

# The Identification of a Potential “Invisible” Hearth Feature at FIPf-62 Using Magnetic Susceptibility

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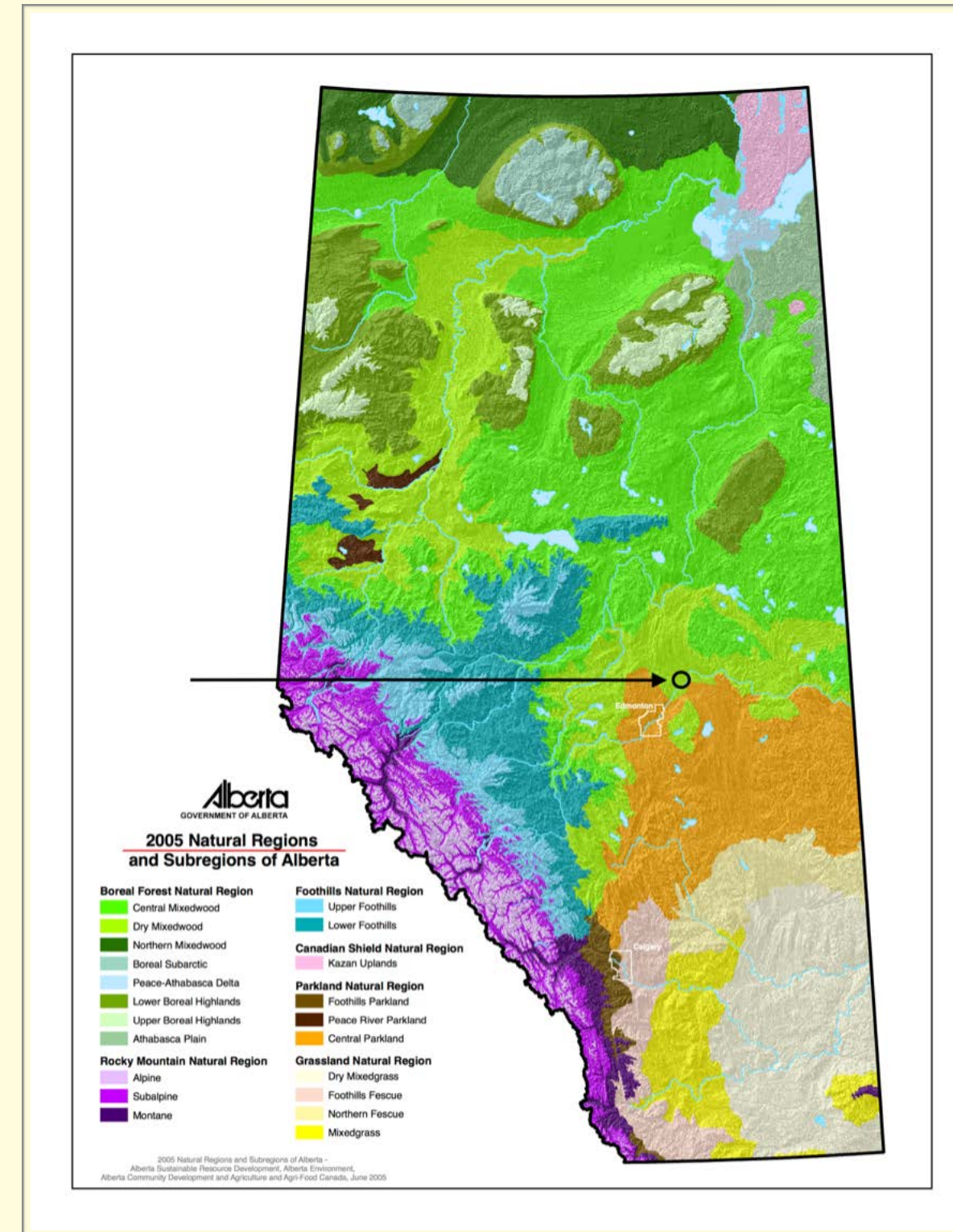
## Introduction

When conducting an Historic Resources Impact Assessment (HRIA) or controlled excavation, archaeologists may encounter indicators that a hearth feature should be present (e.g., Fire cracked rock, calcined bone); however, there is no visual evidence to support this claim. To address this, Western Heritage has been collecting magnetic susceptibility readings from the soils in and around suspected hearth areas in order to develop a more objective means of identifying potential hearths in the absence of any visual evidence.

During the 2017 field season a potential hearth feature was identified during Stage 1 excavations at FIPf-62 based on 72 magnetic susceptibility readings that were taken from a 2 m x 2 m excavation block<sup>1</sup>. By measuring the magnetic susceptibility of the soil at regular intervals it was possible to identify a spike in magnetic susceptibility readings at the same depth as suspected heat-altered artifacts, suggesting a hearth may have been present at one time.



2 m x 2 m excavation block where a potential hearth was identified.



Location of study area<sup>2</sup>.

## What Is Magnetic Susceptibility?

- Magnetic susceptibility measurements characterize the response of minerals when they are exposed to a magnetic field<sup>3</sup>.
- Magnetic susceptibility measurement is a dimensionless value most often measured in SI Units<sup>1</sup>.
- Can be used to document mineral changes induced by burning or during soil formation (magnetic susceptibility values will be elevated relative to the values for sediments that have not undergone these processes)<sup>4</sup>.
- Magnetic susceptibility measures maghemite, a by-product of intensive burning<sup>5</sup>.
- Non-susceptible iron compounds in soils are converted to magnetically susceptible compounds by repeated heating and cooling.
- Maghemites are extremely durable and remain in place in undisturbed soil for many thousands of years<sup>5</sup>.
- The durability of these compounds makes it an excellent candidate for interpreting ancient cultural behaviour.

## Magnetic Susceptibility Readings

West Wall 479N/254E	Reading (SI Units)	Standard Deviation	North Wall 479N/254E	Reading (SI Units)	Standard Deviation
Level 1	0.154	0	Level 1	0.169	1
Level 2	0.183	1	Level 2	0.133	0
Level 3	0.137	0	Level 3	0.188	1
Level 4	0.118	0	Level 4	0.117	0
Level 5	0.149	0	Level 5	0.205	1
Level 6	0.183	1	Level 6	0.118	0
Level 7	0.046	0	Level 7	0.085	0
Level 8	0.260	2	Level 8	0.101	0
Level 9	0.224	1	Level 9	0.091	0
Level 10	0.134	0	Level 10	0.098	0

South Wall 478N/255E	Reading (SI Units)	Standard Deviation	West Wall 478N/254E	Reading (SI Units)	Standard Deviation
Level 1	0.129	0	Level 1	0.129	0
Level 2	0.191	1	Level 2	0.085	0
Level 3	0.166	1	Level 3	0.169	1
Level 4	0.139	0	Level 4	0.236	2
Level 5	0.245	2	Level 5	0.157	0
Level 6	0.143	0	Level 6	0.272	2
Level 7	0.101	0	Level 7	0.056	0
Level 8	0.163	1	Level 8	0.166	1

North Wall 479N/255E	Reading (SI Units)	Standard Deviation	East Wall 479N/255E	Reading (SI Units)	Standard Deviation
Level 1	0.127	0	Level 1	0.093	0
Level 2	0.268	2	Level 2	0.132	0
Level 3	0.232	2	Level 3	0.235	2
Level 4	0.294	3	Level 4	0.305	3
Level 5	0.135	0	Level 5	0.211	1
Level 6	0.105	0	Level 6	0.222	1
Level 7	0.121	0	Level 7	0.190	1
Level 8	0.135	0	Level 8	0.261	2
Level 9	0.131	0	Level 9	0.176	1
Level 10	0.136	0	Level 10	0.136	0

South Wall 478N/255E	Reading (SI Units)	Standard Deviation	East Wall 478N/255E	Reading (SI Units)	Standard Deviation
Level 1	0.033	0	Level 1	0.121	0
Level 2	0.159	1	Level 2	0.101	0
Level 3	0.159	1	Level 3	0.200	1
Level 4	0.073	0	Level 4	0.131	0
Level 5	0.113	0	Level 5	0.170	1
Level 6	0.428	5	Level 6	0.148	0
Level 7	0.065	0	Level 7	0.205	2
Level 8	0.130	0	Level 8	0.108	0

- Site was excavated in arbitrary 10 cm levels. Readings were taken at each level.
- The measured minimum susceptibility value recorded was 0.033 SI Units, the maximum was 0.428 SI Units, and the average was 0.159 SI Units.
- The standard deviation in the data was 0.067 SI Units.
- Susceptibility measurements greater than 2 standard deviations were considered significant.
- Elevated readings were observed in Level 4 of 479N/255E and Level 6 of Unit 478N/255E.

## Detecting “Invisible” Features

- TerraPlus KT-10 Susceptibility Meter:
- Obtains “live” measurements without the need for soil sampling
- Accurate ( $1 \times 10^{-6}$  SI Units).
- Affordable (~\$2,000) when compared to conventional soil sampling techniques.



TerraPlus KT-10 Susceptibility Meter

## Evidence For A Possible Hearth Feature

- FCR and calcined bone collected from a depth of 50-60 cm BS.
- A projectile point preform was also collected from a depth of 50-60 cm BS.
- Found in three pieces (thermal shock?).
- Possible potlid flake scars along the base of the tool.
- These heat altered artifacts were found at the same depth as the biggest spike in magnetic susceptibility values.



Refit projectile point preform. Possible potlid flake scars are visible along the base.

## Interpreting The Data

- Sediments with elevated values may reflect cultural burning activities that have either taken place repeatedly within an *in situ* hearth, or that have taken place elsewhere, and the sediments within the stratigraphic profile thus represent discarded debris as a result of hearth cleaning.
- Experimental studies have demonstrated that magnetic susceptibility values increase with repeated firing of the same hearth<sup>3, 4, 5, 6</sup>.
- Based on the presence of Fire cracked rock (FCR), calcined bone, and a tool with potlid flake scars, it seems likely that there was a hearth present in the vicinity of unit 478N/255E at a depth of 50-60 cm BS.



South wall of unit 478N/255E. Dashed yellow line indicates the location of elevated magnetic susceptibility readings. Note the absence of a bowl-shaped soil discolouration associated with some hearths.

## Why Is Hearth Identification Important?

- Hearths are an indicator of focussed human behaviour.
- Can be used to reconstruct habitation patterns on living floors.
- Identifying hearths at an archaeological site increases its interpretive potential which has an impact on recommendations for site avoidance/mitigation.
- Easier to focus future excavations on specific parts of a site if suspected activity areas have already been identified.

### References

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### Acknowledgements

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