Location of historic mass graves from the 1919 Spanish Influenza in the Aboriginal community of Cherbourg using geophysics

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Abstract

The Spanish Influenza of 1919 had a devastating effect on Aboriginal Australian communities, particularly Cherbourg (formerly known as Barambah Aboriginal Reserve), which resulted in a loss of ~15% of their population. Deaths happened so quickly that coffins were not built and, in some cases, trenches or mass graves were used to inter the dead in addition to individual graves. Although the trench locations were formally unknown by the Cherbourg community today, a major concern of the Cherbourg Elders is that they wanted to memorialise those affected by the 1919 pandemic, especially 100 years later. One attempt to locate the mass graves was to apply geophysical methods in the New and Old Cherbourg cemeteries to detect these unmarked burials. Our paper demonstrates how ground-penetrating radar (GPR) and magnetic gradiometry were used along with oral histories and Indigenous knowledge to detect three mass graves associated with the Spanish Influenza. Outcomes such as this play an important role is supporting 'Truth Telling' for the Cherbourg Aboriginal community.

Introduction

Worldwide, archaeological geophysics has been widely employed in archaeology and cultural heritage because these methods provide valuable information on archaeological sites and associated landscapes in a timely and efficient manner (Gaffney and Gater 2003; Johnson 2006; McKinnon and Haley 2017). Since they provide a more strategic approach for assisting to formulate an excavation methodology, they are increasingly applied to interpret cultural landscapes and for understanding the integrity of cultural sites in academic research and cultural heritage management (Sunseri and Byram 2017). In Australia, an important application of geophysical methods is supporting Aboriginal and Torres Strait Islander communities researching the significance of sites, the degree of a site's structural integrity, and for the detection of specific cultural events of significance. There is also an element of initially assessing the land surface to detect archaeological sites too and help formulate strategies for more strategic archaeological investigation (e.g. Westaway et al. 2021). While geophysics has been increasingly applied across the world in contexts where large numbers of individuals have been disposed of in mass graves in both archaeological and forensic contexts (Fernández-Álvarez et al. 2016; Ruffell et al. 2009), it has not been employed in Australia. However, several attempts have been used to identify individual graves which is one area of priority for Aboriginal groups (Lowe et al. 2014; Moffat et al. 2008, 2010; Ross et al. 2019; Sutton et al. 2020; Wallis et al. 2008).

Archaeology is increasingly becoming more applied in its approach to support Indigenous aspirations around such concepts as 'Connection to Country', 'Truth Telling' and the promotion of Aboriginal and Torres Strait Islander heritage in their region (HCANZ 2020). Archaeological geophysics, which involves measuring changes in the Earth's physical surface to reveal buried cultural features on archaeological sites, offers one important outcome of this approach for Indigenous communities (Johnson 2006; Nelson 2021; Wadsworth et al. 2021). It provides the opportunity to map a site's integrity and features and reveal information about past people's behaviour through a method of ground-surface examination with minimal disturbance.

Outside Australia, a major objective for Indigenous and First Nations groups is to employ methods that align more towards their values of site conservation and management where an approach is developed that avoids or minimally disturbs culturally significant sites (Nelson 2021; Sanger and Barnett 2021). Geophysics, for example, offers an opportunity for excavations of sites to be more strategic, connect local knowledge to inform contemporary management and help combat destruction of sites through mapping (Conyers 2013). They can also serve community sovereignty and the pursuit of justice as they have the potential to play a critical role when exposing past human rights abuses while helping to reinforce the significance of the site to the descendant communities (see Wadworth 2019; Wadsworth et al. 2021).

One example of relevance to this study in support of a descendant community includes Wadsworth's (2019) investigation on enslaved African Americans in southwestern Ontario, Canada, where geophysical mapping provided subsurface information on unknown burial locations. Here archaeological geophysics offered a scientific method and strategy with minimal impact. It was also a means for connecting local knowledge to inform contemporary management of the cemetery for the African American community. In this example, geophysics served as an important foundation for the community to consider further options such as conducting additional research through excavation to individuate people and connecting directly to families. When combined with ethnographic information, the two datasets provided a powerful cultural history of the site and its locality while helping to reinforce the significance of the site to the community.

Internationally we have seen an increase by communities and through community-based projects that focus on the use of archaeological geophysics such as the example provided above (cf. Nelson 2021; Wadsworth 2019). Such outcomes can lead to broader social, cultural, political, and economic impacts for local communities. Our paper demonstrates how geophysical methods including ground-penetrating radar

(GPR) and magnetic gradiometry can play an important role in supporting 'Truth Telling' for one Indigenous community affected by the Spanish Influenza of 1919, the Aboriginal community of Cherbourg. Aboriginal populations were significantly impacted by a series of pandemics introduced by European from the late eighteenth century onwards. It is estimated that mortality rates between 60–90% in Aboriginal populations occurred in the wake of the introduction of Old World diseases (Butlin 1983, 1993; Campbell 2016; Dowling 2021; Hunter and Carmody 2015). While there have been some investigations from an archaeological perspective of the impact of Old World pandemics (e.g. Dowling 1997) there has been no discussion in the literature on mass graves associated with these often catastrophic events.

This investigation represents one way to quantify the devastating impact of disease through oral histories and by employing geophysical methodologies it has confirmed the location of two previously documented mass graves from work carried out by Schlencker Surveying for the Cherbourg Shire Council in 2012 while identifying one more mass grave. In total three mass graves were detected (Lowe 2020). A similar survey was carried out at the Taroom Aboriginal Reserve in the mid-1990s (Yelf and Burnett 1995). Using GPR, they detected multiple unmarked graves and trench graves in the Lower Cemetery where Spanish Influenza burials were interred. While there was no mention of 'mass graves', the mapped trench graves could have been associated with those affected by the 1919 pandemic. The successful detection of unmarked graves using GPR consequently made it a useful comparison for Cherbourg while also highlighting the uniqueness of such studies for Indigenous Australians.

Outcomes of this study, sadly reported at the time of a new pandemic resulting from the global spread of COVID-19, highlight the importance of recognising and remembering the significant impact pandemics had for Indigenous people in their history. Of greater importance is the recent COVID-19 pandemic which has made the concerned community potentially vulnerable once again 100 years later (Robinson 2022; South Burnett 2019).

The Spanish Influenza in Cherbourg

Cherbourg is a town and locality of the Aboriginal Shire of Cherbourg, in southeast Queensland, Australia (Figure 1). It is in Wakka Wakka tribal boundaries, near the border of Gubbi Gubbi territory. Formally known as the Barambah Aboriginal Reserve and founded as an Aboriginal settlement in the early 1900s under the *Aboriginals Protection and Restriction of the Sale of Opium Act 1897*, the Cherbourg community was significantly impacted by the Spanish Influenza in 1919. Within three weeks ~15% of the community died from the influenza (Blake 2001; Briscoe 1996). As a result, the victims were buried first individually and then in mass graves in areas away from the current Aboriginal community – an area never demarcated. In 2019, 100 years after the event, local Indigenous Elders sought out specialists to conduct non-invasive remote sensing in an attempt to find the mass grave sites so that the people buried there could receive recognition for their final resting place and have an appropriate memorial (e.g. plaque or marker). Wakka Wakka Elder Eric Law, the Ration Shed Museum and several Elders associated with the community worked together with the University of Queensland to locate the mass burial sites.

Figure 1. Location of the town of Cherbourg in SE Queensland, Australia.

Despite the town of Cherbourg having one of the highest mortality rates in Australia from the 1919 pandemic, many residents today are unaware their town was affected so significantly in the past. According to *The Queenslander* (14 June 1919:10) the medical record:

> state only 10 people out of 596 remained unaffected by the 1919 pandemic, and 69 deaths were reported including 45 males and 22 females.

The final death toll reported ~87 deaths; however, the exact numbers are still unknown (Queensland State Archives Item ID 336726). Taroom was the second largest Aboriginal mission infected by the influenza, with 200 people affected and 31 deaths (*The Week* 20 June 1919:19). Most infected people were sent to government relief depots such as Barambah (Cherbourg), Duaringa and Taroom (Figure 2).

While the pandemic had a major impact in Australia and resulted in over 12,000 deaths, it had a greater impact on Aboriginal settlements (Cumpston 1989). Briscoe (1996:1) identified at least 30% of Queensland's death toll from the pandemic were Aboriginal (315 people in total), a high rate when considering the rate of mortalities for the rest of Queensland which was 1,030. This is not to diminish the severity of the Spanish Influenza as it was one of the worst pandemics in world history, killing at least 2.7% of the global population (mainly young adults) or at least 21 million deaths (Douglas 1985; Johnson and Mueller 2002; Wengert 2018). It did, however, have a disproportionate impact on Aboriginal and Torres Strait Islander populations compared to that of non-Indigenous Australians. The estimated Indigenous population of Australia in 1921 was 72,000, down from 93,000 in 1901 (Smith 1980).

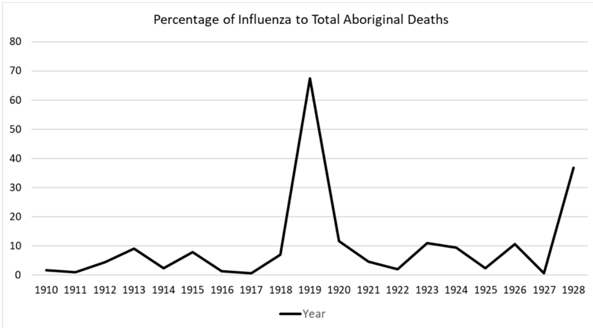

Figure 2. Aboriginal influenza deaths as a proportion of total Aboriginal deaths in Queensland from 1910–1928 (Queensland State Archives A/58973). Note these are reported deaths. There is no confidence in the accuracy reported due to some deaths listed as a single cause, deaths being inaccurately recorded as caused by other diseases or that some people who left and died elsewhere were not recorded. It is likely that true total and percentages are higher.

Traditionally, it appears that Aboriginal people had no means of adapting to a pandemic threat of the scale of the Spanish Influenza. The severity of the pandemic mortality rate on Aboriginal communities was likely related to both their physiological and social circumstances (Briscoe 1996). Indigenous people were at risk because they had no immunological familiarity with Old World diseases that had coevolved with European populations for around 10 millennia (Crosby 1989). To further exacerbate the situation their compound living conditions, following a transition from the bush to an urban setting, resulted in new hygienic and social conditions (Briscoe 1996:15). People who were infected were often forced to travel long distances to seek care, causing many people to relocate from remote pastoral properties and fringe camps to a centralised place such as Cherbourg.

Newspaper archives and oral histories have provided important historical context for understanding what happened to those who died from the Spanish Influenza in Cherbourg. Oral histories from several Cherbourg Elders reported at least two known mass graves within the New Cherbourg Cemetery. It is unknown how many people were placed in these graves; however, Evelyn Serico, an Aboriginal Elder who was interviewed by Thom Blake in the 1984 (2022), stated that her mother was buried in ‘a long trench with at least eleven other people’. Ettie Meredith, another Aboriginal Elder interviewed by Blake in 1982 (1990, 2022), said that ‘they use to put six into one trench. They would dig a couple of graves … They might dig two trenches, three in one and three in the other’. No coffins were built, or death certificates issued as the deaths happened too quickly, but individuals were wrapped up in blankets and laid down in a line in mass graves (Blake 2001, 2022). It was reported that men were engaged to make coffins but were unable to keep pace with the mortality rates, therefore some were interred in trenches (*The Brisbane Courier* 7 June 1919a:5; *The Telegraph* 6 June 1919:2). It was recently reported that a third mass grave was located at the Old Cherbourg Cemetery, in an area away from the main part of cemetery and near one of the ironbark trees (Aunty Sandra Morgan, pers. comm., 2019).

The Chief Protector of Aboriginals, Mr. J. W. Bleakley, recaps similar observations regarding the 1919 influenza deaths:

> that the coffin makers had been unable to keep pace with the demand for coffins. Mr Bleakley pointed out that it was not usual for natives to be buried in a coffin, this being done only when the relatives desired it. The custom was to dispose the body in the tribal manner, wrapping it in a blanket, bark and so on. All natives who died had been decently buried, according to tribal custom and through three or four had been buried in a trench the bodies were all interred at the proper depth, and with due regard to tribal and family feelings, and given Christen burial (*The Queenslander* 14 June 1919:10).

These types of burial customs were also observed at the Taroom Aboriginal Reserve which, as previously mentioned, was significantly impacted by Spanish Influenza. Bodies were typically wrapped in their own blankets and sometimes placed in bark (L’Oste-Brown et al. 1995). There was no mention that coffins were used at Taroom, but Superintendents provided the first burial service by reading passages from the Bible before traditional burial customs were carried out (L’Oste-Brown et al. 1995:44-46). It was also noted that sacred objects or artefacts such as weapons, belts or totems were interred with the burials well into the 1920s (L’Oste-Brown et al. 1995:46).

Landscape Setting

The Old and New Cherbourg cemeteries are located in the southern part of the town of Cherbourg, on a rolling hillside which is characteristic of this region (Figure 3). Sediments found on these types of hillsides are generally loamy surface soils that have strongly bleached subsurfaces with neutral to alkaline clay subsoil which is coarsely structured and commonly mottled (CSIRO 2001). Therefore, grave shafts for burials would be relatively shallow about 1–1.5 m below surface given the nature of the local geology. The Esk Formation underlies the hillslopes, a fragmented pebble to boulder conglomerate comprising feldspathic sandstone, shale and minor acid tuff. It is Palaeozoic to early Mesozoic in age and is located along the eastern margins of Australia. It is overlain by Late Triassic silicic volcanic rocks.

The New Cherbourg Cemetery is located on top of a grassy hill and is mainly clear of large trees. In the area of the mass graves only a few burial markers (e.g. wooden crosses) and concrete borders marking out known burials were visible. The southern half of the cemetery slopes south. The Old Cherbourg Cemetery is situated on another hill that also slopes south. Therefore, the southern half of the cemetery is topographically lower. Exposed clay and chert were visible in the southeast corner.

Methods

Both GPR and high-resolution magnetic gradiometry were used to carry out the geophysical surveys at the Old Cherbourg Cemetery. Magnetometry is a passive method meaning that it does not transmit anything into the ground, and instead, measures the strength or alteration of the Earth’s magnetic field across an area (Aspinall et al. 2008; Clark 1996; Gaffney and Gater 2003; Witten 2006). While magnetometers are not commonly used on either Indigenous or non-Indigenous burial sites in Australia (see Stanger and Roe 2007; St Pierre et al. 2019; Wallis et al. 2008), it was anticipated that iron objects associated with the burials or soil contrasts associated with the construction of a mass grave may be detected. Since it also quick and easy to use, and complementary with GPR, it was also chosen.

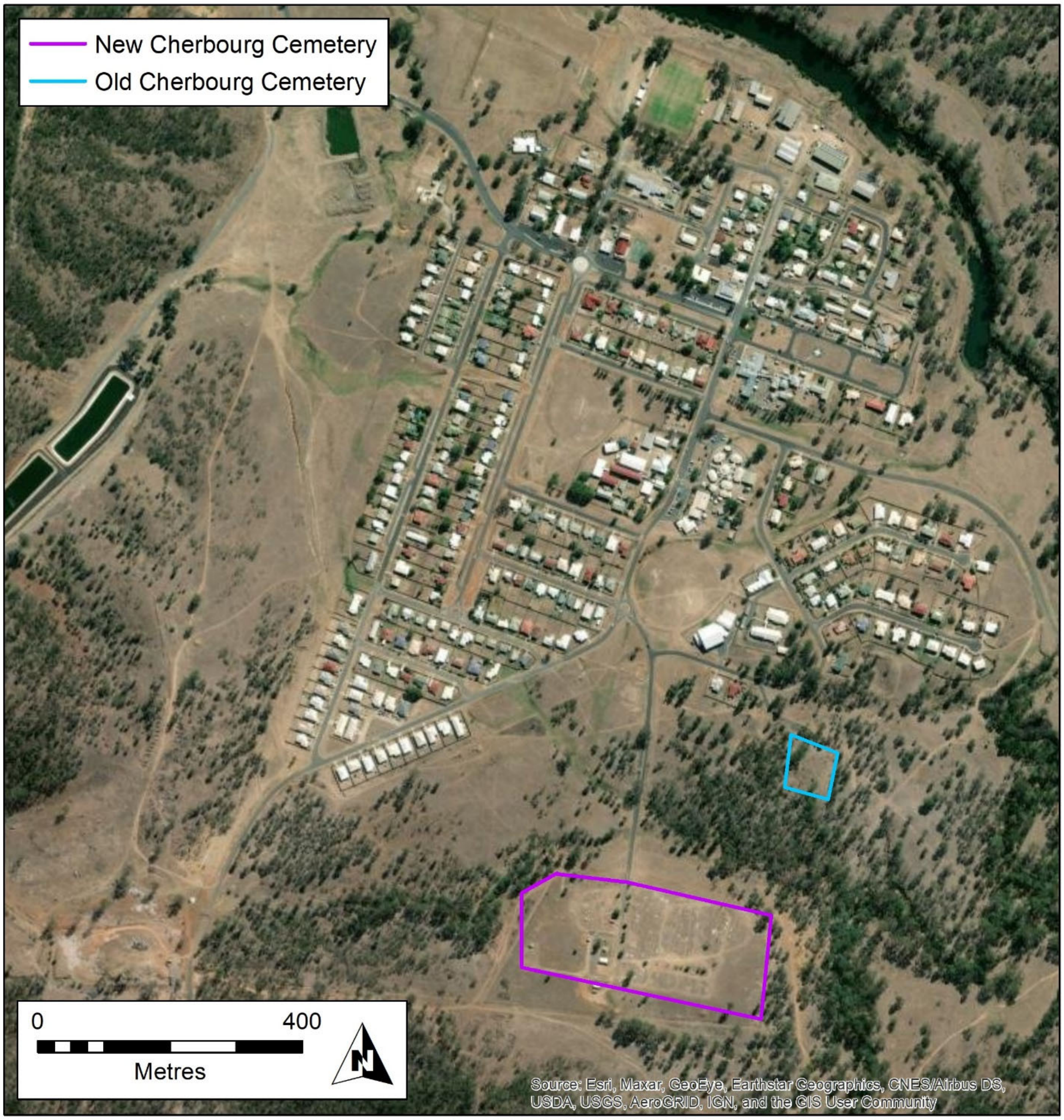

Figure 3. Location of the New and Old Cherbourg cemeteries in Cherbourg.

GPR works by transmitting electromagnetic energy in the form of radar waves into the ground (Bevan 1998; Conyers 2013). When the wave encounters a different material in the soil (such as air voids, stone or a material with different moisture content), a reflection occurs, sending part of the wave back to the surface, where it is received and recorded. GPR was selected because of its popularity with Indigenous communities and GPR's ability to map in three dimensions. It is also the most used method for locating unmarked graves, especially in Australia (Bladon et al. 2011; Brown et al. 2002; Kemp et al. 2014; Long and von Strokirch 2003; Lowe et al. 2014; Marshallsay et al. 2012; Moffat et al. 2016, 2020; Powell 2010; Randolph et al. 1994; Sutton and Conyers 2013; Sutton et al. 2021; Yelf and Burnett 1995).

For this project, a Bartington Instruments Fluxgate Grad601-2 was used to collect the magnetic gradiometer data. This instrument utilises four magnetometers – two pairs stacked vertically 1 m apart to provide a measure of the magnetic gradient at each measuring station. Gradiometers allow for the recording of very subtle (0.1 nT) fluctuations in the local magnetic field. The instrument was set up to record data eight times per meter with 0.5 m spaced survey transects (16 samples/m^2). Processing was limited to destriping to remove abnormal high/low readings and high-pass filtering.

The GPR survey was conducted using a Geophysical Survey Systems, Inc. (GSSI) SIR-3000, 400 MHz antenna and a model 620 survey wheel. Transects were spaced every 0.5 m, and 16-bit data were collected with a 40 nS time window, 512 samples/scan and with 25 scans/meter. The data were processed (time zero correction, background removal and bandpass filter) and converted into slice maps using GPR-SLICE v7.0. The hyperbola-fitting function to estimate the relative dielectric permittivity, which is calculated from the two-way travel time to depth, was used to make the time slices and provide an estimated depth of the data (Goodman and Piro 2013; Jacob and Urban 2016).

A 20 x 40 m grid was established in the southeast corner of the Old Cherbourg Cemetery, in an area reported to contain another mass grave and where only two known graves were present. Mapping and cartography were completed in ESRI ArcGIS 10.8.1. A Garmin global position system (GPS) device was used to record the corners of the grid, and these were adjusted using drone imagery. All processed geophysical images were exported as JPEGs and georectified to the appropriate GPS points in the survey area. Drone imagery was collected by the Cherbourg Shire Council to provide higher resolution imagery of the cemeteries. No geophysical survey was completed at the New Cherbourg Cemetery. This was largely due because a previous GPR survey was completed in 2012 by Schlencker Surveying for the Cherbourg Shire Council as well as time constraints for the 2019 survey. Access to any of the 2012 data was unsuccessful for our project; therefore, the Schlencker Surveying map provided by Uncle Eric Law was used instead for relocating the two large mass graves. They were georeferenced and used to support the field survey.

Results

Old Cherbourg Cemetery

GPR was completed first at the Old Cherbourg Cemetery. Localised differences in the GPR (radar waves) were detected in the survey area and these differences were interpreted based on contrasts and reflectivity differences (either strong or weak amplitude reflections), size, orientation and shape. While we could not directly evaluate the geophysical anomalies, all GPR reflections with higher contrasts or strong reflections are shown in yellow and red, while weaker reflections are shown as blue. Due to the complex nature of mapped GPR features with depth, an Overlay Analysis was used to combine the amplitude time-slices to show GPR targets of interest from 50–75 cm and 75–100 cm. Burial depths are often calculated at 1.2–1.5 m below the ground surface (Conyers 2013:132), and Yelf and Burnett's (1995) survey at Taroom noted burial estimates to be about 1.1–1.2 m in depth. Overlaying the data helps in the interpretation of the reflection features as the time slice levels are overlaid to show the most robust reflectors at specified depths (Goodman and Piro 2013).

Despite the Old Cemetery having a higher clay ratio in the subsoil, the signal attenuation was quite good with depth estimates to about 2.2 m below surface. The GPR data revealed several high amplitude reflections in the areas of known graves as well as in the centre of the survey area, a concentration of ovoid high-amplitude reflections adjacent to the ironbark tree which is interpreted to be Mass Grave 3 (Figure 4a). Mass Grave 3 is about 4.3 x 5 m in size. Several high amplitude reflections ranging from 0.5–2 m are found in the western and southern parts of the survey area. From 75–100 cm, the same mapped features to those detected above are shown indicating a continuation of these high reflections (Figure 4b). High amplitude reflections found southeast of the ironbark tree result from exposed hard clay, which was observed on the ground surface during the survey and during a recent site visit.

High-resolution magnetic gradiometry was completed after the GPR The data has been annotated to show two types of anomalies: positive responses anomalies or values that are very magnetic represented in black, and negative response anomalies or values that are magnetically weak represented in white. Overall, there are two types of anomalies: monopoles (single highs or lows) and dipoles (pairs of highs and lows). Dipole anomalies are commonly associated with strongly magnetised materials such as metal. They can be 'non-normal' dipolar, meaning that their magnetic low is oriented to the west and the magnetic high is oriented to the east, or 'normal' dipolar, which refers to the permanent alignment of magnetic domains along a single axis within a material (Fassbinder 2016). Monopole anomalies are caused when a strongly magnetised mineral is oriented so that one pole is near the sensor, and the other is far enough away to be unrecorded (Aspinall et al. 2008).

Positive (high values) and negative (low values) response magnetic anomalies were visible throughout the survey area (Figure 4c). These circular, semi-circular to ovoid anomalies range in size from 0.5–2 m and do not appear to form any visible pattern. There is only one sizeable positive response anomaly located adjacent to the ironwood tree. Several linear anomalies are also visible and are situated in the northeastern half, central and eastern section of the surveyed area. These features might be natural, although their nature is unknown. They appear to be weaker responses bordered by positive responses. Interpretations of the GPR and magnetic gradiometer anomalies are shown in Figure 4d. This aids in understanding if there are any correlations in mapped features by the two instruments.

The magnetic gradiometer image was clipped to highlight magnetic high (3 to 4 nT) and low (-3 to -4 nT) values. This was largely done to see if there was a correlation between the mapped GPR reflections in both overlays, specifically in those areas where known and potential burials were detected as well as within the mass grave (Figure 5). The clipped data revealed only a few magnetic high values within the mass grave and in some areas where potential burials occurred, of which might be associated with metal based on the GPR reflection. In general, there is no direct correlation of magnetic features to those produced by the GPR. As Conyers (2018) observed, some magnetic anomalies are off-set some distance from the GPR mapped buried features.

The GPR reflection profiles were examined to better understand the contrasts below the surface and assist in determining if a mass grave was present. The known burial shows reflectivity differences that resulted from soil disturbance and refilling of the burial (Figure 6a). This patterning was used to determine the location of the mass grave and any unmarked burials. Using the results of the known burial reflections, at least eight unmarked burials were detected (see Figures 5a, 6b). Metal, which shows up as strong and long hyperbola reflection because it contains a higher energy that produces multiple reflections in the ground (Conyers 2013), was also visible within the potential burials and in some areas of the mass grave (Figures 6b-6c). As observed in Yelf and Burnett's (1995) survey, burial estimates were about 1.1–1.2 m below surface.

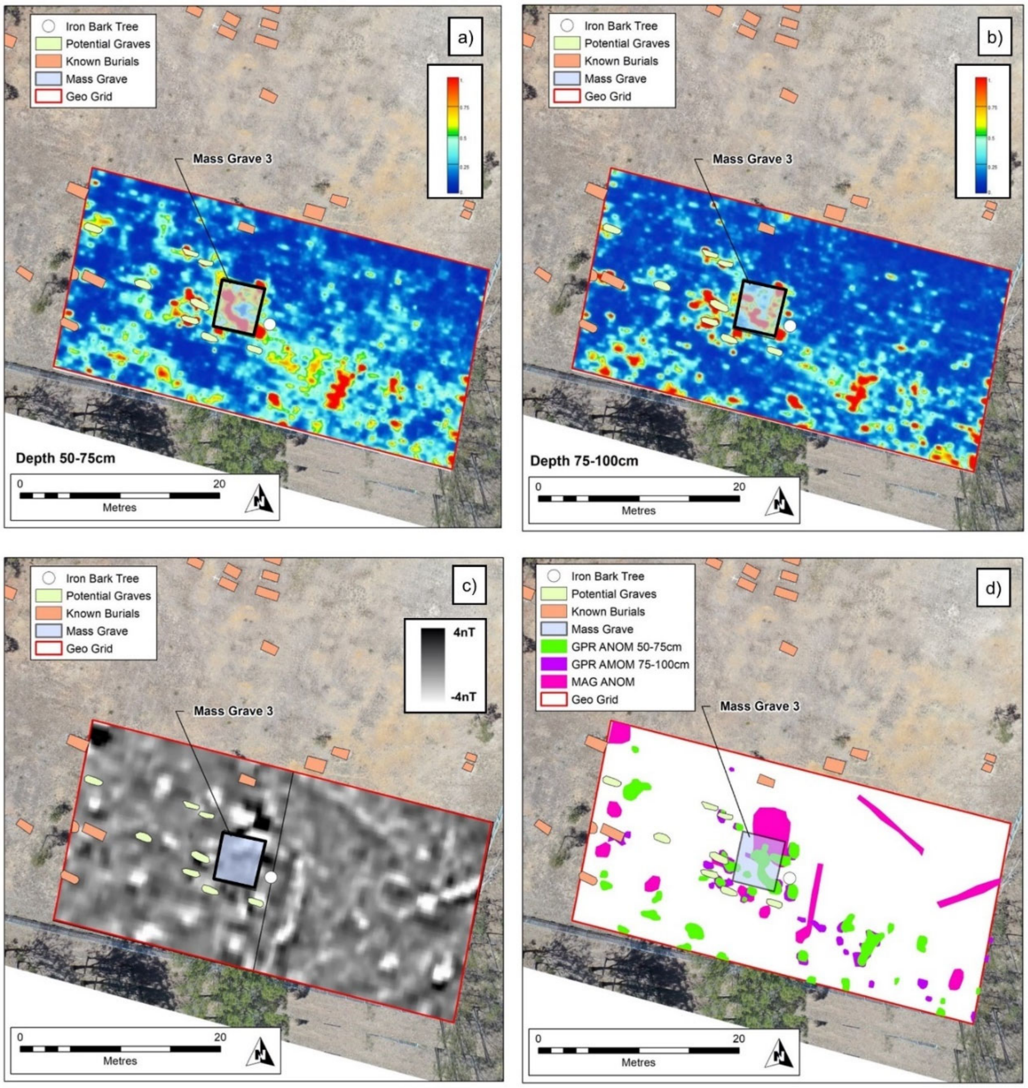

Figure 4. Amplitude GPR slice-map showing depths at (a) 50–75 cm and (b) 75–100 cm. Areas with higher reflections are shown in yellow and red. (c) Magnetic gradiometer map with black representing positive magnetic gradient and white a negative magnetic gradient. (d) Overlay of interpreted geophysical anomalies (Drone image courtesy of Jason Baker from the Cherbourg Shire Council).

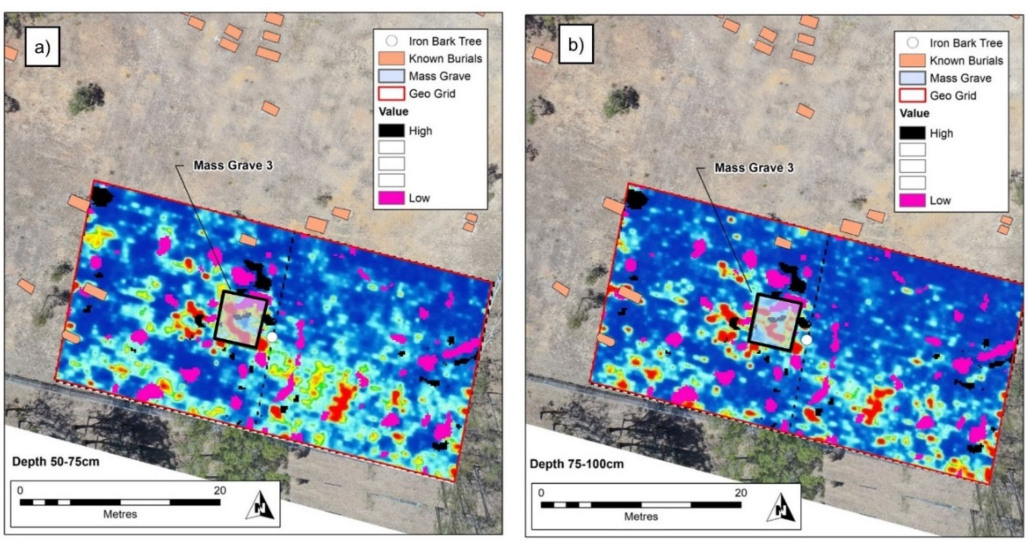

Figure 5. Amplitude GPR slice-map overlaid with the clipped high (black) and low (pink) magnetic gradiometer for depths (a) 50–75 cm and (b) 75–100 cm.

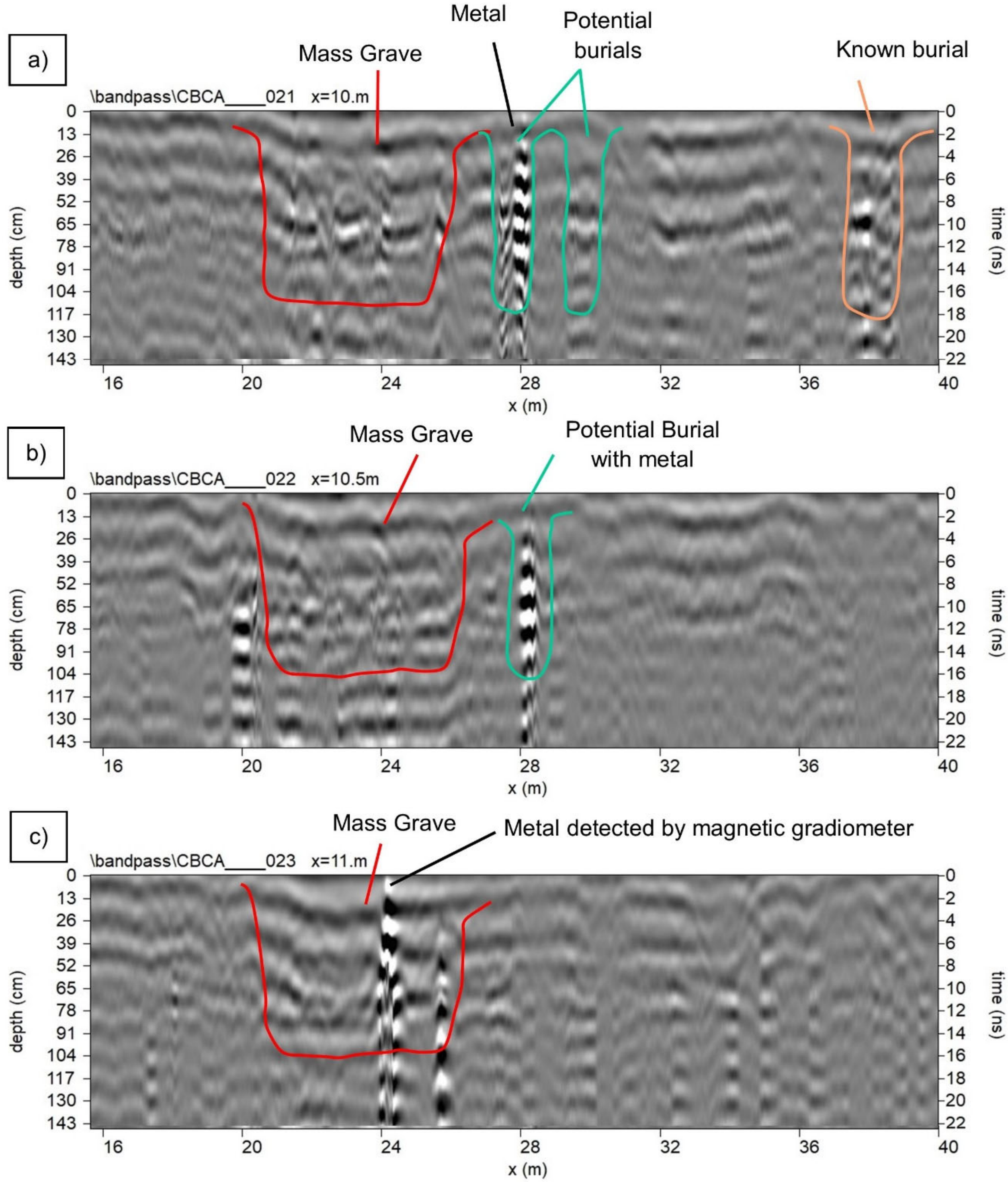

Figure 6. GPR reflection profile of the Old Cherbourg Cemetery showing (a) a known burial (pink), two of the eight potential burials (green) of which one (b) contains metal and (c) the mass grave (red) which also contains metal.

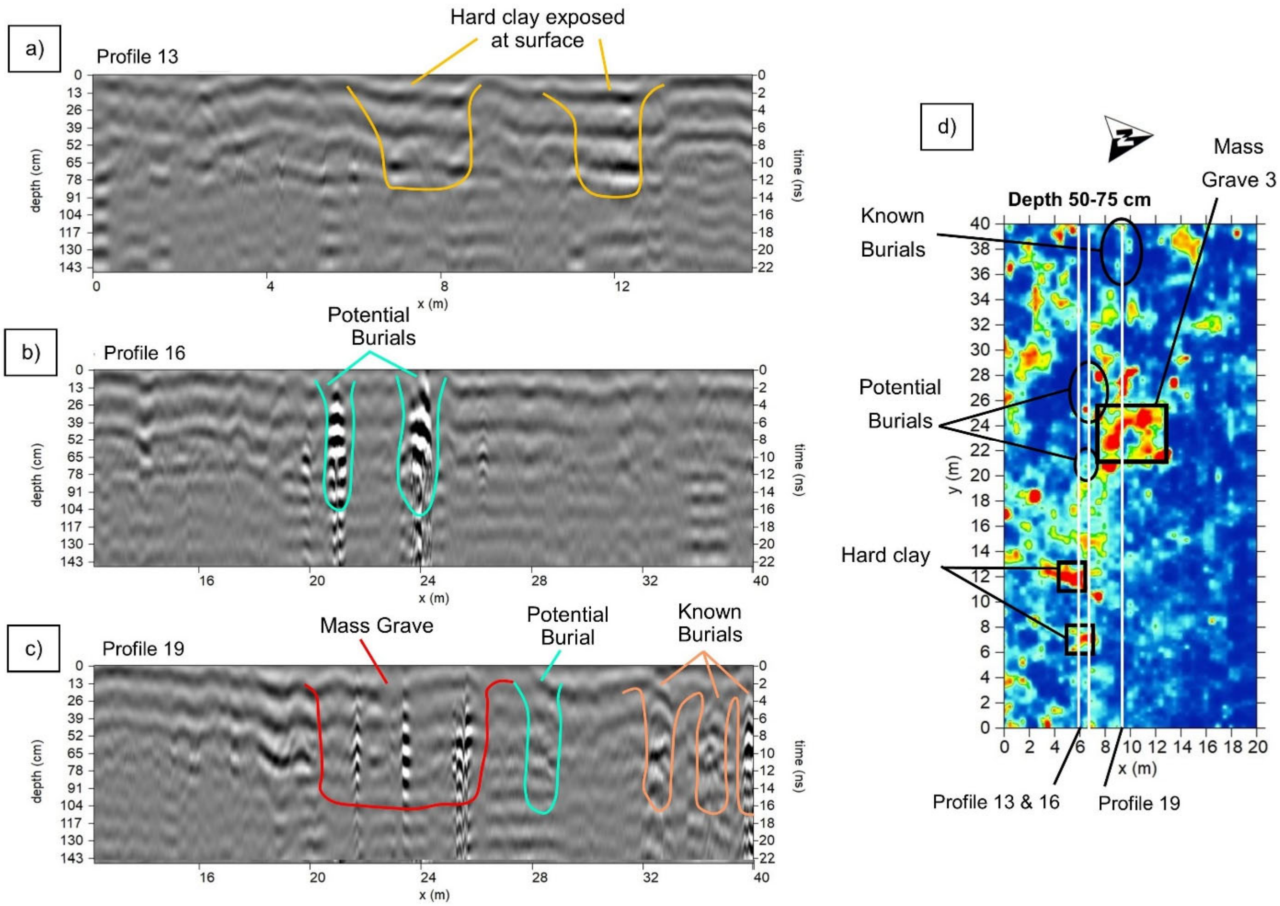

Figure 7. GPR reflection profile of the Old Cherbourg Cemetery showing (a) the hard exposed clay (yellow) in Profile 13. (b) Profile 16 shows two potential burials (green) and (c) Profile 19 shows Mass Grave 3 (red) with the detected metal as noted by the strong long hyperbolic waves, another potential burial (green) and three known burials (pink). (d) Amplitude slice-map of depths 50–75 cm with Mass Grave 3, known burials, three potential burials and hard clay layers.

Although mass grave studies are still rare in GPR prospecting, those studies that have been done state that pits are often visible in the reflection profiles, and sometimes point-source hyperbolic reflections are found within them (Conyers 2013:147). Using that as a guide, we can see many distinct contrasts around the concentrated GPR reflections designated as Mass Grave 3 (Figure 6). Slumped surface soils, strong shallow reflections, and soil disturbances which are caused by trenching and refilling of the pit/grave shaft are also visible within this GPR feature. Surrounding the trenches are stratified homogenised soil layers, indicating little ground disturbance except in areas that potential burials were detected (Figure 7b). Again, these were determined by contrasts to the background signal and represent soil disturbances associated with digging and refilling as seen in the known burials (Figure 7c). The clipped high magnetic values observed in some areas within the mass grave is metal and these could be funerary objects or clothing (e.g. belt buckles) associated with the burials (Figure 7c). The strong but long planar reflection found southeast of the ironbark tree was exposed hard clay (Figure 7a). This area of the Old Cemetery was more eroded and contained little topsoil exposing the hard clay subsurface in areas where topography was lower.

New Cherbourg Cemetery

No geophysical survey was conducted at the New Cherbourg Cemetery; however, the Schlencker Surveying 2012 map was used to assist in identifying the location of the two mass graves (Figure 8). Several of the Cherbourg Elders as well as personnel from the Ration Shed Museum came out to assist the University of Queensland team with this. Patterns in the vegetation (rectangular depressions sometimes containing darker vegetation) were also used to support the two mass grave locations as well. Depressions with darker grass were visible throughout the northeast section of the cemetery in an area absent of burial markers. Many of these depressions correspond to the individual unmarked graves identified in the 2012 survey when the map was georeferenced (see Figure 8).

Orientation of the interments is less random in the area mapped by Schlencker Surveying, meaning that the graves are not in rows, but they are facing east-west, which is common in Christian burials. Mr Bleakley, the Chief Protector of Aboriginals during the 1919 pandemic noted that all individuals who died were given both a tribal and Christian burial (*The Queenslander* 14 June 1919:10). Most of the individual graves ranged from 0.8–1 x 1.75–2 m which is a common dimension for grave shafts (Conyers 2013). The mass graves were larger, with Mass Grave 1 being about 3 x 5.6 m, while Mass Grave 2 was about 4.7 x 7 m.

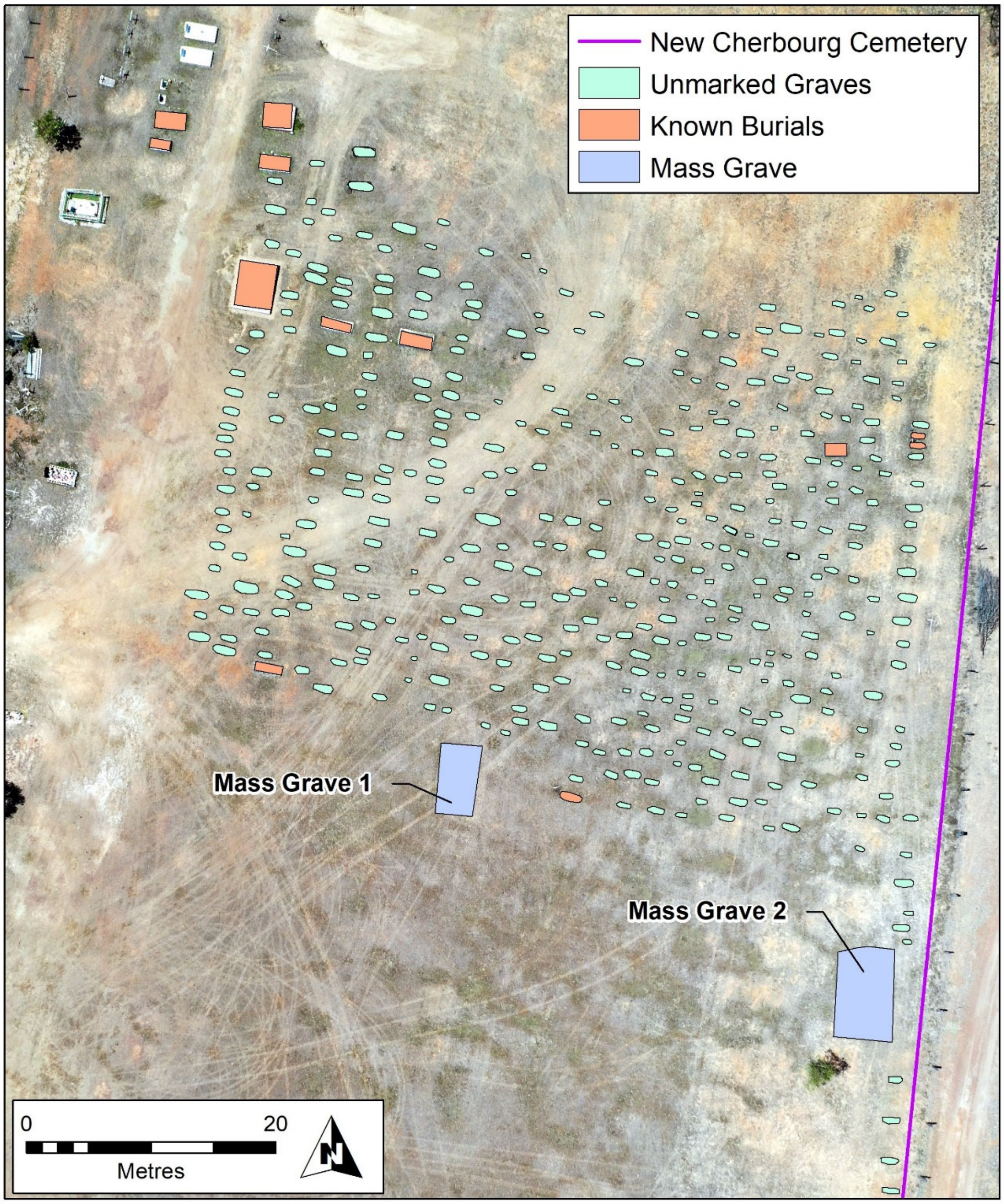

Figure 8. The New Cherbourg Cemetery georeferenced with Schlencker Surveying's 2012 results showing the location of the two mass graves (Drone image courtesy of Jason Baker from the Cherbourg Shire Council).

Discussion

Geophysical research on Aboriginal or unmarked burials is still uncommon in Australia, however, Lowe (2012) states that of the methods used, GPR has been the most common and with varying degrees of success (see Lowe et al. 2014). All geophysical prospection, particularly GPR, do not offer a fool-proof method when detecting graves or burials. This is because the data can produce false positives due to other sources of disturbance or, in cases where graves are indistinguishable from the surrounding area, they can produce false negatives or no results (Bevan 1991; Dalan et al. 2010; Davenport 2001; Nobes 1999). Most importantly, GPR does not detect human skeletons, but rather the disturbances resulting from the digging of the grave and the type of interment that has taken place (with or without a coffin). These difficulties were considered in our data interpretation, as well as vegetation, namely large tree roots which also create anomalies like those that might represent a burial, thus aiding in the difficulty for burial detection.

Along with oral histories from the Indigenous community Elders, at least three mass graves were identified at Cherbourg. Two mass graves were in the New Cherbourg Cemetery, while our geophysical investigation identified GPR contrasts resulting from soil disturbances associated with a third mass grave at the Old Cherbourg Cemetery, in an area directly west of the ironbark tree. Oral histories and historical newspapers acknowledge that individual graves were dug as well as trenches for those affected by the 1919 pandemic. Anomalies present in the Old Cherbourg Cemetery, mainly in the GPR data, indicate multiple burials in an area of similar size to the two mass graves identified in 2012. Subsequently, the trench graves identified by Yelf and Burnett (1995) at Taroom were similar in size and orientation. Examination of the GPR profiles revealed evidence of ground disturbances that would have resulted from activities such as trenching. This confirms Aunty Sandra's story about her mother seeing bodies transported by dray to the Old Cemetery in 1919 when her mother was only four or five. She also said her mother 'remembered a pit had been dug for the dead near an old ironbark tree in the old cemetery' (Aunty Sandra Morgan, pers. comm., 2019).

Mapping the known burials at the Old Cemetery provided some indication of what burials might look like at the Old Cherbourg Cemetery particularly 'disturbed' soil used to fill the grave shaft since coffins were not used for the mass grave, and the 'undisturbed' soil below the grave shaft (Conyers 2006:66). Other factors to consider was evidence of slumping from excavated grave shafts which can produce strong shallow reflections and distinct reflective profiles in excavated fill layers which may be associated with funerary objects. According to the *Brisbane Courier* (7 June 1919a:5), men were engaged to make coffins at first but were unable to keep pace with the high death rate and, therefore, some bodies were interred in trenches. This is confirmed by Ettie Meredith's interview from the 1980s (Blake 2022) where she states 'pits were dug quickly as there was no time to make coffins. They were wrapped up in blankets and laid down in a line with six in one trench.' Absence of coffins and use of trenching was confirmed by the Chief Protector of Aboriginals, Mr Bleakley (*Brisbane Courier* 10 June 1919b:8; *The Queenslander* 14 June 1919:10) and local papers (*Brisbane Courier* 7 June 1919a:5; *The Telegraph* 6 June 1919:2) and at Taroom, if two family members died at the same time, they were often buried in the same grave (L'Oste-Brown et al. 1995). Based on that information, the main mapped GPR features would have been soil disturbances (backfill layers), slumping and reflections found within the mass graves that may be associated with artefacts or clothing, of which all were apparent in the data. While the magnetic gradiometer results contain some anomalies not associated with the GPR, the contrasts of the positive and negative magnetic anomalies might occur from other events such as the trenching activities which would result in soil movement and burden from excavation, refilling or it could be an off-set from the mapped GPR buried features (Conyers 2018). While GPR and magnetometry can be complimentary (Gaffney and Gater 2003), the two methods do not always produce maps of the same properties of buried materials.

It is unknown how many people were placed in the mass graves at Cherbourg as the deaths happened too quickly, but the oral histories provide some indication that the mass graves sometime contained 3–4 burials, and up to at least 12. Blake's (2022) 1980 interview with Evelyn Serico reported that 'her mother, plus five other women and six men were buried in a long trench in the New Cemetery. They were twelve people who never got mentioned as no death certificates were provided as the deaths happened too quickly.' Mrs Serico said she knew exactly where the trench was located, 'in an area that is flat today and where an ironbark tree used to be located with a gate at the bottom going to Bralbin'.

Examination of historical aerial images of the two cemeteries indicate that ironbark trees were present in both cemeteries in 1951 (Figure 9a). We note the resolution is not ideal, but the aerial images provided some information about Cherbourg's past landscape. By the 1960s, the area containing the 2012 Schlencker survey in the New Cemetery had been cleared and only a few trees were present to the south (Figure 9b). Some vegetation clearing in the Old Cemetery took place after the 1960s, however the larger ironbark trees remained and are visible in the 1979 images and today (Figures 9c, 9d). Given that the deceased were laid east to west in both cemeteries and that there were accounts that ironbark trees were located near them, it is very probable that Mass Grave 2 might have interred the 12 individuals discussed by Evelyn Serico. The dimensions of Mass Grave 2 (4.7 x 7 m) would be the approximate size for interring at least 12 individuals (2 rows of six) and the presence of trees (most likely to be ironbark) in the aerial images in the 1950s supports this. While Mass Grave 1 (3 x 5.6 m) could be big enough to inter at least six individuals. Based on this, it seems probable to say that Mass Grave 3 in the Old Cemetery could inter at least 6–8 individuals (4.3 x 5 m).

Our study demonstrates how geophysical applications, and the use of oral histories can play an important role in reconstructing the more recent history of the Cherbourg people. Elders from the community were familiar with the oral history associated with the 1919 pandemic and wanted to relocate the mass graves of those people (and descendants) who were somewhat marginalised due to the quick nature of the deaths. By identifying the mass graves and burials of the lives lost, the community could finally have a known resting place for a traumatic historic event that devastated their community. While there has always been some debate as to where the people were buried, the confirmation of the three mass graves allows the community to now create a final resting place for those affected as no death certificates or burial markers were issued due to the high number of deaths in a short time. A memorial will be erected dedicated to those lost so that 'people will know where they have been resting for the last hundred years' (Eric Law, pers. comm., 2019). This is a powerful outcome where many Indigenous people, especially younger generations, are unaware of tragic past events despite still being a part of the Barambah and Cherbourg story.

Reconciliation efforts through applied research and access to scientific approaches such as this one, are giving Indigenous peoples a stronger voice when defining cultural significance and protecting their heritage. This was the case first for Taroom Aboriginal Reserve and now Cherbourg. Fortunately, we are seeing this more and more in Australia for Aboriginal and Torres Strait Islander communities when it comes to national issues of loss. For example, the Mithaka Aboriginal Corporation in southwest Queensland, the Mapoon people at the Mapoon Mission Cemetery in Weipa and the Gunditj Mirring people of the Lake Condah Mission in Victoria have worked alongside researchers to assist them in understanding the resting places of their ancestors and families (Groves 2018; Moffat et al. 2016; Neal 2019; Sutton and Conyers 2013). Because most Indigenous cemeteries were not recognised or recorded until 1967, there is a growing push by communities today to find and protect those resting places (see Sutton et al. 2021). It is projects such as these that ensure lives are not forgotten and that Indigenous values are being safeguarded and that the memories of traumatic events in a community's history are not lost.

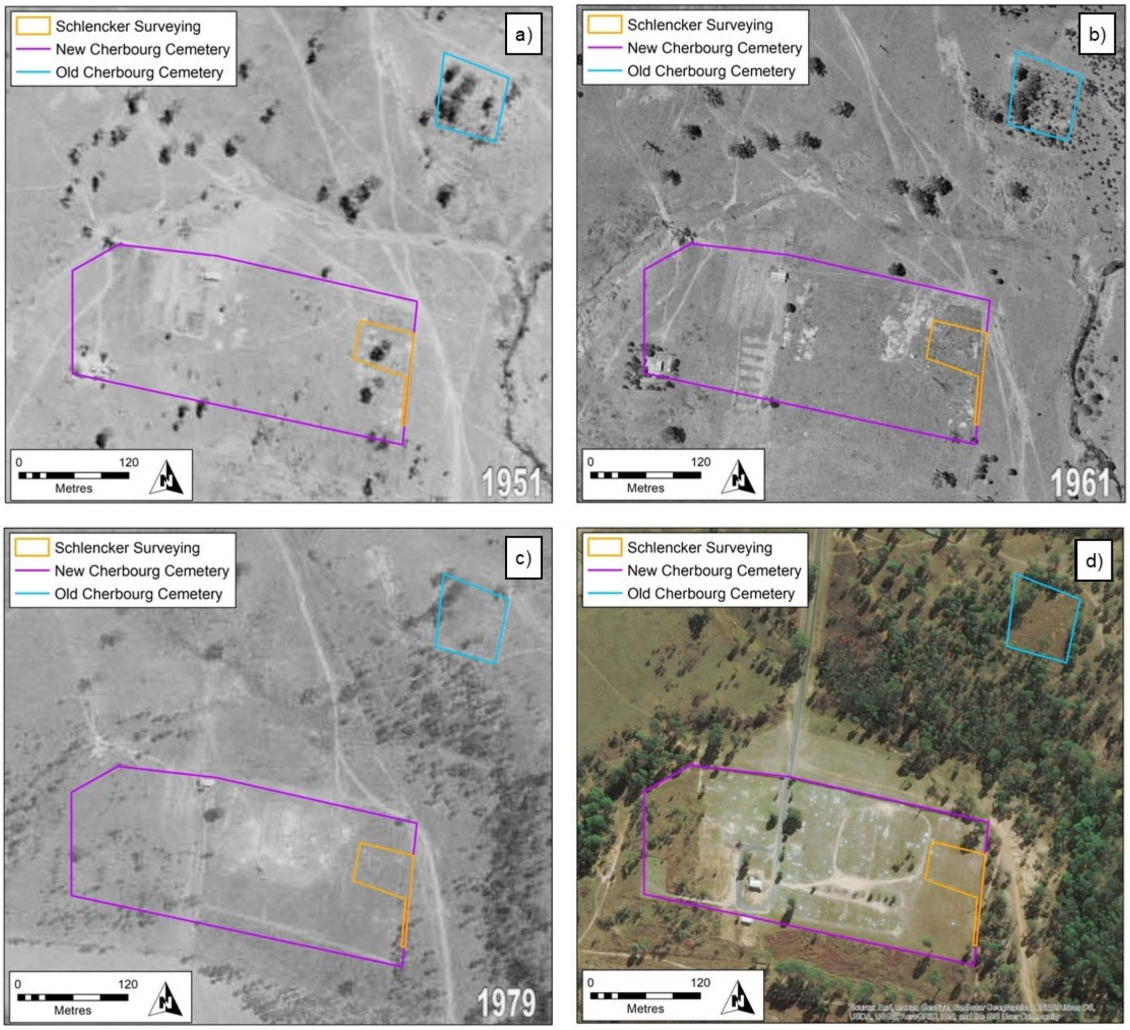

Figure 9. Historical aerial images showing (a) the two Cherbourg cemeteries in 1951 and presence of ironbark trees near the Schlenker Survey. (b) Aerial from 1961 showing some moderate vegetation clearing in the New Cemetery. (c) Vegetation clearing is evident in both cemeteries by 1979. (d) Aerial image from today for comparison.

There has been a growing push particularly in North America for Indigenous communities to not only be involved as partners and initiators in archaeological research projects but to also recommend the use of minimal invasive remote sensing methods on their sites as a priority to archaeological investigation (see Wadsworth et al. 2021; Warrick et al. 2021). This is mainly because these tools offer an alternative to mitigation strategies that largely focused on subsurface disturbance such as excavation. Our study is an example of how this can be applied in Australia, where the community considered much of the objectives and methods before work was undertaken, and where excavation is not an option. Through the combined use of oral histories and geophysics, the community could work together to ensure their values about burial places were respected (and preserved) and that knowledge of the events of the past could be remembered by the community today. It also illustrates how cultural identity can be renewed and recreated using archaeology and scientific technology (Sutton et al. 2020). As previously stated by one of us (Law), 'We've got to remember these people because they are part of our community and they'll always be a part of our community' (Hegarty 2019). This ensures that a sensitive place such as the three mass graves and other unmarked burials associated with the Spanish Influenza can still be remembered and commemorated today.

For communities like Cherbourg and Taroom, the death of numerous people in five weeks would have had a devasting impact on the community as one out of every seven people's lives were claimed (Blake 1990:66). In this case, almost every individual would have lost a family member or close relative due to the pandemic, and losses such as this would likely have prompted distress in the community not only due to the loss of loved one but also a general fear as to whether this might happen to them (see Blake 1990). However, such a tragic event may have also had a positive effect on the community later, by bringing the community closer together as a larger group which is evidenced today in Cherbourg and Taroom. Prior to the Spanish Influenza and shortly after the establishment of Barambah, much of the community consisted of several discrete groups or tribal camps within a larger reserve. The death of ~87 people would have impacted each of these groups significantly. To deal with these losses, many groups united to form one larger group. An example of this unification is depicted in Caroline Tennant Kelly's photograph of dancers at a funeral in Cherbourg in 1934, just 15 years later (Figures 10-11). Law suggests that the dancers

Figure 10. Dancers at Funeral at Cherbourg Aboriginal Settlement 1934 (Caroline Tennant Kelly Collection UQFL 489).

Figure 11. Dancer at graveside at Cherbourg Aboriginal Settlement 1934 (Caroline Tennant Kelly Collection UQFL 489).

in the image likely represent six discrete groups based on the way they are dressed and painted. Each person was brought up to behave and perform a funeral dance based on their tribal group, yet in this photograph they are dancing together as a community. This funerary ritual was also observed at Taroom, where participants in the burial ceremonies painted themselves in a variety of designs and patterns based on their tribal affiliations (L'Oste-Brown et al. 1995:44). The painted bodies reflected the different tribal groups within the reserve, but it was also a sign of respect to the community.

Remembering the pandemic may have a more significant influence on the modern community, as we currently make our way through another devastating global pandemic, COVID-19. As Law notes, it can be easy for people to forget the past. Like the Spanish Influenza, the current COVID-19 pandemic has led to major impacts on the health and lives of people throughout the world, and one where outcomes may take decades to recover (Dhurvey et al. 2021). Since both viruses can enter a host's respiratory system and replicate, the consequences for infection and transmission have been alarming (Patterson and Pyle 1991). Rural Indigenous communities like Cherbourg, are at higher risks for emerging infectious diseases and lethal pandemics like COVID-19, which arguably are attributed to social, economic, and educational disadvantages and the lack of community involvement when health research is conducted (Briscoe 1996; Butler et al. 2001). However, in a world full of information sharing, communities are working towards Indigenous-led solutions (Power et al. 2020). Examination of cultural determinants of health and recognition of the lives lost such as what happened to the Cherbourg community in 1919, might be one way to assist us in how Indigenous people might respond to COVID-19 and other diseases of the future.

Conclusion

Our study discusses the potential for archaeological geophysics to be applied to map a significant event in our recent cultural history. Through the integration of oral histories, GPR and magnetic gradiometry, we have been able to identify three mass graves in Cherbourg, a town and community that was significantly impacted by the 1919 Spanish Influenza – one of the deadliest pandemics in modern history. Oral testimony indicated that mass graves were dug for those who died during the pandemic, however pedestrian and geophysical surveys of the two cemeteries were able to confirm this. Studies such as this one or at Taroom demonstrate how scientific approaches can confirm important yet devastating histories of Aboriginal people. Documentation of these final resting places is an important outcome for the Cherbourg people, especially the Elders who still recall the stories from their ancestors regarding the epidemic. Community driven research such as this highlight the recognition and need for more Indigenous-led projects overall, especially when it provides a voice about untold and unrecognised parts of their local history.

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