4** XRD results of amazing green serpentine

XRD results of violet serpentine showed that the calcite is the main mineral of the sample. Antigorite is other mineral (**Figure 5**).

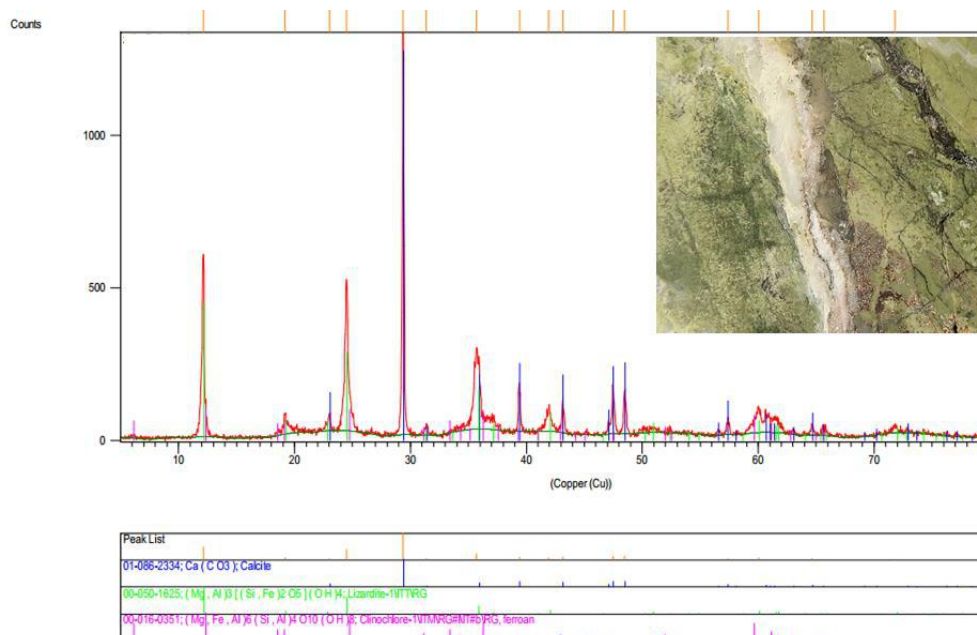


**Figure 5** XRD results of violet serpentine

XRD results of verdetifone serpentine showed that the antigorite is the main mineral of the sample. Calcite content is lower than antigorite content. Accessory minerals such as clinochlore were observed (**Figure 6** and **Figure 7**).



**Figure 6** XRD results of verdetifone serpentine



**Figure 7** XRD results of verdetifone serpentine

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## Conclusion

The results of XRD test showed that Jolbar serpentine is mainly composed of phyllosilicate serpentine subgroup (namely, lizardite  $((\text{Mg}, \text{Al})_3 (\text{Si}, \text{Fe})_2 \text{O}_5)(\text{OH})_4$ ), antigorite  $((\text{Mg})_3 \text{Si}_2\text{O}_5 (\text{OH})_4$ ) and calcite ( $\text{CaCO}_3$ ). These minerals pose no threat to the human health.

Generally speaking, the color of the stone turns into green with the increase in the amount of serpentine minerals. In other words, the color of the stone turns into white with increasing in amount of calcite.