Carboniferous volcanic rocks in the Picadilly Mine, Sussex, New Brunswick, Canada

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Recent mining activities in the PCS Picadilly potash mine, southeastern New Brunswick revealed the existence of disrupted, finely laminated buff- to reddish-brown layers hosted near the top of the basal anhydrite unit (Upperton Formation) of the lower Carboniferous evaporite sequence (Windsor Group) in southern NB. The layers are characterized by millimeter-scale euhedral semi-translucent crystals set in a fine-grained matrix locally interrupted by fragmental textures defined by lenticular and more deeply coloured reddish clasts up to 2 cm in length. These layers are distinctively different from other finely-laminated greyand grey-brown siliciclastic horizons in the deposit.

Petrographically, the fine-grained matrix can be seen to be composed of large (1–2 cm) mattes of optically continuous carbonate and anhydrite and exhibits a foam-like texture defined by 50–200 µm flattened ellipsoidal features that resemble variably squashed ‘bubbles’ and cuspate bubble fragments. These fragmental textures are reminiscent of ash-fall tuffs whereas more coherent masses of intact bubbles resemble perlitic fractures in glassy volcanic flows. Scanning electron microscopy revealed individual ellipsoidal domains to comprise an outer rind of a K-AlMg silicate mineral whereas the inner domains are either carbonate or halite. The matrix also contains exotic REEminerals such as chevkinite. Euhedral fluorite and zircon crystals were also locally identified in the matrix. The larger euhedral minerals visible in hand sample were identified as quartz and altered sanidine. Cathodoluminesence imaging of fresh quartz grains revealed faint oscillatory zoning, again reminiscent of igneous phenocrysts. The U-Pb age of zircon in the sample was measured using in-situ LA-ICPMS. A total of 5 zircon grains in 3 samples yielded a range of Pb^*/Pb^c and generated a semi-total Pb/U isochron with a lower intercept of 335 ± 8 Ma. The Pb^c -corrected data are near-concordant with a spread of $^{206}Pb/^{238}$ U ages ranging from 349 Ma to 333 Ma and a weighted mean age of 338 ± 9 Ma.

These results point to the origin of these rocks as tuffs, with U-Pb zircon ages that overlap within error the episode of peralkaline felsic volcanism documented in the Cumberland Hills rhyolite, east of Grand Lake, New Brunswick. Whereas the phenocryst assemblage and volcanic eruption ages are well preserved, the silicate matrix has been almost completely replaced by a mixture of carbonate and halite while preserving the intricate details of volcanic glass shards and perlitic fractures. The nature and physical conditions attending this replacement process are still under study.

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