



NEWS

24/04/2016

## GRS Alert: Unusual phosphorescent pebbles identified as synthetic aggregates

Phosphorescent pebbles are presented in the market as natural rounded pebbles (3.53 density) possessing extraordinary properties such as green phosphorescence when exposed to a strong light source and patchy blue to green fluorescence in short- and long wave UV-light (Figure 1), again with green phosphorescence (no blue).



Figure 1: Synthetic aggregate pebble of over 930 ct exposed to long wave UV-light (365nm) exhibiting patchy blue to green fluorescence. Photo Warren Serrie / © GRS Gemresearch Swisslab AG.

Such items appeared multiple times in the last two years at our laboratories (see explanatory movie clip). They are sold at very high prices of thousands of US dollars per piece or sometimes even per carat. The first specimen we have tested initially appeared in Burma (Myanmar) in 2014. Similar material appeared as carvings on the Chinese market according to an article published on the website of the Gems & Jewelry Trade Association of China.

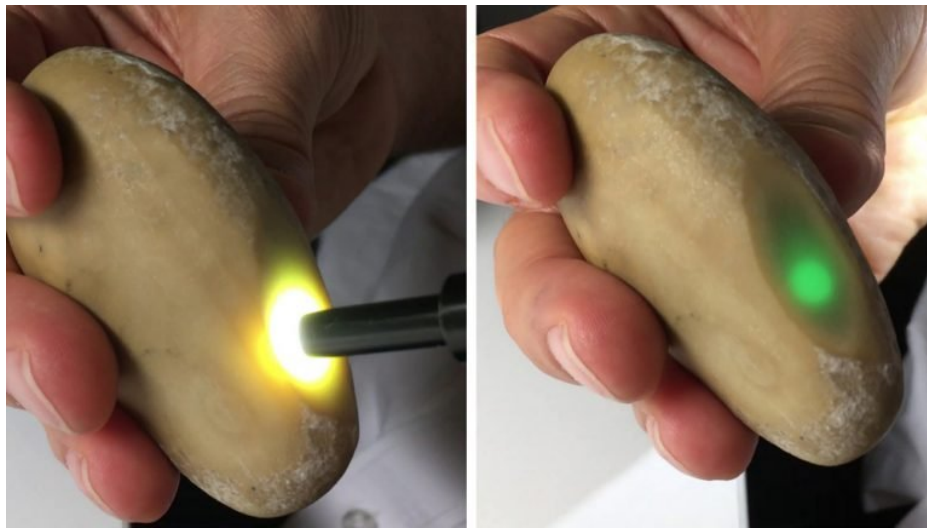


Figure 2: Polished surface of synthetic aggregate showing strong green phosphorescence after exposure to strong light source. Photo: A. Peretti, © GRS Gemresearch Swisslab AG.

Initially, we thought this is an erratic problem within the industry and not worth alerting the public about. But since this type of material continued to reappear at our laboratory, we believe it is necessary to alert the public with an official GRS Alert. Our research indicated that the synthetic material had been purposely tumbled and aged through a chemical alteration process with the intention of mimicking a naturally weathered product (Figure 3).



Figure 3: Tumbled and chemically altered surface of synthetic aggregate. Photo: A. Peretti, © GRS Gemresearch Swisslab AG.

We had the material analyzed by XRD through the University of Bern, Switzerland by Prof. Thomas Armbruster to identify it structurally, then measured it using ED-XRF analysis at our GRS laboratory for chemical composition.

## Results

The analyses showed that this material is a synthesized aggregate material (Fig. 4). The material was first synthesized in Russia in 1976 as  $\text{Sr}_4\text{Al}_4\text{O}_{25}$  and published by Nadezzhina (1976), *Kristallografiya*, 21, 826. The literature from Chinese researchers (Chengkang et al. 2006) confirmed that this type of material was later doped with Europium (Eu) on Strontium (Sr) position, which creates phosphorescence.

Detailed XRD analyses revealed that the material we had tested also contained a minor secondary synthetic phase of  $\text{SrAl}_2\text{O}_4$  in addition to the material mentioned above, actually identifying the pebbles as an aggregate of two structurally different synthetic substances. Additional ED-XRF analyses confirmed the elements Strontium (Sr) and Aluminum (Al) but showed that instead of Europium (Eu), the major REE element was Dysprosium (Dy).

No traces of radioactivity were found when tested with a Geiger counter.

		
<b>GEMSTONE REPORT</b> EDELSTEINBERICHT RAPPORT DE PIERRE PRÉCIEUSE		
No.	2016-Sample	
Date	21st April 2016	
Object	One rough item	
Identification	Synthetic Aggregate ( $\text{Sr}_4\text{Al}_4\text{O}_{23}$ and $\text{SrAl}_2\text{O}_5$ )*	
		
Weight	930.42 ct	
Dimensions	72.6 x 45.9 x 29.4 (mm)	
Cut	rough	
Shape	oval	© GRS Gemresearch Swisslab AG, P.O. Box 3628, 6002 Lucerne, SWITZERLAND
Color	brownish yellow-green with green phosphorescence when exposed to intense light	
*Rare earth element doped		
<small>Dieser Edelsteinbericht wird nur unter der Voraussetzung abgegeben, dass die wichtigsten Informationen auf der Rückseite als Vermögensgegenstand mit der GRS Gemresearch Swisslab AG akquiriert worden sind. Spezielle Beachtung ist der Handhabung mit der Deklaration von Behauptungen zu schenken.</small>		
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Figure 4: GRS report of synthetic aggregate pebble of 930 ct. © GRS Gemresearch Swisslab AG.

## Explanatory Video

## Literature

Shen Hao Qinglong, Qing Shi Cheng, Ni Cui Wenxiu. 2011. *Discussion of Synthetic luminous gem crystal structure and luminescence mechanism study (Translated from Chinese)*.

[ONLINE] Available at: [http://www.jewellery.org.cn/news\\_nr.aspx?ClassID=152&ContentID=3321&CID=2&Maticsoft=74&Ms=152](http://www.jewellery.org.cn/news_nr.aspx?ClassID=152&ContentID=3321&CID=2&Maticsoft=74&Ms=152). [Accessed 25 April 2016].

Chengkang Chang, Zhaoxin Yuan and Dali Mao (2006): Eu<sup>2+</sup> activated long persistent strontium aluminate nano scaled phosphor prepared by precipitation method. *Journal of Alloys and Compounds* 415, p. 220-224.

Nadeshina T. N., Pobedimskaya E. A., Belov N.V. crystal structure of strontium aluminate [ $\text{Sr}_4\text{Al}_4\text{O}_{23}\text{Al}_{10}\text{O}_{23}$ ][J], *Kristallografiya*, 1976 (21): 826-828.

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