

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. Crystals typically tabular on {010}, also pyramidal, prismatic, and, rarely, capillary; curved faces common. Stalactitic, reniform, fine-granular massive; cockscomb and spearhead shapes due to twinning on {101}. *Twinning:* Common and repeated on {101}; less common on {011}. Intense twin lamellae development observed in polished section.

Physical Properties: *Cleavage:* {101}, rather distinct; {110} in traces. *Tenacity:* Brittle. Hardness = 6–6.5 VHN = 915–1099 (200 g load). D(meas.) = 4.887 D(calc.) = 4.875

Optical Properties: Opaque. *Color:* Tin-white on fresh surface, pale bronze-yellow, darkening on exposure, iridescent tarnish. *Streak:* Grayish or brownish black. *Luster:* Metallic. *Pleochroism:* [100] creamy white; [010] light yellowish white; [001] white with rose-brown tint. *Anisotropism:* Very strong, yellow through pale green to dark green. R₁–R₂: (400) 40.4–44.5, (420) 41.9–45.4, (440) 43.4–47.3, (460) 44.3–50.1, (480) 45.2–52.8, (500) 46.3–54.8, (520) 47.7–56.1, (540) 48.9–56.3, (560) 49.5–55.9, (580) 49.6–55.2, (600) 49.5–54.8, (620) 49.2–58.4, (640) 48.7–53.8, (660) 47.9–52.9, (680) 47.2–51.9, (700) 46.6–51.2

Cell Data: *Space Group:* $Pn\bar{m}$. $a = 4.436$ $b = 5.414$ $c = 3.381$ $Z = 2$

X-ray Powder Pattern: Webb City, Missouri, USA. 2.70 (100), 1.755 (90), 3.43 (60), 2.41 (60), 2.32 (60), 1.911 (50), 1.094 (50)

| Chemistry: | (1) | (2) | (3) |
|------------|--------|-------|--------|
| Fe | 46.53 | 46.55 | 46.55 |
| Cu | trace | | |
| As | | trace | |
| S | 53.30 | 53.05 | 53.45 |
| rem. | 0.20 | | |
| Total | 100.03 | 99.60 | 100.00 |

(1) Joplin, Missouri, USA; remainder is SiO₂. (2) Jasper, Wyoming, USA. (3) FeS₂.

Polymorphism & Series: Dimorphous with pyrite.

Mineral Group: Marcasite group.

Occurrence: Typically formed under low-temperature highly acidic conditions, both in sedimentary environments (shales, limestones, and low rank coals) and in hydrothermal veins formed by ascending solutions.

Association: Pyrite, pyrrhotite, galena, sphalerite, fluorite, dolomite, calcite.

Distribution: From numerous localities world-wide. In the USA, at Joplin, Jasper Co., Missouri; Picher and Cardin, Ottawa Co., Oklahoma; and Baxter Springs and Galena, Cherokee Co., Kansas; in Wisconsin, at Mineral Point, Iowa Co., and Racine, Racine Co. In the Czech Republic, from Vintřov, Litnice, Most, Osek, and other places. In Germany, at Clausthal, in the Harz Mountains, and Freiberg and Annaberg, Saxony. In France, at Cap Blanc-Nez, Pas-de-Calais. From England, in the chalk at Kent, and between Folkestone and Dover; at Tavistock, Devon. In Mexico, in the Santa Eulalia district, Chihuahua. From Llallagua, Bolivia. In the Oppu mine, Akita Prefecture, Japan.

Name: A word of Arabic or Moorish origin, early applied to pyrite and other substances.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 311–315. (2) Brostigen, G., A. Kjekshus, and C. Rømming (1973) Compounds with the marcasite type crystal structure VIII. Redetermination of the prototype. Acta Chem. Scand., 27, 2791–2796. (3) Dódony, I., M. Pósfai, and P.R. Buseck (1996) Structural relationship between pyrite and marcasite. Amer. Mineral., 81, 119–125. (4) Berry, L.G. and R.M. Thompson (1962) X-ray powder data for the ore minerals. Geol. Soc. Amer. Mem. 85, 102. (5) Criddle, A.J. and C.J. Stanley, Eds. (1993) Quantitative data file for ore minerals, 3rd ed. Chapman & Hall, London, 354.

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