Trenches at Martley Rock, Worcestershire, 2nd September 2014

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Summary

Further to trenching in and around the small inlier of Precambrian meta-igneous rocks at Martley, Worcestershire in 2010, 2011 and 2013, a further phase of temporary trenching with a JCB digger was carried out on 2nd September 2014 (Plate 1). This report presents the results of this recent trenching. New discoveries include the presence of copper mineralisation at the Malverns Complex/Halesowen Formation boundary and two previously unknown outliers of the Malvern Quartzite Formation.

Introduction

The results of the 2010 trenching were given by Barclay (2010) and, along with those of the 2011 trenching, are incorporated in a paper by Barclay et al. (2013). The results of the 2013 trenching were given by Barclay and Payne (2013). The 2010 trenches (Figure 1, trenches 1 and 2) remain open as a geosite visitor attraction, with display boards and plaques marking the geological formations that are exposed in the trench. The 2011 and 2013 trenches were temporary and are backfilled. The new trenches add important data on the boundaries between formations and add precision to the previous versions of the provisional geological map given by Barclay et al. (2013) and Barclay and Payne (2013). In addition to the trenches, three pits were dug to the north of the Precambrian inlier.

Trenches

The numbering of the trenches follows consecutively from the eight trenches dug in previous years. Figure 1 shows the locations of trenches 9, 10, 11 and 12. These were dug on 2nd September 2014 and examined in the following days. Trench 13 [SO 74550 59767] is not shown on Figure 1. It was back-filled immediately. In addition to the trenches, three shallow pits (not shown on Figure 1) were dug between Trench 13 and the end of Trench 12 to locate the Halesowen Formation/Raglan Mudstone Formation boundary. The numbering of the pits follows consecutively from a previously hand-dug pit (Pit 1). Pits 2 and 3 proved only red clay of the Raglan Mudstone Formation and were back-filled immediately. Pit 4 [SO 74520 59687] proved the Halesowen Formation/Raglan Mudstone Formation boundary and was left open for further examination in the following days. All the trenches and pits were subsequently back-filled.

TRENCH 9

Trench 9 commenced in the west in hard meta-igneous granodioritic rock of the Neoproterozoic (Late Precambrian) Malverns Complex. A 6m-wide rockhead depression 1.5 m deep 3 m from the end of the trench may be a former pit and is filled with soft, weathered Malverns Complex debris. The eastern limit of the Malverns Complex is marked by an irregular surface of weathered pink granodiorite dipping gently eastwards, although a small rock step on the surface dips at about 40˚ at one point. This surface is draped by grey and green-grey clay of the Carboniferous Halesowen
Formation (Plate 2). On and immediately above the surface, the clay and the friable, weathered top of the Malverns Complex contain a small amount of copper mineralisation in the form of green malachite and vivid blue azurite. 1.5m to the east of the surface, stiff, red clay of the Raglan Mudstone Formation overlies green-grey and black carbonaceous clays of the Halesowen Formation (Plate 3). The junction is irregular, but generally dips about 20° to 30° to the east (Plate 3). It is interpreted as a west-directed thrust fault. 3m to the east, the red clay of the Raglan Mudstone Formation is truncated by the East Malvern Fault. A 2m-wide zone of green sandstone along the fault is succeeded by typical orange-brown, soft sandstone of the Bromsgrove Sandstone Formation, seen to the east end of the trench.

TRENCH 10

At its western end, Trench 10 proved orange and pale grey orthoquartzite of the Malvern Quartzite Formation, tectonised and mostly shattered to gravel. This outcrop is truncated 8m from the western end of the trench by a fault trending about 193°. This is the Martley Rock Fault. To its east are grey clays of the Halesowen Formation. 1.3 m to the east, grey, carbonaceous clay appears to be thrust over red clay of the Raglan Mudstone Formation in the south wall of the trench, the east-directed thrust junction dipping approximately 20° to 272°. However, the situation in the north wall at this point is less clear, with a complex inter-fingering of red and grey clays (Plate 4). From here eastwards for 11 m, very stiff red clays (Raglan Mudstone Formation) and dark grey, green-grey and black carbonaceous clays (Halesowen Formation) display a very complex and intricate inter-relationship. A small, rounded erratic Old Red Sandstone pebble found within these clays suggests that periglacial processes of solifluction or cryoturbation may have been responsible for these complexities. At the eastern end of this 11m-wide zone, red clays to the east are juxtaposed against the grey clays along a west-directed thrust junction dipping approximately 50° to 102° in the south wall of the trench. The red clays, with some pale green mottling, extend eastwards for 4 m to a 0.5 m-wide zone of weathered, clayey pale green sandstone and red clay gouge marking the East Malvern Fault. The fault trends about 9°. Orange-brown, fine-grained, friable sand/sandstone of the Bromsgrove Sandstone Formation lies to the east.

TRENCH 11

Trench 11 commenced in mostly broken, shattered pink and green granodioritic rock of the Malverns Complex, which extends 10 m from the eastern end of the trench. Joints 2 m from the end dip 45° to 130°. A vertical fault striking 40° separates the Malverns Complex to the east from shattered, orange-weathered, fine-grained orthoquartzite of the Malvern Quartzite Formation to the west. This is the Martley Rock Fault. The orthoquartzite extends for 5 m to the west, where it overlies green clay of the Halesowen Formation in a gently west-dipping thrust junction. Green clay with thin, dark green, fine-grained hard/tough sandstone layers lie to the west. The sandstones contain carbonaceous fragments. The dip of these beds is low and indeterminable. They extend for 9 m to the west, where they are followed by a 6 m-wide outcrop of mainly very stiff dark grey to black clay. 1 m from the western end of the trench, this rests on very stiff, red clay with pale green mottling of the Raglan Mudstone Formation. The junction is near-horizontal and marked by an oxidised orange clay layer up to 0.08 m thick (Plate 5).
TRENCH 12

Trench 12 was excavated mainly in beds of the Halesowen Formation, with some orthoquartzite of the Malvern Quartzite Formation also encountered. From its the north end, a 1 m-thick sandstone occupies 6 m of the trench to the south. The sandstone is mostly broken, tectonised and fractured, dull darkish green, hard to tough, fine-grained and containing carbonaceous traces. A dip measured is 10° to 290°, but it may be unreliable. It is underlain by khaki and grey, orange-stained clay with some sandstone that extends for 15 m south to a rock bar in the base of the trench. This comprises a tough, massive orthoquartzite with some mm-scale laminations visible in hand specimen (Plate 6). It is interpreted as an outlier of the Malvern Quartzite Formation. Very broken, tectonised, shattered, locally quartz-veined, pale and dark grey orthoquartzite extends from there for 9 m to the south. Its southern boundary is unclear, but appears to be a low-dipping surface above clay of the Halesowen Formation. The clay is grey-green, with some dark, carbonaceous layers and orange sandy clay layers. This extends for 9 m south where a black clay is truncated against a grey, tough orthoquartzite outcrop about 0.75 m wide in the base of the trench. Clay lies above the orthoquartzite in the west wall of the trench, suggesting that the orthoquartzite is part of a thin thrust wedge of Malvern Quartzite Formation within the Halesowen Formation, fault bounded on its north side. To the south, orange, sandy clay with some grey-green clay extends for 6 m. It is overlain by dull mid to dark green, hard, broken sandstone which occupies 5 m of the trench southwards. This is overlain by a green-grey clay bed that is in turn overlain by mainly broken, dull green sandstone with an orange/yellow-stained clay bed that crops out 6 m from the southern end of the trench and its junction with Trench 11. Thinner clay beds occur above.

TRENCH 13

This trench was dug to locate the position of the East Malvern Fault where it crosses the Worcestershire Way. Barytes? was discovered in the fault zone which separates red clay of the Raglan Mudstone Formation to the north against soft orange-brown sandstone of the Bromsgrove Sandstone Formation.

Pits

Pits 2 and 3 proved red clay of the Raglan Mudstone Formation. Pit 4 [SO 74520 59687] proved red clay of the Raglan Mudstone Formation overlying grey clay of the Halesowen Formation (Plate 7). The junction dips 10° to 15° to 290° and is interpreted as a west-directed thrust fault. A vertical fault striking c. 184° apparently truncates the Raglan Mudstone Formation thrust sheet against grey-green clay of the Halesowen Formation in the east side of the 2m-wide pit.

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References


Figure 1

Plan showing the location and geology of all the trenches dug at Martley Rock.

Plates


4. Inter-fingering red clay (Raglan Mudstone Formation) and grey clay (Halesowen Formation). South wall of Trench 10. W. Barclay.


Plate 4. Inter-fingering red clay (Raglan Mudstone Formation) and grey clay (Halesowen Formation). South wall of Trench 10. W. Barclay.
Plate 5. Unconformable junction of the Halesowen Formation and the Raglan Mudstone Formation. Trench 11, looking ESE. Note the orange sandy clay layer on the unconformity. W. Barclay.