

Crystal Data: Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. As crystals, to 12 cm, typically tabular on {010} and elongated and striated \parallel [001]; rarely tabular on {001}; commonly pyramidal {111} or pseudohexagonal with {120} and {111}. *Twinning:* On {120}, uncertain.

Physical Properties: *Cleavage:* {120}, indistinct; {001}, in traces. *Fracture:* Subconchoidal to irregular. *Tenacity:* Brittle. Hardness = 5.5–6 D(meas.) = 4.08–4.18 D(calc.) = 4.133

Optical Properties: Opaque to translucent, transparent in thin fragments. *Color:* Brown, yellowish brown, reddish brown; dark brown to iron-black; yellowish brown to dark brown in transmitted light. *Streak:* White to grayish white or yellowish white. *Luster:* Metallic adamantine to submetallic.

Optical Class: Biaxial (+). *Pleochroism:* Very weak; yellowish, reddish, orange to brown.

Orientation: $Z = b$. *Dispersion:* $r > v$, very strong, with crossed axial dispersion.

Absorption: $Z > Y > X$. $\alpha = 2.5831$ $\beta = 2.5843$ $\gamma = 2.7004$ $2V(\text{meas.}) = 0^\circ\text{--}28^\circ$, variable with wavelength.

Cell Data: *Space Group:* $Pcab$. $a = 5.4558$ $b = 9.1819$ $c = 5.1429$ $Z = 8$

X-ray Powder Pattern: Magnet Cove, Arkansas, USA.

3.51 (100), 2.900 (90), 3.47 (80), 1.893 (30), 1.662 (30), 2.476 (25), 1.691 (20)

Chemistry:

| | (1) | (2) |
|--------------------------------|--------|--------|
| TiO ₂ | 98.59 | 98.77 |
| Fe ₂ O ₃ | 1.41 | 1.48 |
| Total | 100.00 | 100.25 |

(1) Snowdon, Wales; corresponds to $(\text{Ti}_{0.99}\text{Fe}_{0.01})_{\Sigma=1.00}\text{O}_2$. (2) Magnet Cove, Arkansas, USA; corresponds to $(\text{Ti}_{0.99}\text{Fe}_{0.01})_{\Sigma=1.00}\text{O}_2$.

Polymorphism & Series: Trimorphous with anatase and rutile.

Occurrence: An accessory mineral in alpine veins in gneiss and schist; in contact metamorphic zones and hydrothermal veinlets; a common detrital mineral.

Association: Anatase, rutile, titanite, orthoclase, quartz, hematite, calcite, chlorite, muscovite.

Distribution: A widespread mineral, but only a few localities afford fine crystals. At Fron Oleu, near Tremadog, Gwynned, Wales. From Bourg d'Oisans, Isère, France. In Switzerland, in the Maderanthal and Griessertal, Uri, at Salvan, Valais, and elsewhere. In Austria, found near Prägraten and Virgen, Tirol. From Hardangervidda, Norway. In Russia, at Atliansk, near Miass, Ilmen Mountains, Southern Ural Mountains, and large crystals in the Dodo mine, about 100 km west-northwest of Saranpaul, Subpolar Ural Mountains. In Italy, at Monte Bregaceto, near Genoa, Liguria. In Brazil, in the diamond placers of Bahia and Diamantina, Minas Gerais. In the USA, at Magnet Cove, Hot Spring Co., Arkansas; Ellensville, Ulster Co., New York; and near Powderhorn, Gunnison Co., Colorado.

Name: For Henry James Brooke (1771–1857), English crystallographer and mineralogist.

References: (1) Palache, C., H. Berman, and C. Frondel (1944) Dana's system of mineralogy, (7th edition), v. I, 588–593. (2) Deer, W.A., R.A. Howie, and J. Zussman (1962) Rock-forming minerals, v. 5, non-silicates, 44–47. (3) Meagher, E.P. and G.A. Lager (1979) Polyhedral thermal expansion in the TiO₂ polymorphs: refinement of the crystal structures of rutile and brookite at high temperature. *Can. Mineral.*, 17, 77–85.