Penroseite  
(Ni, Co, Cu)Se$_2$

Crystal Data: Cubic.  
Point Group: $2/m$ 7.  
As reniform masses with radiating columnar structure.

Physical Properties:  
Cleavage: Perfect on {001}; distinct on {011}.  
Fracture: Subconchoidal.  
Tenacity: Brittle.  
Hardness = 2.5–3  
VHN = 500–583 (100 g load).  
D(meas.) = 6.58–6.74  
D(calc.) = 6.7

Optical Properties:  
Opaque.  
Color: Lead-gray; in polished section, creamy grayish white.  
Streak: Black.  
Luster: Metallic, tarnishes rapidly.  
R: (400) 40.2, (420) 40.1, (440) 40.1, (460) 40.2, (480) 40.4, (500) 40.7, (520) 41.1, (540) 41.5,  
(560) 41.9, (580) 42.3, (600) 42.8, (620) 43.3, (640) 43.6, (660) 44.0, (680) 44.1, (700) 44.2

Cell Data:  
Space Group: Pa3.  
a = 5.991  
Z = 4

X-ray Powder Pattern:  
Colquechaca, Bolivia.  
2.68 (100), 2.45 (100), 1.806 (90), 1.599 (40), 3.02 (30), 1.662 (30), 1.151 (30)

Chemistry:  
\[
\begin{array}{lcc}
& (1) & (2) \\
\text{Ni} & 22.9 & 12.5 \\
\text{Co} & 3.2 & 9.2 \\
\text{Cu} & 2.1 & 5.7 \\
\text{Se} & 71.7 & 72.3 \\
\text{Total} & 99.9 & 99.7 \\
\end{array}
\]

(1) Colquechaca, Bolivia; by electron microprobe, corresponds to \((\text{Ni}_{0.84}\text{Co}_{0.12}\text{Cu}_{0.07})\Sigma=1.03\text{Se}_{1.97}\).  
(2) Hope’s Nose, England; by electron microprobe, corresponds to \((\text{Ni}_{0.36}\text{Co}_{0.34}\text{Cu}_{0.20})\Sigma=1.00\text{Se}_{2.00}\).

Polymorphism & Series:  
Dimorphous with kullerudite.

Mineral Group:  
Pyrite group.

Occurrence:  
In hydrothermal veins.

Association:  
Naumannite, clausthalite, gersdorffite, tiemannite, pyrite, chalcopyrite (Pacajake mine, Bolivia); clausthalite, sederholmite, trüstedtite (Kuusamo, Finland).

Distribution:  
From the Pacajake mine, Hiaco, 24 km east-northeast of Colquechaca, Potosí, Bolivia [TL].  
At Shinkolobwe, Katanga Province, Congo (Shaba Province, Zaire).  
From Hope’s Nose, Torquay, Devon, England.  
In Germany, in the Harz Mountains, at Tilkerode.  
At Kuusamo, northeastern Finland.

Name:  
In honor of Dr. Richard Alexander Fullerton Penrose, Jr. (1863–1931), American economic geologist, of Philadelphia, Pennsylvania, USA.

Type Material:  

References:  

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