Butianite \(\text{Ni}_6\text{SnS}_2\)

**Crystal Data:** Tetragonal. *Point Group: 4/m 2/m 2/m.* As irregular grains to 8 \(\mu\)m.


**Cell Data:** *Space Group: I4/mmm.* \(a = 3.65 \quad c = 18.14 \quad Z = 2\)

**X-ray Powder Pattern:** Calculated pattern. 4.535 (100), 1.825 (38), 1.693 (30), 1.963 (14), 3.024 (12), 1.291 (12), 1.241 (11)

**Chemistry:**

\[
\begin{array}{ccc}
\text{Ni} & 62.1 & 65.83 \\
\text{S} & 8.9 & 11.99 \\
\text{Ge} & 5.3 & \\
\text{Te} & 10.3 & \\
\text{Sn} & 11.1 & 22.18 \\
\text{Fe} & 1.3 & \\
\text{Total} & 99.1 & 100.00
\end{array}
\]

\(1\) Allende CV3 carbonaceous chondrite meteorite; average of 4 electron microprobe analyses; corresponds to \((\text{Ni}_{5.93}\text{Fe}_{0.13})\approx_{-0.66}^{0.12}(\text{Sn}_{0.52}\text{Ge}_{0.41})\approx_{-0.93}^{0.02}(\text{S}_{1.56}\text{Te}_{0.45})\approx_{-2.01}^{2.01}.\) \((2)\) \(\text{Ni}_6\text{SnS}_2.\)

**Occurrence:** Very late-stage, vapor-deposited, alteration product in veins and as mono-mineralic crack-filling material in igneous diopside in the Type B1 Ca-Al-rich inclusion (CAI) ACM-2 from the Allende CV3 carbonaceous chondrite.

**Association:** Al-Ti-rich diopside, nuwaite, heazlewoodite, Ge-bearing Ni-Fe alloy, possibly monticellite.

**Distribution:** From the Allende CV3 carbonaceous chondrite meteorite.

**Name:** After the Chinese words “Bu Tian,” meaning *patching the sky,* in allusion to this secondary mineral filling cracks in a primitive refractory inclusion in the early solar system.

**Type Material:** National Museum of Natural History, Washington, D.C., USA (7616).

**References:** (1) Ma, C. and J.R. Beckett (2018) Nuwaite \((\text{Ni}_6\text{GeS}_2)\) and butianite \((\text{Ni}_6\text{SnS}_2)\), two new minerals from the Allende meteorite: Alteration products in the early solar system. Amer. Mineral., 103(12), 1918-1924.