

Malanite**Cu(Pt, Ir, Co)₂S₄**

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Crystal Data: Cubic. *Point Group:* $4/m\bar{3}2/m$. Crystals are octahedral or dodecahedral, to 0.2 mm; massive, in veinlets and granular.

Physical Properties: *Cleavage:* On {111}, may be observed. *Tenacity:* Brittle. Hardness = 5 VHN = 445–479, 462–471 average (20 g load). D(meas.) = n.d. D(calc.) = 7.35–7.57

Optical Properties: Opaque. *Color:* Steel-gray; in polished section, bright white with a faint brown to green tint. *Streak:* Black. *Luster:* Metallic.

R: (400) —, (420) —, (440) —, (460) 34.8, (480) 35.3, (500) 35.8, (520) 36.3, (540) 36.5, (560) 36.7, (580) 36.9, (600) 37.1, (620) 37.4, (640) 37.5, (660) 37.6, (680) 37.8, (700) 37.9

Cell Data: *Space Group:* $Fd\bar{3}m$. $a = 9.910\text{--}9.940$ $Z = 8$

X-ray Powder Pattern: Malan Valley, China.

1.75 (10), 2.48 (8), 1.90 (8), 0.783 (8), 1.011 (7), 2.98 (6), 5.70 (5)

Chemistry:	(1)	(2)	(3)	(1)	(2)	(3)
Cu	9.95	10.9	11.0	Ir	25.23	23.2
Ni	0.33	0.3		Pd	0.45	0.5
Co	2.60	2.2		Rh		0.7
Fe	1.00	0.6	0.1	S	23.47	23.8
Pt	36.77	37.0	33.0			11.1
				Total	99.80	99.2
						100.5

(1) Malan Valley, China; by electron microprobe, corresponds to $(\text{Cu}_{0.85}\text{Fe}_{0.10}\text{Ni}_{0.03})_{\Sigma=0.98}(\text{Pt}_{1.02}\text{Ir}_{0.71}\text{Co}_{0.24}\text{Pd}_{0.02})_{\Sigma=1.99}\text{S}_{3.98}$. (2) Do.; by electron microprobe, corresponds to $(\text{Cu}_{0.93}\text{Fe}_{0.06})_{\Sigma=0.99}(\text{Pt}_{1.03}\text{Ir}_{0.66}\text{Co}_{0.20}\text{Rh}_{0.04}\text{Ni}_{0.03}\text{Pd}_{0.03})_{\Sigma=1.99}\text{S}_{4.03}$. (3) Konder massif, Russia; by electron microprobe, corresponds to $(\text{Cu}_{0.92}\text{Fe}_{0.01})_{\Sigma=0.93}(\text{Pt}_{0.90}\text{Ir}_{0.58}\text{Rh}_{0.57})_{\Sigma=2.05}\text{S}_{4.03}$.

Polymorphism & Series: Forms a series with cuproiridisite.

Mineral Group: Linnaeite group.

Occurrence: In peridotite-type platinum ores with Cu–Ni sulfides (Malan Valley, China).

Association: Pentlandite, pyrrhotite, bornite, magnetite, cooperite, sperrylite, moncheite, platinum, olivine, pyroxenes, serpentine, chlorite (Malan Valley, China); osmiridium, ferrian platinum (Shuangfeng village, China); osmium, laurite, isoferroplatinum (Konder massif, Russia).

Distribution: In China, in Hebei Province, from the Malan Valley, Zunhua Co., about 150 km east of Beijing [TL]; at Shuangfeng village, Yanshan Mountains, about 200 km northeast of Beijing; from near Damiao village and the Yixun River, about 270 km north of Beijing. In Russia, from the Konder massif, Aldan Shield, Sakha, and in the Mt. Bolshaya Varaka deposit, Imandra complex, Kola Peninsula. At the Kirakkauppura deposit, Penikat layered complex, northeast of Kemi, Finland. In the Ojén lherzolite massif, Málaga Province, Spain. In the Baula complex, Orissa, India. From the Merensky Reef, Bushveld complex, Transvaal, South Africa.

Name: Apparently for the Malan Valley, China.

Type Material: Geological Institute, Academy of Geological Sciences of China, Beijing, China.

References: (1) Yu Zuxiang (1981) A restudy of malanite and cobalt-malanite (dayingite). *Geol. Rev.*, 27, 55–71 (in Chinese with English abs.). (2) (1982) *Amer. Mineral.*, 67, 1081–1082 (abs. ref. 1). (3) Rudashevskii, N.S., A.G. Mochalov, V.V. Shkurskii, N.I. Shumskaya, and Y.P. Men'shikov (1984) First discovery of malanite $(\text{Cu}(\text{Pt}, \text{Ir}, \text{Rh})_2\text{S}_4)$ in the USSR. *Mineral. Zhurnal*, 6, 93–97 (in Russian). (4) Rudashevskii, N.S., Y.P. Men'shikov, A.G. Mochalov, N.V. Trubkin, N.I. Shumskaya, and V.V. Zhdanov (1985) Cuprorhodsites CuRh_2S_4 and cuproiridisite CuIr_2S_4 – new natural thiospinels of platinum elements. *Zap. Vses. Mineral. Obshch.*, 114, 187–195 (in Russian). (5) Yu Zuxiang (1996) Malanite – a new cupric platinum (Pt^{3+}) and iridium (Ir^{3+}) sulfide. *Acta Geol. Sinica*, 70(4), 309–314 (in Chinese).

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