

Serpentinities of the Tyoya Iron-ore Deposit as a Coloured Decorative Stone and Its Use for Manufacture of Collection, Jewellery & Carved Products

(Republic of Khakassia, Russia)

蒂亞鐵礦床的蛇紋岩作為一種有色裝飾石材及其在收藏品、珠寶和雕刻品製造中的應用 (俄羅斯哈卡斯共和國)

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位於俄羅斯哈卡斯共和國（葉尼塞河西伯利亞）的蒂約亞鐵礦床的蛇紋岩礦床屬於接觸交代（硅卡岩）成因。除磁鐵礦和赤鐵礦外，礦石還含有蛇紋石、碳酸鹽（方解石、白雲石）、金雲母和黃鐵礦。蛇紋石質地緻密，略帶半透明。它本身或與其他礦石礦物混合使用時，都是一種極具裝飾性的寶石。蛇紋石的顏色豐富多樣，從典型的綠色到粉紅色、白色、黃色、橙色、藍色、紅色和黑色，應有盡有。這種寶石可以拋光至極佳的光澤，適合用於製作珠寶、服飾配件、紀念品以及精美的雕刻品。

Abstract

Serpentinities of the Tyoya iron ore deposit are located in the Republic of Khakassia (Yenisei Siberia, Russia). The deposit is contact-metasomatic (skarn) in origin. In addition to magnetite and hematite, the ores contain serpentinite, carbonates (calcite, dolomite), phlogopite, and pyrite. Serpentinite is dense and slightly translucent. It is a highly decorative ornamental stone both on its own and in combination with other ore minerals. It is characterised by a varied and rich palette of colours, from typical green shades to pink, white, yellow, orange, blue, red, and black. The stone allows a high-quality polish and is suitable for manufacture of jewellery, clothing accessories, Objet d' art as well as souvenirs and highly artistic carved products.

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The Tyoya iron ore deposit is located in the Republic of Khakassia within the Kuznetsk Alatau mountain

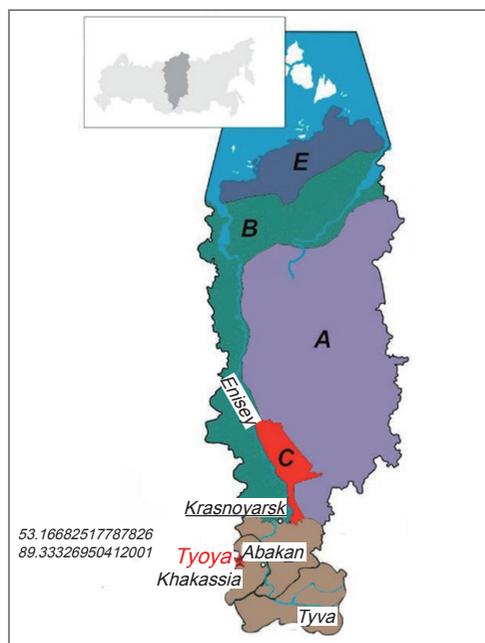


Fig. 1 Map-scheme of geologic structures of Yenisei Siberia (Krasnoyarsk Territory, Republic of Khakassia & Republic of Tyva):

A – Siberian platform; B – West Siberian platform with Yenisei-Khatanga trough; E – Taymyr-Severozemelsk folded region; C – Yenisei ridge. Krasnoyarsk is the capital of the Krasnoyarsk Territory, and Abakan is the capital of the Republic of Khakassia

葉尼塞西伯利亞（克拉斯諾亞爾斯克邊疆區、哈卡斯共和國及圖瓦共和國）地質構造示意圖：

A — 西伯利亞地台；B — 西伯利亞地台及葉尼塞-哈坦加槽；E — 泰梅爾-北澤梅爾斯克褶皺帶；C — 葉尼塞山脊。克拉斯諾亞爾斯克是克拉斯諾亞爾斯克邊疆區的首府，阿巴坎是哈卡斯共和國的首府。

system of the Altai-Sayan folded region (Fig. 1). It was discovered in 1930.

A steeply dipping limestone and dolomite stratum of the Middle Cambrian age is an ore-hosting one at the deposit. The deposit is contact-metasomatic (skarn) in origin. It has been developed since 1960 by open-pit mining.

The ores of the deposit are divided into magnetite (5%), hematite-magnetite (8%), serpentine-magnetite (60%), carbonate-magnetite (25%), and carbonate-serpentine-phlogopite-magnetite (2%). The serpentine-magnetite and hematite-magnetite ores contain decorative serpentinite rocks. It is locally known as “Tyoya jade”, which is a beautiful stone composed of serpentine (chrysotile, antigorite, lizardite), magnetite, amphibole, fluorite, pyrite, hematite, iron hydroxides, calcite, graphite, phlogopite, chlorite, brocrite, talc, calcite, quartz, and vesuvianite. The intensity of green colouration of serpophyte depends on the degree of serpentine crystallisation. The most fully crystallised serpophyte has a nephrite-like appearance.

The Tyoya serpentinite deposit was penetrated by a pit driven to a depth of 400 m (Fig. 2). It has been mined for over 30 years. Although the deposit has been worked out, it has significant reserves of ornamental stone in the dumps. Unfortunately, the lower horizons penetrated the most colourful serpentinites. They are under water, while the upper horizons are dominated by the green varieties.



Fig. 2 Pit of the Tyoya iron ore deposit.
Photo by S.A. Ananyev in 2022
蒂奧亞鐵礦礦坑

In serpentine-magnetite ores, large inclusions of black magnetite are cemented by dense bright green serpentine aggregate. Such ores may sometimes be decorated with large idiomorphic crystals of brassy yellow pyrite (Fig. 3).



Fig. 3 Serpentine-magnetite ore with pyrite dissemination. Dimensions 55 x 45 x 43 cm. *Photo by S.A. Ananyev*
含黃鐵礦浸染的蛇紋石-磁鐵礦礦石。
尺寸：55 x 45 x 43 厘米

Serpentinite units in iron ores of the deposit can reach significant sizes, as evidenced by the discovery of blocks more than one metre in size in the dumps.

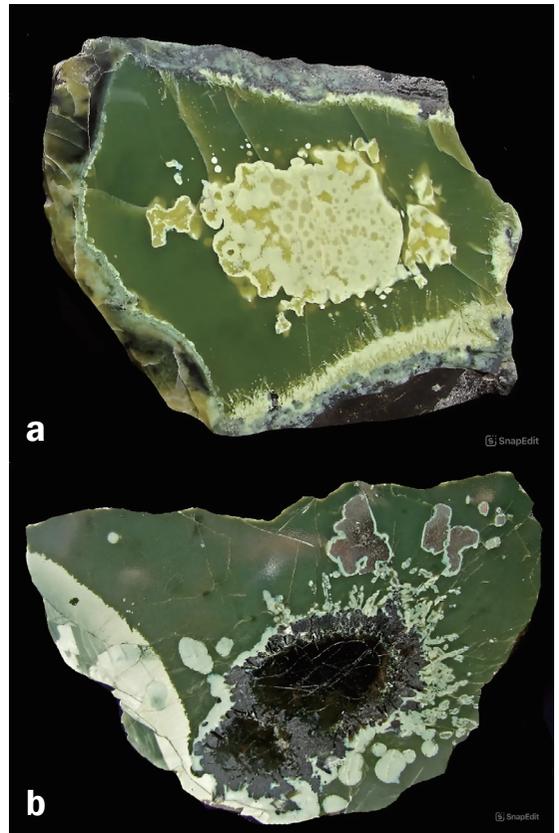


Fig. 4a, b Typical colour Tyoya serpentinite after polishing. Dimensions 8 x 11 cm and 7 x 12 cm.
Photo by S.A. Krasnolutsky
拋光後的典型顏色的Tyoya蛇紋岩。
尺寸分別為8 × 11 厘米和7 × 12 厘米。

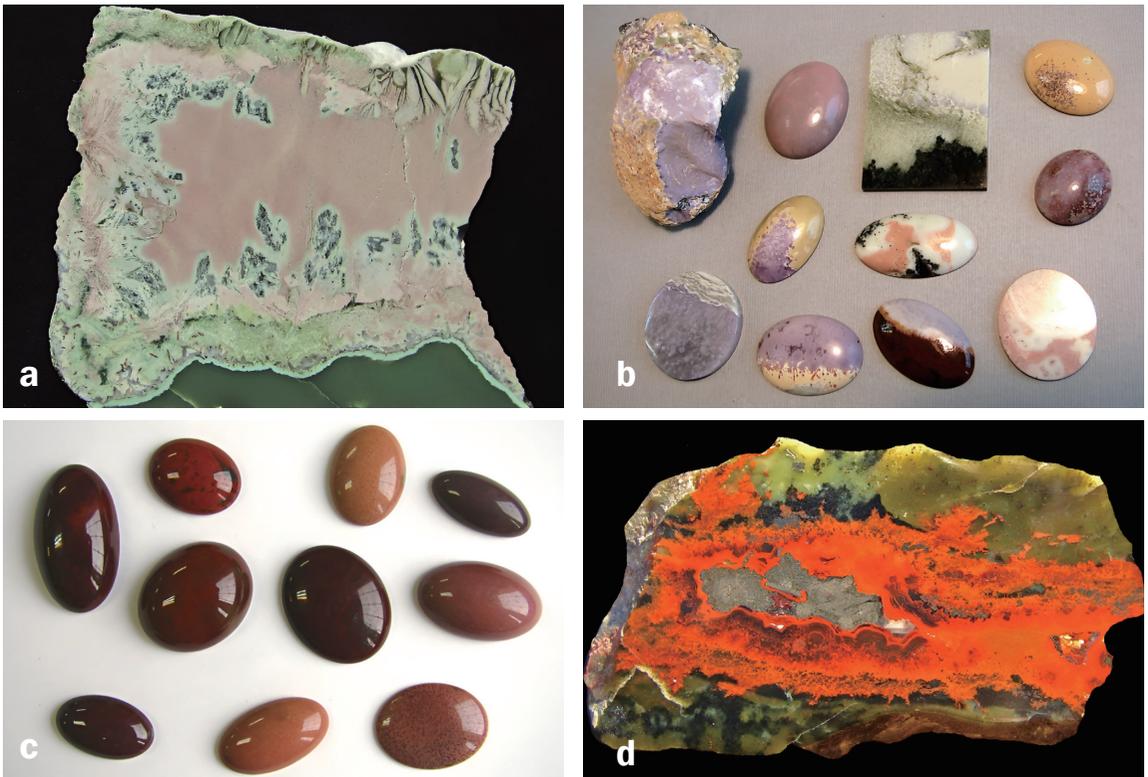


Fig. 5 Rough and cabochons of Tyoya serpentinites. Polishing dimensions: Fig. 5a 7 x 6 cm; Fig. 5d 7 x 3.5 cm. Photo by S.A. Krasnolutsky
 蒂亞蛇紋岩原石和弧面形寶石
 拋光尺寸：圖5a 7 x 6 厘米；圖5d 7 x 3.5 厘米



Fig. 6 Necklace and earrings: "Fire" made from serpentinite (with magnetite phenocrysts), of the Tyoya deposit. Made by S.A. Krasnolutsky
 項鍊和耳環：項鍊和耳環：《火》，由蛇紋石（含磁鐵礦斑晶）製成，產自天谷礦床。

The unique feature of the Tyoya serpentinites is their high decorative value. It is characterised by a diverse and rich palette of colours. It lines in a typical range of green colours (Fig. 4a, b), with less frequent colours, such as bright red, purple, pink, brown, orange, yellow, black, white and blue, which are not characteristic of typical serpentinites (Fig. 5a, b, c, d). Stones with contrasting transitions from green to bright red are especially pronounced where magnetite phenocrysts are present (Fig. 5d; Fig. 6).

The stone is applicable for high-quality polish. Its colour palette closes to Myanmar jadeite, which can be carved into bright and colourful products by professional carvers.

The major colouring agent is hematite inclusions. Its distribution and concentration determine the pattern and colour of the stone. Spotty, looped, agate-like (Fig. 7a), veinlet-shaped, veinlet-spotty (Fig. 7b), flame-shaped and other textural patterns are observed (Fig. 8).

There are unusual rosette-shaped inclusions of hematite along disk-shaped fractures (probably stress fractures) around pyrite phenocrysts (Fig. 8).

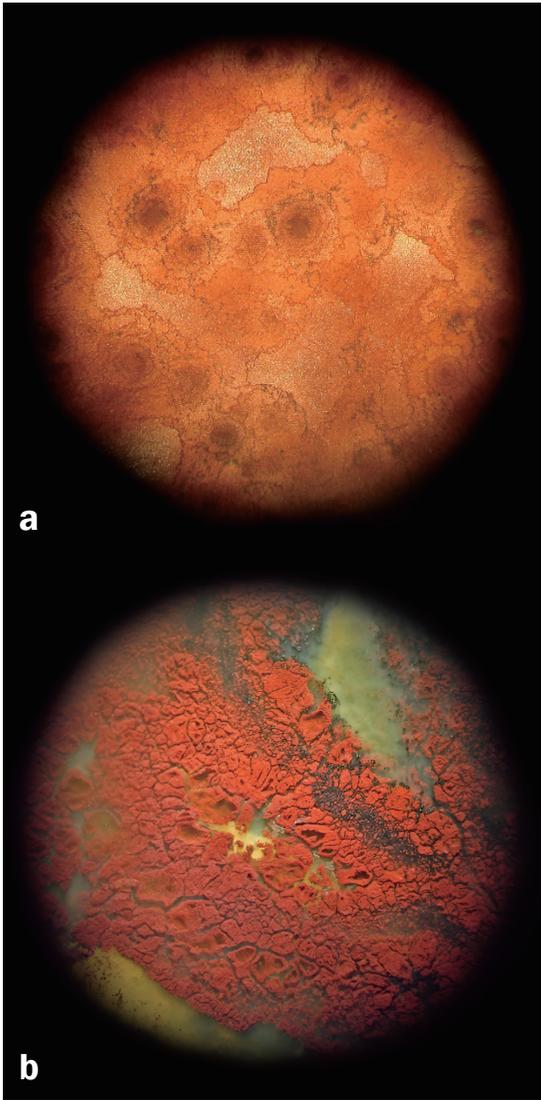


Fig. 7a, b Hematite distribution under the microscope in polished Tyoya serpentinite. *Made by S.A. Krasnolutsky*
顯微鏡下拋光的Tyoya蛇紋石中的赤鐵礦分布



Fig. 8 Rosette-shaped hematite inclusions around pyrite crystal inclusions in fine serpentinite groundmass.
Photo by S.A. Krasnolutsky
細粒蛇紋岩基質中黃鐵礦晶體包裹體周圍被玫瑰花狀赤鐵礦包裹。

The decorative features of Tyoya serpentinites (Figs. 9-11) are perfectly revealed in the carved works from the famous stone master carver, Sergey Anatolievich Krasnolutsky.



Fig. 9 Sculpture "Clouds", dimensions 23 x 22 x 8 cm. *Carved by S.A. Krasnolutsky*
雕塑《雲》，尺寸為 23 x 22 x 8 厘米。



Fig 10 Sculpture "Footsteps by the Fire", dimensions 30 x 18 x 8 cm. *Carved by S.A. Krasnolutsky*
雕塑《火的腳步》，尺寸為 30 x 18 x 8 厘米。

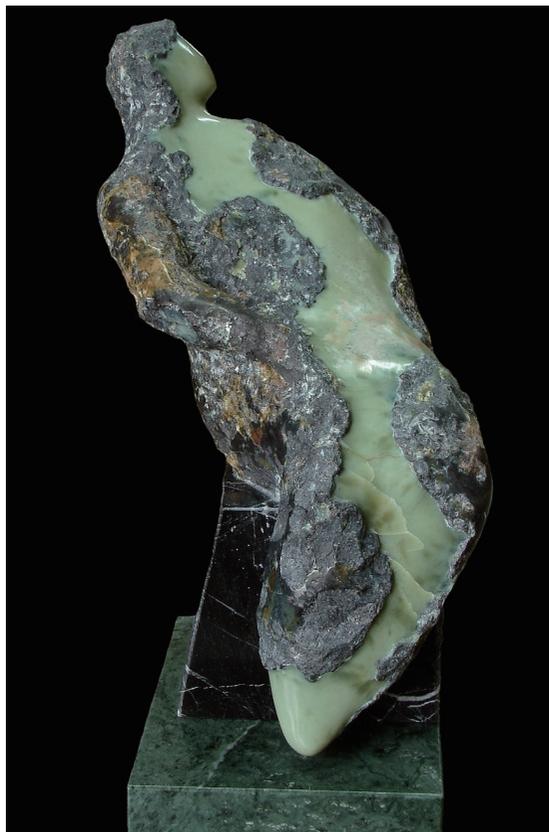


Fig. 11 Sculpture “River”, dimensions 23 x 15 x 8 cm.
Carved by S.A. Krasnolutsky
雕塑《河流》，尺寸為 23 x 15 x 8 厘米

The above carvings are made of coloured Tyoya serpentinite – “Tyoya jade” demonstrates the high decorative value of this stone with a rich, varied palette of colours. The stones were polished in high quality and are suitable for objet d’art and jewellery items, as well as souvenirs.

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References

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