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Kopylovite in Sloan diamonds and evidence for an unusual diamond-forming environment beneath the Wyoming craton margin

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The Devonian Sloan 1 and 2 kimberlite pipes, Colorado–Wyoming State Line district, USA, are among the best-known diamondiferous kimberlites in North America, yet they have seen little study since bulk sampling campaigns in the 1980s–1990s. Low diamond grade limited further exploration and left historical collections largely unstudied. Here we report new results from a re-examination of Sloan diamonds and their inclusions using modern microanalytical methods.

Revisiting archived material previously described by Otter (1989), together with additional previously unstudied diamonds from Mal McCallum's collection, reveals that Sloan diamonds host an unusual inclusion assemblage relative to many other kimberlite localities, including abundant inclusions of solid CO2, rutile, as well as potassium-rich phases. A potassium-bearing mineral inclusion, noted but not identified in earlier work (Otter, 1989), was relocated and characterized by synchrotron X-ray diffraction, electron probe microanalysis (EPMA), and electron backscatter diffraction (EBSD). These analyses identify the inclusion as the new mineral kopylovite, K2Ti(Si3O9) (IMA 2025-084).

The occurrence of kopylovite in diamond, together with other atypical inclusions, points to a chemically unusual environment of diamond formation and storage in the Sloan mantle source along the margin of the Wyoming craton.

References

Otter, M. L. (1989). Diamonds and their mineral inclusions from the Sloan diatremes of the Colorado-Wyoming State Line kimberlite district, North America (Doctoral thesis, University of Cape Town). OpenUCT.

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