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Discussion Paper 2: On Ground Searches

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On May 23, 2021, the Tk'emlúps te Secwépemc First Nation announced that a ground-penetrating radar (GPR) survey had identified 215 potential burials at the former Kamloops Indian Residential School (Montgomery & Supernant, 2022). This national news created a flurry of activity as Indigenous nations, archaeologists, geophysicists, and other consultants raced to address growing concerns over the presence of graves at other former Residential Schools. These efforts asked to ground searches that used archaeological and geophysical techniques to locate potential unmarked graves of missing children. Although communities have known about these tragedies for decades, and Tk'emlúps te Secwépemc was not the first nation to use GPR to locate unmarked graves in former Residential Schools sites (see Nichols, 2015), never had a national and international focus on these missing children, found through a 'miracle' geophysical technique, been seen before.

Over a year into this national crisis, many more Residential Schools continue to be surveyed with GPR to locate unmarked graves of the missing children. The United States also plans to embark on similar research on their boarding schools system (Secretary of the Interior, 2021). These continued ground searches require reflection on best practices and current challenges with applying archaeological, geophysical, and other techniques to provide justice for the missing children and their loved ones.

History of Involvement

All techniques used in these ground searches were developed for other purposes (e.g., industrial, environmental, or research). Over the last few decades, archaeologists were among the few professionals who deployed these technologies to locate and map archaeological sites and features (Luo et al., 2019). These surveys included the commonly requested task of identifying unmarked graves; therefore, many early studies focused on the development of consistent and proven approaches for this application (Conyers, 2006; Gaffney et al., 2015; Schmidt et al., 2015; Vaughan, 1986). This history of experimentation has led to the unambiguous conclusion that in many contexts GPR and other geophysics ***can*** locate burials.

The recent popularity of GPR, however, has obscured many of its limitations and challenges. Moreover, it has caused people to overlook other important technologies and techniques that can be used to help locate graves. In addition, all geophysical techniques were infrequently applied in Canada before the Tk'emlúps te Secwépemc announcement. Frankly, prior to the May 23rd announcement, the scale at which GPR was known and practiced among Canadian

archaeologists or other professionals used for unmarked grave identification could never have accommodated (or foreseen) its upcoming demand (Wadsworth, 2022). Given this unexpected and rapid adoption, this position paper raises questions concerning the continued widespread application of GPR and related approaches to ground searches in these incredibly sensitive contexts.

Challenge 1: Signal Interpretation

Given the recent widespread adoption of geophysical techniques in the search for potential unmarked graves, significant questions remain around *who* is interpreting the collected data. This question is not simple to answer. Many trained geophysicists, who have varying degrees of knowledge as to the techniques, have never worked with GPR or only used for purposes such as locating utility lines (something categorically different than locating unmarked human burials). Similarly, archaeologists who have experience with the identification and analysis of burial contexts seldom had experience with or training in geophysical techniques. Ideally, a good interpretation would come from someone who possesses a strong background in archaeology, had a firm understanding of geophysical techniques, and had experience undertaking similar surveys in the region. Few of these individuals exist, raising the question of **how best do we train individuals to perform and interpret these surveys?**

The next issue is ***what* features are specialists interpreting as burials?** Although there are many academic papers discussing how burial identification is undertaken in different conditions (e.g., Conyers, 2006; Gaffney et al., 2015), there is also limited consensus between the traits and characteristics linked to graves (Martindale, Wadsworth, Simons, & Grier, 2021). knowledge of the varying physical/archaeological burial contexts are important in grave identification, but this has not been fully investigated. For example, a person buried in a traditional funeral might look different than one who was buried under suspicious or nefarious contexts. Similarly, *where* these studies took place is also important both in terms of data collection (i.e., navigating around trees, slopes, water) and in interpretation (differences in soils/matrices leading to different interpretable shapes and features in geophysical data). Without comparative data, the job of interpreting burials from a location becomes very challenging. It is always good practice to start an unmarked grave survey with a survey of a known cemetery where possible. Even still, as described above, significant research needs to be undertaken in order to continue research on which geophysical signals indicate unmarked graves.

In addition, a great deal of research must be placed on ground searches in northern regions. Subarctic and arctic environments have received even less attention than southern residential school sites when it comes to ground searches. In addition, northern sites have complicating factors that are distinct from those found in southern Canadian context. The presence of permafrost changing geophysical responses of graves, limited sedimentation and presence of exposed bedrock limiting search/burial areas, the restricted survey season/poor accessibility of survey sites are just a few factors that additionally complicate ground searches in northern environments. If standards are developed to facilitate ground searches and interpret the data we

collect, **how do we ensure that the unique considerations for surveys in northern regions are addressed and accounted for?**

Challenge 2: Speed and Scale

The majority of GPR/geophysical instruments available in Canada are "single-channel" (one sensor) tools that are manually dragged back and forth across a site by researchers. As Residential School landscapes are often very large and burials very small (requiring tightly spaced surveys), the search for burials quickly becomes a daunting task and the complete survey of all lands associated with a Residential School especially time consuming. The dense collection of GPR data by ATV-mounted "multi-channel" (multiple sensors) systems represent a valid upgrade for reasonably unobstructed landscapes (Trinks et al., 2018). Such systems would greatly increase the speed of surveys, covering more ground without sacrificing data resolution. However, such systems are expensive and, like single-sensor systems, are limited to very flat ground (which may not be possible depending on the landscape). To account for this, it has also been suggested that drone-mounted GPR systems could be used to locate larger areas/ indicators of burial activity narrowing down search areas. Both multi-channel and drone-based surveys could be effective in ground searches yet remain largely untested or unproven in Canada. A key question going forward could be, **how do we balance high-resolution data collection and large-scale survey coverage?** In other words, how do we maintain a standard (high) quality of data collected, account for issues in survey terrain, and communicate realistic expectations to communities about survey coverage?

Challenge 3: Multi-component Investigations

After the May 23rd announcement, GPR became the primary tool used to identify unmarked graves, and much of the early work by researchers who were familiar with non-invasive approaches was focused on communicating that it was only one possible technique among a suite of tools. Many other non-invasive techniques have been shown to be effective at locating unmarked graves (Gaffney et al., 2015; Wadsworth, Bank, Patton, & Doroszenko, 2020). These additional techniques include other geophysical techniques (e.g., magnetometry, resistivity), drone-based remote sensing (e.g., ortho-imagery, LiDAR), archaeological techniques, and other forms of survey (e.g., cadaver dogs). Each of these techniques provide additional information that help form burial interpretations, and in some cases, act as either an alternative or a supplement to GPR. For instance, geophysical techniques such as resistivity and magnetic techniques could locate objects associated with burials (e.g., coffin hardware, grave markers) and/or soil differences between the grave and surrounding ground. Photographic and LiDAR drone techniques could be used to produce high-resolution maps of sites to highlight surface depressions and vegetation differences associated with burials and to narrow down areas for additional ground survey. As a result of these different forms of information, it is widely accepted that corroborating results from different technologies provides data that we can use with greater confidence to draw important conclusions. However, **how best do we integrate this data (since each has their own limitations) and in what stages should these various**

techniques be applied? Building additional techniques into surveys also requires a larger investment in resources (e.g., money and time) and skill at communicating their importance.

Challenge 4: General Limitations, Communicating Results, and Archiving

From the very beginning, how researchers communicate the results of ground searches has been a key priority. Every non-invasive technique has its unique limitations, whether that be data collection strategies, speed, or environment suitability. Likewise, geophysical techniques specifically measure changes in the subsurface, some of which are known and understood by the interpreter and other features less so. Therefore, these techniques can never provide 100% confidence in unmarked grave identification. While a degree of uncertainty may be acceptable for scientists, such is not always the case with communities who want to take specific actions to mark, commemorate, or in other ways respond to the presence of graves. Adding to this complexity, the media often over- or under-reports the significance of ground searches. These general limitations raise the question: **how do we communicate our findings in a way that does not cause additional trauma or create impressions of certainty that are not supported by the limitations of the data?** Similarly, because of the charged nature of this research, who controls the flow of communication from the scientists once it is collected and interpreted**?**

In many ways, the archiving of collected data and reports from these surveys represents a different side of this challenge. Once the search results are given to communities, how data is stored and who can view the results can compromise the integrity of the survey. This begs the question of **how can researchers help develop responsible storage/reporting practices with communities without casting additional scrutiny upon the results?**

Summary of Key Questions Going Forward

- What is the best approach to training individuals so that they can perform and interpret ground searches? How best to build capacity in Indigenous communities so they can carry out these searches on their own?
- What standards should be applied to data interpretation? What are the specific features and characteristics communities need to be able to interpret particular anomalies as graves?
- Can there be a balance between high-resolution data collection and large landscape surveys? If so, how is this achieved in a way that is respectful to community timelines and needs?
- What is needed to ensure a reasonable consistency in data quality, while better addressing the variable landscapes requested by communities? What can be done to develop standards of best practice for each of the techniques available?
- How should certain techniques be selected and ordered for ground searches? What can be done to ensure the inherent limitations in technologies are accounted for?
- What is the best way to frame interpretations and research design so as to not cause additional trauma?

- Acknowledging that no geophysical/remote sensing survey can be provide 100% certainty in grave identification, what is the best method for ensuring and building confidence in interpretations, especially those that might have legal implications?
- What could be some inroads in developing ethical stages/phased recommendations for communities?
- How can academia support respectful and community-engaged research, especially regarding ground searches?
- What can be done to best ensure sensitive to community expectations and to ensure that data and analysis are communicated in ways that reflect realistic outputs of ground searches?
- What are the next actionable steps forward for both the coordination, enactment, archiving, and reporting of IRS ground surveys in Canada?

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