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Contextual synthesis of multi-disciplinary data from Gaping Gill, North Yorkshire, UK.

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A new GIS (Geographical Information System) database relates legacy geological mapping and hydrochemistry to new geophysical survey data. The legacy data provide context for our geophysical images. Visualised in 3D, our combined image data show the relationship between Gaping Gill Main Chamber (GGMC) and the cave sediments beneath. LIDAR (Light Distance and Ranging) data yield volumes and show evidence of void migration. The GPR (Ground Penetrating Radar) data are of exceptional quality. They image sedimentary structures in 3D, with measured depths. Gravimetric data test the inferred distribution of limestone, void space, cave sediment and basement rocks.

At least two suites of karst-forming processes are active in GGMC. Limestone removal drives ‘bottom-up’ processes. Dissolution migrated down to the basement unconformity and does not require local groundwater sinks. The resulting void migrated upwards by roof stoping. As the void breached the land surface, ‘top-down’ processes started to dominate and GGMC became a pitfall trap. More aggressive, nascent

groundwater could accelerate dissolution. Yet the flood flow direction reversed, perhaps because stream sediments blocked outlets. Fine sediments now make the floor of GGMC a partial aquiclude.

A combination of dominant processes appears to steer the Fell Beck waters across GGMC floor. Over the past century, low-water channels moved significantly, whilst usually flowing away from the central shaft. Underlying solution may lower the floor uniformly, though sedimentary inputs raise it. Wall-rock collapse builds locally and peripherally, whereas roof falls should be sporadically distributed. Stream sediments form a low central cone, but the fines disseminate. GGMC is a dynamic space, the continued monitoring of which should elucidate the active processes.