5.2 The GPR surveys on terrace 1

The GPR surveys on terrace 1 consisted of a three grid surveys and three transect surveys. The areas for the surveys were selected after consulting the LiDAR images and targeted a series of terrace deposits with associated palaeochannels.

5.2.1 Terrace 1 transect 1 (T1T1)

The terrace 1 transect 1 (T1T1) survey was 395m long, running in a north/south direction, targeting two areas of terrace 1 intersected by a large palaeochannel (Fig. 5.14). The transect employed a 200MHz antenna, using high gain settings for maximum penetration. This has caused some data to be clipped with the minimum and maximum values not being realised over particularly strong reflectors, such as when gravels were very close to the surface. Through calibration with the gouge core transect the dielectric constant was set at 19. The data was analysed through using a variable velocity migration.

The transect has clear structure (Fig. 5.15). The interpretation of the data clearly defines the major geomorphological units being alluvium, gravels and palaeochannels. The gravels underlying the alluvium have a heterogeneous structure. The interpretation of the data identifies two types of unit within the gravels, being stronger reflecting (T1A) and weaker reflecting (T1B) units. The weaker reflecting units (T1B1 – T1B6) may represent Devensian deposits, generally lying beneath more recent Holocene gravels (T1A1 – T1A6). Alternatively both gravel units T1A and T1B could be have been deposited in the Holocene and the difference between the two units is a product of gravel/sand ratios. The GPR pulse does not penetrate to the base of the gravels at the junction with bedrock. A unit is seen at the base of the profile on the northern end of the transect (T1D). This is not interpreted as bedrock, as it deemed too shallow at only 3m from the ground surface. This junction could represent a sand or silt dominated deposit under the gravel, which the radar does not penetrate through.

The transect has four definite palaeochannels identified, being T1C1, T1C2, T1C3 and T1C5, and one more speculative palaeochannel T1C4. The four palaeochannels T1C1, T1C2, T1C3 and T1C5 are also evident through aerial photography (Fig. 5.16). The palaeochannel T1C1 is a shallow channel with the basal gravels being encountered at circa 1m from the ground surface. Palaeochannel T1C2 is also relatively shallow with a depth of circa 1.8m at its deepest but with areas of channel fill containing gravel. Likewise, palaeochannel T1C3 has a depth of 2.1m at its deepest point, with areas of gravel fill. On the south side of palaeochannel T1C3 the channel shows a greater level of incision into the terrace suggesting a higher energy erosive flow. The north side of the channel shows some evidence of depositional layers due to a lower energy flow. It is possible that T1C2 and T1C3 are two more recent palaeochannels following the course of the older palaeochannel T1C4. However, the depth T1C4 is deep at 3m and the channel form is a suggested interpretation. At this depth the radar signal has become weak and difficult to interpret.

The largest of the palaeochannels is T1C5, both in width and depth. The coring of the transect revealed a depth to gravels of 2.83m. The GPR pulse did not penetrate to the base of the palaeochannel. Dipping reflecting bands are seen on either side of the T1C5 but definition of any structure in the channel is not possible. These dipping reflecting bands represent either clay and/or sand units overlying the gravels at the edges of the channel T1C5. The level of alluvium overlying the basal gravels close to T1C5 is much deeper than on other sections of the transect. A D shaped enclosure is highlighted on Fig. 5.15, which has been partially covered by alluvium. This has importance in understanding the geoarchaeological potential of terrace 1 and is discussed in chapters 8 and 9.

The coring of T1C5 showed the fill to be a thick brown sandy clay silt, underlain by thick grey sandy clay and banded coarse medium sand. The structure of these units has proved too dense for radar penetration. The water table was also recorded in T1C5 when encountered. The area of the higher water table within the channel relates to a corresponding loss in data quality on the radar trace. Although the GPR did not to reveal the shape and structure of the channel due to the nature of its sediment fill, this is suggestive of a water logged anaerobic environment, which implies a high palaeoenvironmental potential.

The stratigraphic relationships of this transect can be summarised. The T1A deposits postdate the T1B deposits. The palaeochannels T1C1, T1C2, T1C3, T1C4 and T1C5 all post date the T1A and T1B gravel deposits, due to their incision and erosion into these units. Palaeochannels T1C1, T1C2 and T1C3 all post date the palaeochannel, through virtue of their position above T1C4. The chronological relationship between T1C4 and T1C5 is not definable though this GPR transect.

The correlation between the T1T1 interpretation and the gouge core transect is excellent, showing the relationship of the cored data to the interpreted T1T1 data. The depth at which the surface of the gravels was encountered is consistent with the depth profiling of the GPR section. The gouge core transect provided data on the depth and nature of the palaeochannel fill T1C5, when the GPR transect did not provide adequate penetration. In contrast palaeochannels T1C1 – T1C4 had excellent structure revealed through the GPR transect, especially on the nature of their gravel fills. However, the integration of the gouge core and GPR data provided the most information on the nature of the floodplain sediments.

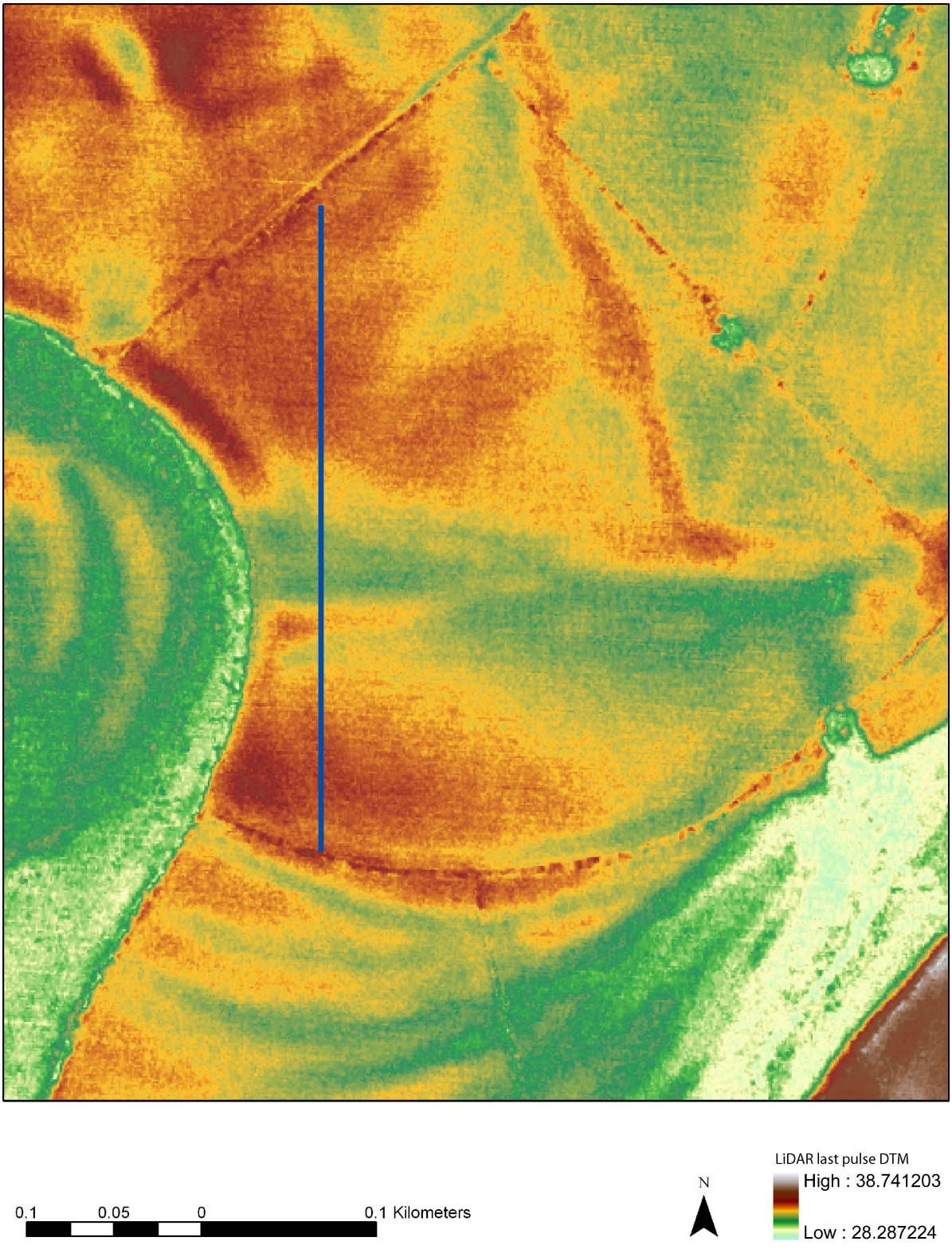
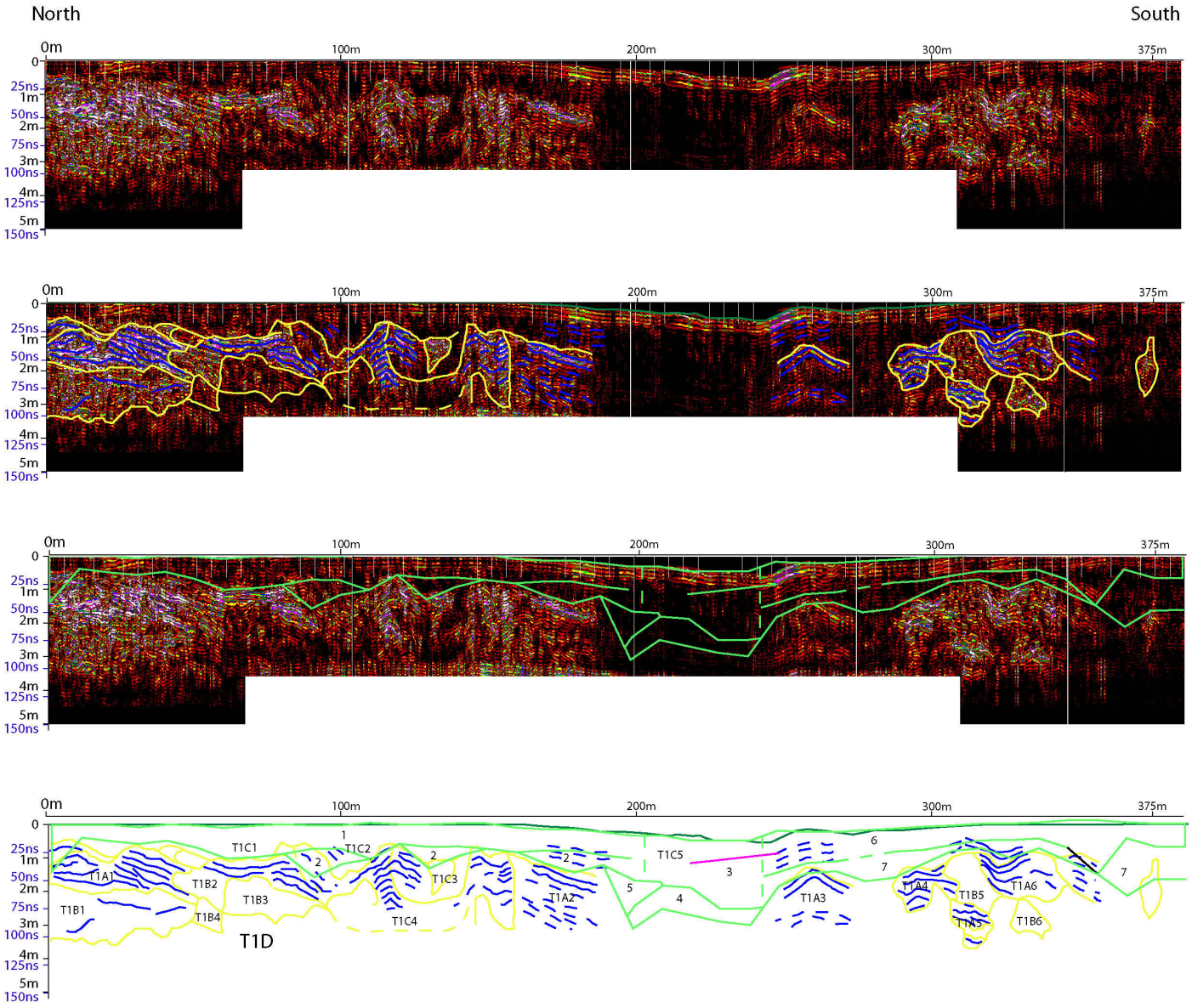


Fig 5.14: The location of the T1T1 survey on terrace 1.



Key

Stratigraphic units from coring (numbers)
1 - Silt with red sand
2 - Coarse sand
3 - Thick brown sandy clay silt
4 - Thick grey sandy clay
5 - Banded coarse medium sand
6 - Clay and fine sand
7 - Free sand
8 - Gravel (impenetrable to thin gouge core)

Stratigraphic units from GPR interpretation (letters):
T1A(number) - gravel unit, higher reflection
T1B(number) - gravel unit, lower reflection
T1C(number) - palaeochannel
T1D - different sedimentary unit

Core transect

Boundary
Water table

GPR interpretation

Strong reflecting layer
Sedimentary boundary
Suggested reflecting layer
Suggested sedimentary boundary

Fig 5.15: The T1T1 transect, shown with interpretation and corresponding gouge core data. Penetration into the palaeochannel was poor, whilst the structure revealed in the deposits surrounding T1C5 is excellent.

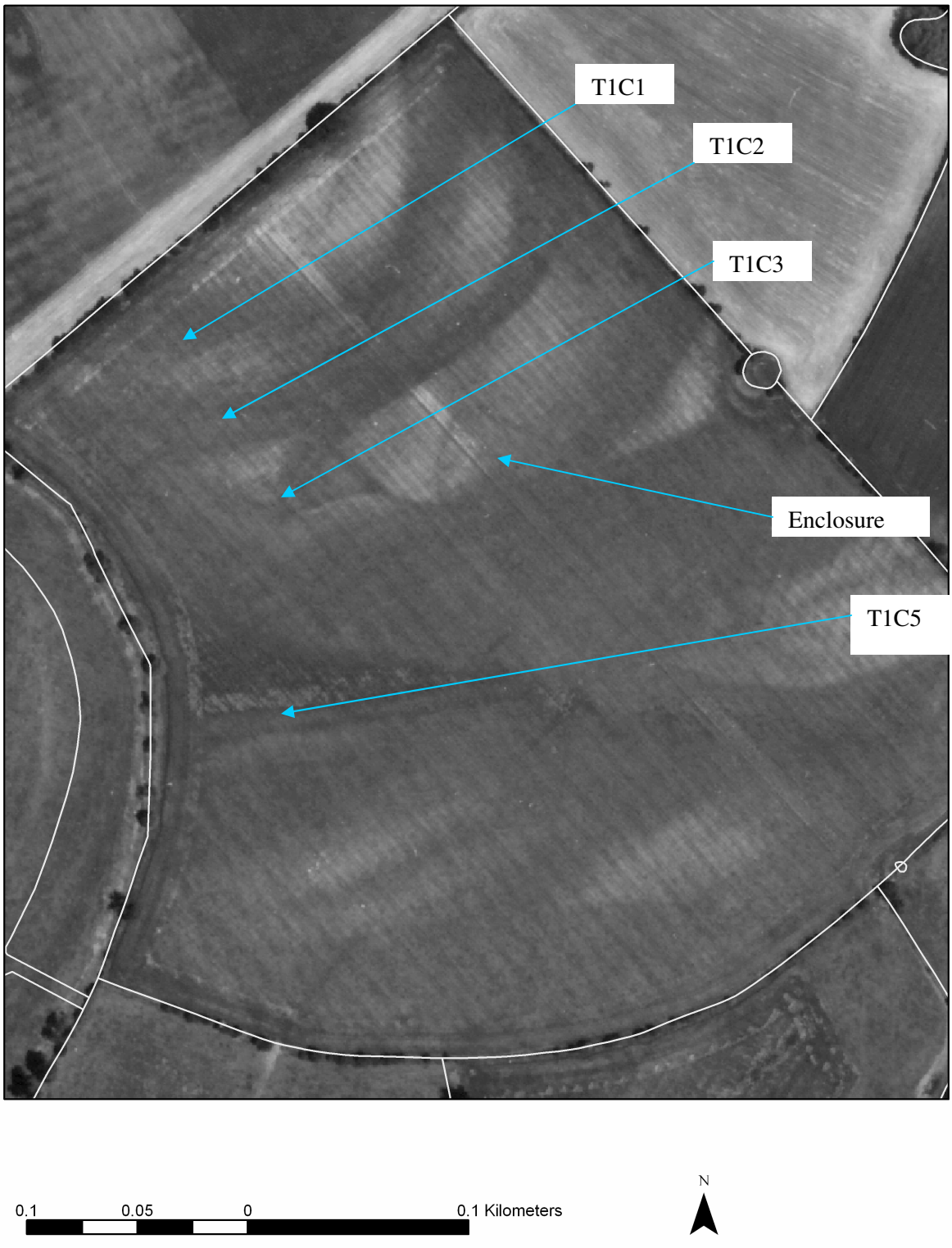


Fig 5.16: A rectified aerial photograph showing the T1T1 survey area. The channels T1C1, T1C2, T1C3 and T1C5 are highlighted, as is a D shaped enclosure that has been partially buried by alluvium deposited from T1C5.

5.2.2 Terrace 1 quarry transect T1QT

The terrace 1 quarry transect (T1QT) survey was just under 70m long, running in a southeast/northwest direction (Fig. 5.17). The T1Q1 survey ran along the edge of a Lafarge quarry at Sawley, allowing a visual comparison between a GPR transect and a recorded section. The transect employed a 200MHz antenna. The section along the transect recorded sediment stratigraphy at 2.5m intervals. The dielectric constant was set through the consulting the section drawing and also the T1T1 calibration and was set at 20.

The transect has clear structure, with the GPR interpretation compared to the section drawing (Fig. 5.18). The alluvium is clearly recognisable as QT1. Units QT4, QT5 and QT6 are interpreted as a series of layers lying on top of the basal gravels. These are high reflecting units, which with calibration from the section drawing proved to be clay and sand deposits. Below units QT5, QT5 and QT6 is gravel. There is little structure within the gravels shown on the GPR trace. The clay units (QT4, QT5 and QT6) have proved to be almost impenetrable for the GPR signal. The base of the gravel deposit is not seen. In general the correlation between the section and the GPR interpretation is good, although the section drawing reveals finer detail in the clay and sand deposits overlying the gravels. However, there is some variation between the location of the basal gravels identified by the GPR transect and the drawn section. Most notably the GPR trace does not identify unit 5 from the section. This unit has a high clay content and GPR penetration into this unit was extremely limited.

The GPR interpretation can also be compared to photographic recording of the section (Fig. 5.19). On the photograph the sediment units of QT1, QT2, QT5 and QT7 are labelled and are visually evident. QT1 proved to be a heterogeneous unit, with smaller 'pockets' of different matrix being encountered such as QT2. The quarrying has revealed substantial organic deposits that appear to have been located within the gravels (Fig. 5.20), although by the time of inspection the trees were '*ex-situ*', so their exact context is not known. On inspection these trees revealed no evidence of anthropogenic activities in the form of tool marks.

The photograph combined with the GPR interpretation and section highlights a key point about this area of terrace 1. A substantial covering of alluvium overlies the gravels, varying from between 1.5m to just over 2.5m when including the clay unit 5. This is in contrast to the T1T1 transect which generally had a much shallower level of alluvium overlying the gravels, although again in the T1T1 transect variation in alluvium depth was seen. The investigation of the gravel deposits in the quarry produced no evidence for bipartite gravel units, suggesting that the weaker reflecting units on transect T1T1 are not Devensian but Holocene gravels.

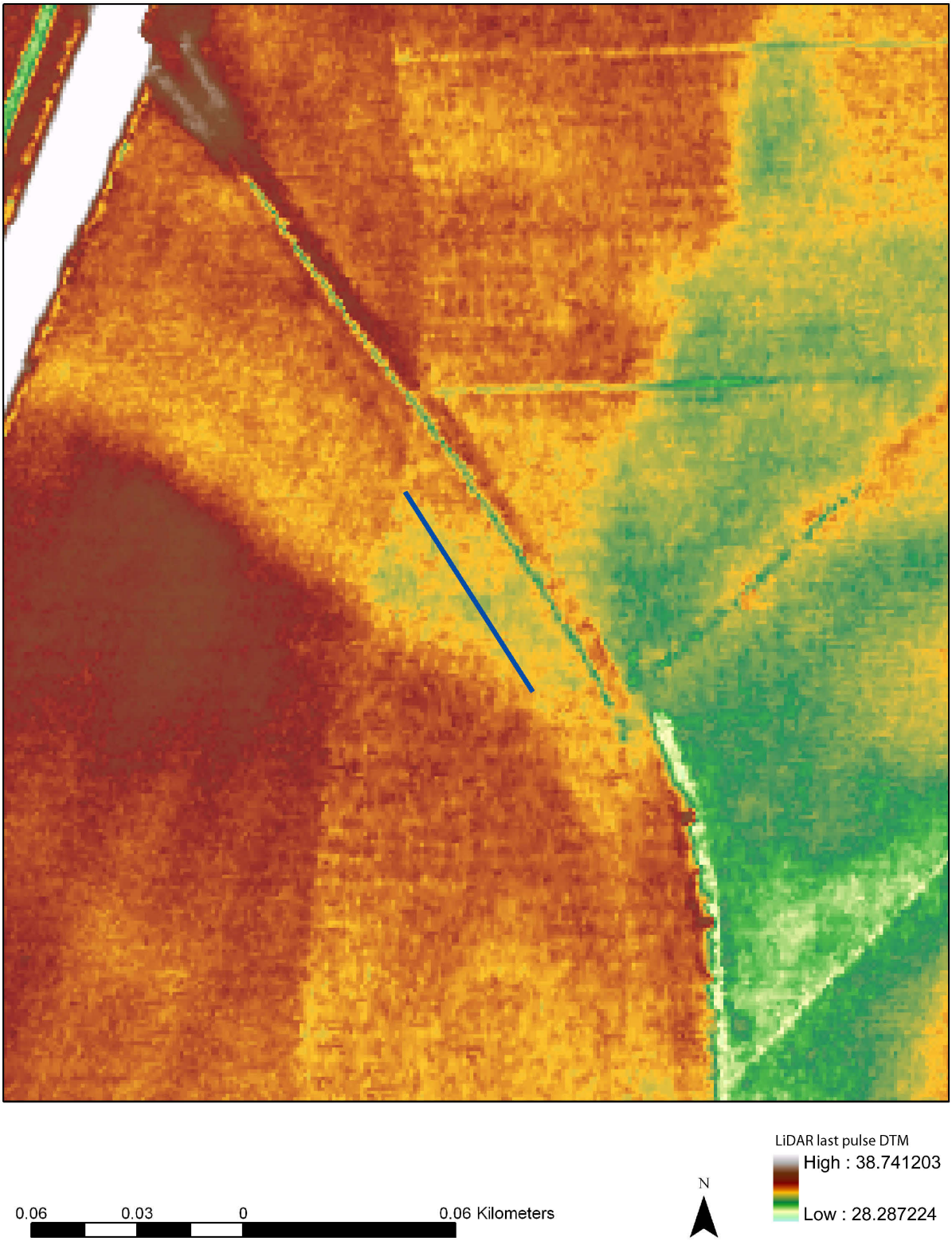


Fig 5.17: The location of the T1QT survey. The field that T1QT was surveyed in is now an active quarry, with the transect creating a section along the quarry edge.

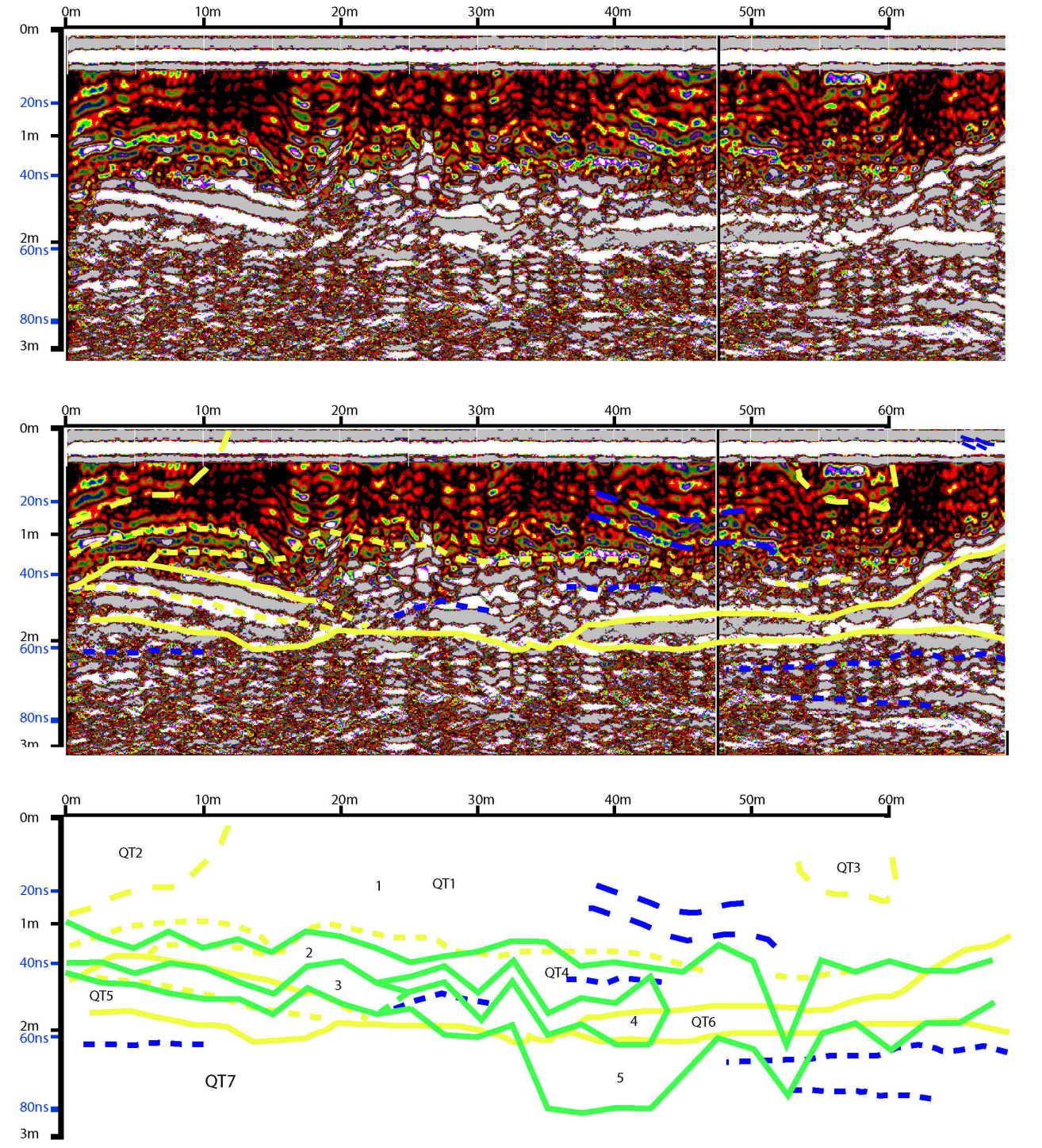


Fig 5.18: The T1QT survey, shown with interpretation and against the section drawing.

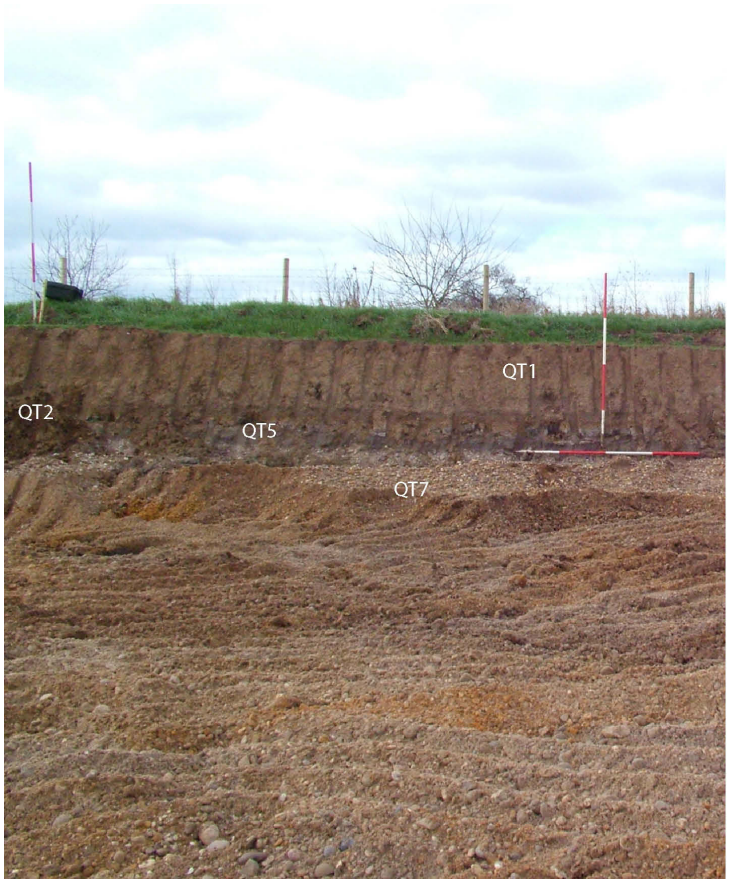


Fig 5.19: A photograph of the start of the T1QT transect, showing the main units from the GPR interpretation.

Fig 5.20: Within the gravel unit on terrace 1 were substantial organic remains, such as these three oak trees. The trees showed no evidence of anthropogenic activity, such as tool marks.