STONE CIRCLE SITE TREATMENT REVIEW AND WORKSHOP
FINAL REPORT

Prepared for:
Resource Management - Archaeology
Heritage Branch,
Saskatchewan Municipal Government

By:
Kit Krozser
and
Ben Hjermstad

On Behalf Of:
Saskatchewan Association of Professional Archaeologists

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FORWARD

On February 6 and 7, 1993, archaeologists from across the Northern Plains met in Regina, Saskatchewan to attend a workshop on the treatment of stone circle sites. The Saskatchewan Association of Professional Archaeologists (SAPA) was contracted to conduct the workshop by the Honourable Carol Carson, Minister of Community Services (now Saskatchewan Municipal Government). SAPA then reviewed proposals to sub-contract the workshop organization and report preparation, and selected Kit Krozser and Ben Hjermstad to conduct the project. The Archaeological Resource Management Program of the Heritage Branch funded and administered the details of the contract.

Results of the lengthy and lively workshop debates relating to stone circle impact assessment, mitigation (feature data collection and excavation), reporting standards and resource management goals are summarized in this report. An annotated bibliography of relevant publications is also included. It is clear that archaeologists will not reach a consensus on many stone circle research issues. Nevertheless, some common ground was discovered. The fact that there are so many approaches to stone circle studies is indicative of the promising future of this research.

SAPA has gained a reputation for holding thought-provoking workshops on current issues in archaeology. The workshop topics we have examined to date cannot be adequately addressed within the usual format of a large archaeological conference. For example, the Archaeological Resource Management - Problems and Issues Today (ARMPIT) Conference of a few years ago brought academic and contract archaeologists and their clients together in a lively discussion regarding several heritage resource management issues. Two workshops held in the last few years brought the archaeological community together for the first time with aboriginal Elders and representatives from First Nations communities to discuss areas of mutual concern. Colleagues from neighbouring provinces and states attending these workshops have contributed their own insights and experience. Because of these workshops, many of us have altered our views regarding heritage management issues, and the way we approach our work.

ACKNOWLEDGEMENTS

The stone circle site treatment workshop and review was initiated and funded by the Resource Management - Archaeology program of the Heritage Branch, Saskatchewan Municipal Government. We would like to thank Carlos Germann for the considerable time and energy he put into making this project a success. The project was managed by the Saskatchewan Association of Professional Archaeologists, who contracted the authors to organize the workshop and prepare the report. Thanks are due to John Brandon for his assistance with the organization of the workshop, and to Allyson Ramsay and Marvin Thomas for reviewing the final report.

Melanie Keisig, Lee Ann Irvine and Geoff Robinson were indispensable in ensuring that the practical side of the workshop went smoothly. Lorie Melit did an excellent job of video-taping the proceedings.

Finally, we would like to thank all the participants who attended the workshop, despite the short notice, and sometimes great distances involved. We would particularly like to thank the five session moderators, Gary Adams, Kimball Banks, John Brumley, Jim Finnigan and Rod Vickers for the effort they put into guiding us through the individual sessions. From the lively discussion, it is obvious that the participants were deeply concerned with the future of stone circle research on the Northern Plains.

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1.0 INTRODUCTION

Stone circle sites are one of the most common types of archaeological sites on the Northern Plains. These sites contain one or more features consisting of stone cobbles set out in a roughly circular outline. They are generally thought to have resulted from the use of stones to secure the edges of circular hide dwellings (tipis), although it has been suggested that they may also have secured ceremonial structures, menstrual huts, sweat lodges and play tipis.

In Saskatchewan, stone circle sites make up twenty-three percent of the provincial inventory (Carlos Germann, personal communication 1993). They are one of the most common types of sites in Saskatchewan to be the subject of heritage resources impact assessment or mitigation studies. Unfortunately, stone circle sites are seldom investigated in pure research contexts (by the academic community). Most developments in stone circle research occur in the context of impact assessment or mitigation, where the prime motivation is economic rather than academic.

Stone circle sites pose particular problems to impact assessment and/or mitigation studies. Unlike most other archaeological sites, visibility of stone circle sites is not dependant upon the size or productivity of the site; even the most briefly occupied stone circle site is highly visible, and therefore likely to be identified as a heritage resource. While many traditional research methodologies are dependant on large quantities of diagnostic artifacts such as stone tools, ceramics or seasonally sensitive faunal remains, such artifacts may not have been deposited in large quantities at stone circle sites. Furthermore, since stone circle sites are often surface sites, various taphonomic processes will adversely affect the deposits. For instance, since there is little deposition to protect deposited artifacts, the diagnostic value of certain artifacts such as ceramics or faunal remains may be greatly decreased due to weathering. Similarly, lack of deposition often means lack of stratigraphic separation in those sites that were repeatedly occupied, posing further problems for interpretation.

These problems, coupled with a lack of consistency in the manner in which stone circle sites are investigated, have resulted in a large body of stone circle data that is often accused of being incompatible, unusable, or of questionable relevance. Archaeologists need to develop reliable and cost effective methods of evaluating the significance of stone circle sites and ways of deriving maximum benefits from recovered data. Since most stone circle site investigations occur in the context of historical resources impact assessments or mitigations, there is a need to develop specific guidelines for assessing and mitigating adverse impacts to stone circle sites. This requires the collaboration of consulting and regulatory archaeologists.

In recognition of this need, the Saskatchewan Association of Professional Archaeologists (SAPA) entered into a contractual agreement with the Honourable Carol Carson, Minister of Community Services (now Saskatchewan Municipal Government) to organise a Stone Circle Site Treatment Workshop and produce a report on the proceedings. The contract

was administered by the Archaeological Resource Management Program of the Heritage Branch. SAPA sub-contracted Kit Krozser and Ben Hjermstad to arrange and execute the workshop and to prepare a report which would include a summary of the workshop proceedings, a literature review, and recommendations for stone circle site treatment guidelines.

The Stone Circle Site Treatment Workshop was initiated to examine the research methods currently employed for evaluating and investigating stone circle sites, and to develop direction and guidelines for such investigations. The workshop engendered lively debate, and although there was frequently a reluctance to commit to specific guidelines in the form of minimum standards, it was successful in formulating more general guidelines and goals for future stone circle research.

2.0 METHODOLOGY

2.1 Workshop

The workshop was held on February 6 and 7, 1993, in Regina. Five individuals with expertise in stone circle research and resource management were invited to attend as session **moderators**. An attempt was made to select individuals with varied backgrounds and from the full spectrum of regions and agencies where stone circle site treatment is an issue of concern.

Notices of the workshop were sent to Universities and government agencies involved in heritage legislation on the Northern Plains. They were also sent to members of the Saskatchewan Association of Professional Archaeologists and the Alberta Association of Consulting Archaeologists. In the United States, notices were sent to the president of the Montana Consultant's Group, to be forwarded to interested members. North Dakota apparently does not have a separate consultants group.

The workshop was well attended, particularly considering the short notice afforded. Of the 41 participants, 25 individuals were from Saskatchewan, including five Heritage Branch personnel, 10 consultants (representing four different companies), one individual from the Regina Archaeological Society, and nine students from the University of Saskatchewan. Eight people from Alberta attended, including one regional archaeologist from the Archaeological Survey of Alberta, four consultants (representing three consulting companies), and three students from the University of Calgary. One Canadian Parks Service representative from Manitoba attended. Six participants were from Montana, including a State Historic Preservation Office representative and five consultants (representing three different companies). One person attended from North Dakota, representing the U.S. Bureau of Land Management. For a full list of workshop participants, see Appendix II.

The workshop was set up in a series of 5 consecutive sessions, each of which was led by one of the invited moderators. The session topics were: Impact Assessment, Feature Data Collection, Excavation, Reporting Standards and Resource Management Goals. The moderators began the sessions with a short description of the problems to be dealt with, and then opened the issue for discussion by all workshop participants. For each phase in the assessment and excavation of stone circle sites, alternative strategies were discussed, and an attempt was made to define minimum acceptable levels of study. A consensus was understandably not always achieved, but issues were generally debated at length.

The workshop discussion was both video-taped and recorded on audio-cassette. Approximately 13 hours of tape were produced for each medium. The tapes will be available along with this report, at the Heritage Branch Archaeology office.

2.2 Report

Following the workshop, the video and audio tapes were reviewed and a summary of the workshop discussion was prepared. This was submitted in the preliminary report to the Heritage Branch for review and comments. Copies of the workshop summary were also sent to the five workshop moderators for review and comments. Revised summaries of the discussion of each workshop session are presented at the beginning of the discussion of each stage in the assessment and mitigation process (sections 3.1.1, 3.2.1, 3.3.1, 3.4.1 and 3.5.1).

It was suggested during the workshop discussion that the various stone circle data recording systems in current use be reviewed for compatibility. Stone circle researchers were therefore asked to submit descriptions of recording forms for their systems. These are compared in section 3.2.2.

A review was conducted of the literature relevant to the problems examined in the workshop. This review was limited for the most part to published literature as access to unpublished reports was limited, and duplicating costs would have been prohibitive. The literature related to each issue is discussed after the summary of the workshop discussion for each session (section 3.1.2, 3.2.3, 3.3.2, 3.4.2, 3.5.2). An annotated bibliography is presented in Appendix I.

Following the literature review, a general discussion is presented for each issue (sections 3.1.3, 3.2.4, 3.3.3, 3.4.3, 3.5.3). From this, a list of recommendations for guidelines for the various aspects of stone circle impact assessment and mitigation are provided (sections 3.1.4, 3.2.5, 3.3.4, 3.4.4, 3.5.4). These recommendations were formulated by the authors of this report, and were arrived at after consideration of both the workshop discussion and the relevant literature on each issue, as well as informal follow-up correspondence with various workshop participants. They do not represent the opinions of all the individual participants in the workshop, nor even necessarily the majority of the workshop participants. It should be noted that recommendations on numeric minimum standards, such as required numbers

of shovel tests/excavation per stone circle or percentage of outside versus inside testing/excavation have been avoided in deference to the majority opinion at the workshop that such matters are better left to be determined by individual research designs.

3.0 PROBLEM DISCUSSION

3.1 Impact Assessment

3.1.1 Workshop Discussion (Moderated by Rod Vickers)

The first session of the workshop dealt with the reliability of current surveying and assessment practices. There was some discussion regarding whether researchers are using biased survey strategies to locate stone circle sites and if so, whether these biases are controllable. Participants generally acknowledged that it is often impossible to locate all sites in a research area. Strategies are biased towards the identification of surface sites; where soil depositional rates are high, buried stone circle sites will inevitably be missed. As a result, buried sites are rarely sampled. While it is important to have a representative sample of all sites in an impact area, it was concluded that it is only in large scale projects, where there is room for more innovative and sometimes costly research, that buried components can be targeted.

Current stone circle site prediction models came under close scrutiny. Are archaeologists inadvertently ignoring environments where sites might be located? There was considerable discussion on the effectiveness of current methods.

Some participants believed that with proper environmental and topographical information it is possible to predict with some reliability high potential areas, with considerable savings to the client. Since total survey is generally not a viable option, extensive study of topographic, soil, geological and air photo maps, as well as information about previous archaeological investigations in the study area, is invaluable for determining high potential areas before the field component begins. Although this may involve more initial research, it can save time in the long run by reducing field samples.

Others felt that the information currently being collected on the environment and topography is inadequate to build predictive models. They argued that researchers need to collect more detailed information on such things as site topography and vegetation. They also point out that it is important to incorporate information on where sites are not being found into these models.

There was also a strong opinion that low potential areas should not be completely excluded. In any survey sample, a small percentage of areas rated as low potential should be examined as a check on sampling strategies. It was generally concluded that the ratio of areas rated

as high, medium and low potential which are included in a survey sample would depend upon the circumstances of the project and the research design.

The issue of site assessment was highly contentious. The primary goal of impact assessment is to determine if the sites in question warrant further investigation (mitigation) or heritage protection. It is therefore important to develop efficient techniques that reliably assess the significance of stone circle sites. Researchers realize it is impossible to excavate every stone circle site encountered; the assessment data gathered will usually be the only record of those sites. There is a need to gather assessment data in a manner that will allow for its application towards answering larger research questions about stone circles. Much of the workshop debate on this issue reflected differences in the relative importance placed on assessing individual stone circle sites versus collecting data with wider research application. While participants acknowledged the importance of collecting feature data which have a maximum research value, they did not always agree on the best methods to accomplish this.

There was some debate on the use of random sampling in testing sites. This once again centred around reconciling the dual needs of collecting data for site assessment purposes, versus general site research purposes. Most participants felt that judgemental sampling is more cost effective than random sampling in providing the type of information required to assess the significance of a site. For example, judgemental sampling allows researchers to concentrate on specific areas that have yielded high returns in the past, such as the centre of a stone circle. However, such techniques may be problematic for use in addressing more general research problems, particularly on a regional basis.

The workshop participants were very reluctant to set limits on the amount of testing necessary to adequately assess a site. Everyone agreed that both the inside and outside of stone circles should be tested. However, the amount of testing was felt to be dependent on research design and site circumstances.

Opinions regarding the use of augers in site testing was especially divisive. Augers can provide, at relatively minimal price, a large body of data that can be used to address regional questions on stone circles. However, considerable doubt was expressed on the effectiveness of augers in assessing individual sites, and in particular, variability within sites (variability between features). The ability to delineate cultural horizons was questioned, as was the ability to make meaningful interpretations from the small samples derived from an 8 inch auger hole. The use of larger diameter augers may alleviate this concern to a certain degree, but a number of participants felt that the use of shovel testing, while slower, allows for some stratigraphic control, and provides a large enough sample size to supply information on individual rings and variability within the site.

All participants agreed that collecting chronological information was of primary importance in understanding cultural patterning on the Northern Plains. Thus, it is important to develop testing designs that assess the potential of the site to produce both diagnostics and

radiometric dates. Some participants felt that ring centres seem to provide the best opportunity to gather such data.

3.1.2 Literature Review

The concerns about sampling strategies discussed in the workshop are usually ignored in the literature. Flayharty and Morris (1974:168) have noted that because of the paucity of cultural materials in rings, it is doubtful that many stone circle sites would be identified without the presence of the stone circles themselves. While most researchers would agree with these observations, there is little discussion in the literature concerning sampling strategies employed to locate stone circles sites.

A considerable number of surveys have focused upon predictive modelling. The earliest examinations of stone circles on the Northern Plains commented on their unusual locations away from major water courses and in windswept, rocky, indefensible positions (Mulloy 1954; Kehoe 1960; Malouf 1961). Many of these observations were centred around the early debate about the function of stone circles. Kehoe (1960) was one of the first to convincingly argue that most stone circles were in fact tipi remains. He also demonstrated differences in stone circle sites based on site size (number of rings). Large stone circle sites tended to be located in more sedentary winter camp spots like river terraces. However, most stone circle sites contain less than four rings and are in open terrain, presumably indicative of a summer occupation. Malouf (1961:381) argued that these latter sites were characteristic of a nomadic people likely moving between spots where there was seasonally available water.

Studies in predictive modelling increased with the introduction of heritage legislation. During the 1970's, the hypotheses put forth by Kehoe and Malouf were for the first time being systematically tested by researchers working on large scale projects like those on the Belly River (Quigg 1974), Red Deer River (Adams 1976 and 1978) and Milk River (Grasspointer 1980). This trend continued into the next two decades with research at Forty Mile Coulee (Brumley and Dau 1988) and the Old Man River (John Brumley, personal communication 1990). Adams and other researchers (Quigg 1979:11, Keyser 1979:142, Davis 1981:11, and Quigg and Brumley 1984:46) stress that environmental and locational information must be collected on a regular and systematic basis, not only to build predictive models, but also to understand seasonality and settlement patterns in the past.

Adams (1978) examined a sample of 197 ring sites from the Lower Red Deer River. He recorded three main variables at each site: location (environment, topography, alternate land forms, exposure and view), resource availability (temporary and permanent water resources, ungulate capacity, and cobble and wood availability) and site composition. From this data base he concluded that most stone circles are found on exposed and variable terrain, with a good view of the surrounding landscape and readily available ungulate populations. Almost all sites have access to seasonally available water, but river terraces

with year round access to water contained few sites. Few sites are found on sheltered terraces.

Assessment procedures are not often detailed in published journal accounts. Most sources reviewed indicated that the stone circles were tested prior to excavation. Few made clear the size, depth or number of these tests, though most agreed that testing should occur both inside and outside of the stone circle.

Auger testing has come under fairly close scrutiny as a method of assessing stone circles. Brumley and Dau (1988) have used augers to alleviate some of the problems caused by the paucity of cultural materials in most stone circles. They have developed an assessment technique that attempts to provide information that is both relevant to assessing site potential as well as answering large scale research questions. This centres around collection of standardized data sets from every investigated stone circle using an 'Analytical Unit System'. This system divides the ring into two subsystems - circular distance units which divide the stone circle into five standard sections (two inside the ring and three outside the ring) radiating out from the ring centre point; and directional sectors, or octants, each of which is centred on a cardinal or intercardinal direction using a compass oriented to true north. This effectively divides the feature into 40 unequal sized sections, 24 of which are located outside of the ring (1988:328-229). Using an eight inch auger (0.03 m2), one of four systematic ten-hole patterns are excavated. Four of these tests from each pattern are located inside the ring (1988:340-343). Brumley and Dau argued that this technique allows for the accumulation of large standardized data pool sets in order to delineate large scale spatial patterning within rings (1988:206-210).

Brumley and Dau found that cultural materials were densest inside and immediately adjacent to the tipi. Artifacts assumed to be associated with male activities (projectile points and exotics) were usually found in this area. Artifacts assumed to be associated with female activities (scrapers and utilized flakes) had a more generalized distribution (1988:205).

These data pool sets were also used in conjunction with environmental data and their limited stone feature data collection system to reconstruct population structure and seasonal movement patterns. These are based on a number of assumptions about ring population density and door location. Brumley and Dau argued that there is a correlation between wind velocity and stone density in rings, and from their data, hypothesized that all rings at Forty Mile Coulee had the door oriented towards the southeast, east or northeast (1988:133). They follow Finnigan (1982) in estimating an average density of 8 persons per ring based on a mean ring diameter of 4.6 m. Since the majority of sites they examined had less than four rings, contained the remains of only a single bison, and did not possess a hearth, they suggested that group size was based on small, transient extended families for most of the year (1988:123).

Some questions regarding the reliability of auger testing were evident in the literature. Quigg and Brumley (1984:49) questioned the ability of small bit augers (22 cm diameter or

less) to adequately assess site potential, citing an instance at a particular site where Quigg found no correlation in artifact density between auger testing and excavation. Brumley and Dau (1988:137-138) encountered similar problems in correlating artifact density and distribution from auger testing and excavation results. They attributed this to the fact that their auger testing pattern did not sample the area immediately within and adjacent to the ring rocks; this area displayed "significant and unanticipated differences" in artifact distribution from adjacent portions of the ring's interior and exterior.

Fredlund, Herbort and Munson included a discussion of stone circle methodology in their report on a Besant ring site in North Dakota (1985:149). Because artifacts are not necessarily evenly distributed within a ring, they felt that the use of small soil probes or a single 1 x 1 m interior test could distort assessment of ring potential. They suggested that four interior 50 x 50 cm tests, one meter from the ring centre should provide the best evaluation of the cultural contents of the ring (ibid.). They also suggested that exterior features such as hearths, bone uprights and refuse dumps are most likely to occur within a zone of three to six meters from the outside edge of the ring. They based this on results of a program of mechanical stripping as a final mitigation technique at the site they were investigating (ibid.). However, they did not specify an assessment strategy for this zone.

3.1.3 General Discussion and Conclusions

The session on site interception procedures was a call for the retention of the *status quo*. Most researchers indicated a high degree of confidence in currently employed site interception procedures. While some biases were admitted in site interception techniques, methods currently employed were considered adequate.

A more contentious issue revolved around the use of predictive modelling in surveys. The resources are not available to examine all areas under impact. Do archaeologists have a large enough sample to adequately predict high potential areas? The answer would seem to be a qualified yes. However, researchers must continue to develop and perfect predictive models. This requires the collection of detailed environmental and locational information from every identified site. This should include as a minimum, information on topography, environment, vegetation, and the distance to wood fuel and permanent and seasonally available water. A review of reports published before 1984 (Brumley and Quigg 1984:46) has shown that most archaeologists have been quite diligent in recording this kind of information. It should be noted here that participants felt that surveys must also examine low to moderate potential areas, to some degree. They felt the relative amounts should be determined by research design.

Most participants seemed to be generally satisfied with current standard methods of assessment. This usually involves the excavation of a number of judgementally placed 50 x 50 cm units in and around the identified rings. They felt that the number and location of tests should be determined by the research design.

Much of the discussion associated with current assessment techniques revolved around the problem of collecting information that might also be used to answer larger research questions. Some researchers have argued that because of the paucity of materials in ring sites, the information gathered during the assessment phase is all that is usually preserved from most sites. Brumley in particular emphasized that it is important to develop methodologies that systematically collect data that can contribute to answering large scale research questions.

There was some doubt expressed regarding the effectiveness of augers in assessing individual features and variability within sites. More specifically, the ability to delineate cultural horizons and to make meaningful interpretations from the small sample derived from an 8-inch auger hole was questioned. The auguring system used by Brumley and Dau is roughly equivalent to excavating 0.12 square meters inside each ring; assuming a ring with a diameter of 4 to 6 meters, this would be between a 0.4% and a 1% sample. The use of larger diameter augers may alleviate this concern to a certain degree, but a number of participants felt that the use of shovel testing, while slower, allows for some stratigraphic control and provides a sample large enough to supply information on individual rings and variability within the site.

It is a generally accepted view that detailed site maps need to be produced for every identified ring site. As mentioned in the literature review, much of the information that can be presented on maps can be used in predictive modelling. A number of the participants also complained about the difficulties in relocating stone circles because of poor site maps. At a minimum, maps should include all identified features, the location of tests, a key, a permanent datum point, a metric scale and appropriate topographic and environmental detail. Air photos can be used to produce very accurate maps, but in most cases these should be augmented by more subtle topographic details.

Feature mapping during the impact assessment stage remains a contentious issue. Many felt that the amount of mapping should be left to research design, while others insisted that at least a minimum amount of complete feature mapping was vital.

3.1.4 Recommendations for Impact Assessment

- Survey should not be limited to areas of high potential. A sample of low and moderate potential areas should be incorporated into all research designs. The size of this sample should be dependant upon research design.
- At all newly identified sites certain minimal information should be recorded. This should include information on topography, environment, distances to wood fuel, and distances to permanent and seasonally available water. To ensure the regular collection of (and access to) such data, these should become required entries on site forms.
- Stone circle assessment can be completed using either shovel or auger tests. These tests should be at least 30 cm in diameter.

- A sample of both the interior and exterior of rings should be tested.
- If testing is to disturb a feature (i.e. a hearth or cairn), full excavation techniques should be used. Minimal unit size should be 50 x 50 cm, and a map of the feature must be completed before it is disturbed.
- A site map must be prepared for all identified sites. The site map should minimally include the location of all features, an indication of which features were tested, and whether these tests were positive or negative. Maps must also include the site number, north orientation, and have a metric scale, key, datum point, and appropriate topographic and environmental detail.

3.2 Mitigation I: Feature Data Collection

3.2.1 Workshop Discussion (Moderated by John Brumley)

It was generally agreed that, in cases where testing indicates that excavation would not be productive, feature recording is a valuable mitigation tool in and of itself. One of the most contentious issues of the entire workshop revolved around disagreements as to the validity of various methods and levels of feature recording.

Most participants agreed that it is not possible to fully map all features at very large sites. Most also agreed that all excavated features should be fully mapped. The disagreement lay in how best to deal with the features that are only tested, or that are not subject to subsurface testing at all.

A number of the participants felt that a limited set of data (diameters, octant rock counts, etc.) should be collected for most, if not all rings that are subject to impact. Others felt that these limited data sets (often referred to by the rather misleading term 'limited mapping') are confined in their application to the research design of the individual who formulated the data set. They feel that full stone circle maps or photo-boom pictures provide a more complete set of data that is much more useful to other researchers that may wish to incorporate the data into their studies. For example, Hanna is currently exploring the use of different ways of dividing the ring up in attempt to derive similar types of information as those pursued by Brumley and Dau using the 'Limited Stone Circle Mapping' technique (Don Hanna, personal communication 1993). Hanna is looking at comparing ring rock loading in overlapping quadrants (one set centred on the cardinal directions and a second on the intercardinals) to wind direction statistics, and dividing the ring into 16ths to determine doorway location and long axis. While he is usually able to derive the data he needs from ring maps, the parameters set in limited stone circle data collection make such data unusable for his research. Hanna and some of the other participants argued that the time spent collecting limited data sets would be better spent producing a larger sample of full feature maps. This debate is one that is not likely to be easily resolved, as it revolves around fundamental differences in research orientation.

It is clear from the workshop sessions that there is a need for compatible data sets. If the need for collecting limited feature data sets (as opposed to full mapping of every feature at all impacted sites) is assumed, then collected data sets and presentation should be standardized to allow use by other researchers. Participants proposed that the major types of feature data recording systems be reviewed for compatibility in the final report for the workshop.

Most participants agreed that the collection of ring rock weights are not cost effective. They generally felt that counts and sample depths of ring rocks serve the same function for a fraction of the effort.

There was some discussion of the effectiveness of mapping rings which had not been fully excavated and therefore may have a significant portion of the rocks buried (although not specified in the workshop discussion, the same argument could be applied to the collection of limited data sets for such features). The degree to which this is a problem depends upon depth of burial of the ring; if the ring rocks are relatively exposed, then there is a strong likelihood that all the ring rocks can be recorded without excavation, whereas if there is a substantial soil deposition, there is a greater probability that some of the rocks will have been completely buried and will not be visible to the recorder. One simple way to determine the presence of buried ring rocks is to use a shovel to probe for buried rocks, and expose any that are found. This may become less cost effective as the ring is more deeply buried.

3.2.2 Review of Limited Stone Circle Data Collection Methodologies

During the workshop it was suggested that it might be useful to evaluate existing feature data collection strategies for comparability. Researchers specializing in stone circle site investigations and/or having stone circle data banks, were asked to provide copies of their data collection forms, lists of data they considered essential, or any comments they might have regarding types of data collected. Information was submitted by members of three Saskatchewan consulting groups, one Alberta/Montana consulting group, and one Montana consulting group. Additional comments on limited feature data sets were obtained from a number of other workshop participants. Since the purpose of this exercise is to examine compatibility of various data collection strategies currently in use, rather than to point out deficiencies of any one collection strategy, individual researchers and/or companies have not been identified here.

There was generally a fairly high degree of correlation in the types of data recorded by those researchers who collect limited data sets on rings which are not mapped. Naturally, all limited feature data recording systems required an indication of site number, feature number, recorder and date. Table 1 outlines the other types of feature data collected in the five systems compared.

TABLE 1: TYPES OF FEATURE DATA RECORDED						
System	**1**	**2**	**3**	**4**	**5**	**Recommendations**
Octant Rock Count	YES	YES	YES	YES	*	YES
Cardinal Diameters	YES	YES	YES	YES	YES	YES
Intercardinal Diameters	YES	YES	NO	NO	NO	YES
Rock Depths	YES	YES	EST.	EST.	NO	YES
Rock Weights	NO	YES	SIZE	YES	NO	NO
Associated Features	YES	NO	YES	YES	NO	YES
Associated Artifacts	YES	NO	YES	YES	NO	YES
Ring Gaps	NO	NO	YES	YES	*	YES
Feature Definition	YES	YES	NO	NO	*	YES
Ring Shape	NO	NO	YES	YES	*	YES
Ring Rock Clustering	YES	YES	NO	NO	*	YES
# of Courses	NO	NO	YES	YES	*	YES
Slope	YES	YES	**	NO	NO	YES
Comments section	YES	YES	YES	NO	YES	YES
* Could be obtained from sketch provided, depending on accuracy of sketch ** This category specified as one possible entry in comments section.						

One of the most common types of data collected was ring rock counts per octant. For the types of analysis based on octant rock counts, octants should be centred on the cardinal and intercardinal directions. An important point made by a number of researchers contacted was the necessity of orienting the octants to true north, rather than magnetic north. Since octant rock counts are essentially a reduction of data, data sets are incompatible if the orientation of the octants are not consistent. The orientation of magnetic north varies considerably with time and location. Since true north remains constant, and since octant rock counts are most often used in conjunction with wind direction statistics, which are themselves measured according to true north, it is important that octant rock counts should also be oriented to true north. True north has not been consistently used in the past, but all the participants contacted agreed that the use of true north should be a standard in the future.

Most data collection systems called for the recording of both inside and outside diameters in the cardinal directions. A number of the systems also included inside and outside diameters in the intercardinal directions.

Depths were not consistently taken. Two data collection systems recorded the depth of a representative rock in each octant, two systems provided for a subjective estimation of depth of burial (% of rock exposed), and one did not record depth at all.

Only one feature data collection system recorded representative weights from each octant. A second system allowed for the collection of total rock weight by octant, and the other three systems did not record weight at all, although two of these included an indication of either a sample rock size or size range of the ring rocks.

Three of the systems specified the collection of data on associated features and artifacts. This was done in varying degrees of detail, ranging from an indication of whether a central feature or associated artifacts were present, to counts and measurements of distance and angle from the stone circle centre.

Only two of the systems recorded the existence of gaps in the ring wall, general shape of ring, and number of courses (whether there was an inner and outer wall). Two other systems specified the recording of clustering in the ring walls, and feature definition (i.e. well defined, poorly defined, amorphous). Two of the systems recorded slope of terrain, and a third specified slope as something to be noted in the 'Comments' section. Four of the five systems provided space for comments or notes.

3.2.3 Literature Review

In their review of 37 pre-1984 stone circle reports from Alberta and the northern United States, Quigg and Brumley (1984:74-75) noted that ring diameter was the most common stone circle characteristic recorded, and that number of ring rocks was also usually counted. They also noted that some researchers recorded observations about spacing of rocks in a ring by using directional segments (i.e. octants), while others took detailed drawings, or simply included observational comments regarding ring rock spacing. The adoption and enforcement of minimum standards was proposed.

Quigg and Brumley recommend the use of full stone circle mapping wherever possible, and particularly for excavated features. They recommend limited stone circle recording for site evaluation purposes only (ibid.:85). However, they also state that "data recorded about any features not subsequently excavated will itself provide an important data base for answering various hypotheses" (ibid.:81).

The feature data recording standards they suggest (ibid.:84-85) are as follows:
- use of **true north**;

- **centre point** - identified using the intersection points of a series of ring diameters;
- **octant rock count** - determined by dividing the ring into eight directional segments centred on the cardinal and intercardinal directions, and counting the number of rocks in each segment;
- **rock depth** - selection of a sample of rocks in the ring wall, and recording their depth and the directional segment (octant) in which they are located;
- **associated features and/or cultural material** - apparently associated features or cultural material should be noted and described or collected, and information regarding location with respect to the ring should be collected;
- **other observations** (e.g. depositional information).

A set of guidelines based on Quigg and Brumley's report was developed by the North Dakota Division of Archaeology and Historic Preservation (Dill 1984). The guidelines recommend the recording of inside diameters, and the preparation of scaled planview drawings (full feature maps) of all features during the assessment phase. No mention is made of weights or depths of ring rocks.

Brumley and Dau's report on their investigation at Forty Mile Coulee (1988) gives a detailed description of their feature data recording methodology. The data that they collected is similar to the categories outlined in Quigg and Brumley (1984), but they state that full circle mapping (using a mapping board or photo boom) was only conducted on rings intended for excavation (Brumley & Dau 1988:343). Feature data recording, which they call 'Limited Stone Circle Mapping', was conducted for every stone circle identified during the Forty Mile Coulee project. In addition to the surface feature data recorded, they consider an integral part of 'Limited Stone Circle Mapping' to be the drilling of auger tests placed in specified locations called 'Analytical Units' in and around the ring (ibid.:340).

Brumley and Dau developed a number of hypotheses to which stone circle feature data can be applied. Their actual application of the data from Forty Mile Coulee and a number of other Alberta stone circle projects met with limited success. There was a general correspondence between mean octant rock loading and yearly mean wind velocity - the average number of rocks tended to be higher in the direction that had highest winds averaged throughout the year. However, little correlation was found between given months of the year and any stone circle data set, and rock loading was not found to be helpful in establishing contemporaneity between rings at a site (1988:127-130).

Burley (1990) voiced doubts on the validity of some of the types of analysis (wind direction statistics and population estimates based on ring size) to which Brumley applies his feature data. However, he recognized that 'elements of tipi ring structure' (feature data) are important variables to consider in future data collection strategies. He considered Brumley's 'Limited Stone Circle Mapping' method an exemplary of cost effective data recovery, and pointed to the need for standardization.

Hanna (1991) tested several hypotheses put forth by Quigg and Brumley (1984) and Brumley and Dau (1988), using cluster analysis on a single stone circle site containing eight rings in two locational clusters. He found little to support the idea that either ring rock depth or ring rock loading can be used to determine feature contemporaneity. Furthermore, he attacked such studies for their "inability to determine a standardized replicatable centre-point for the feature" (Hanna 1991:177), since the centre-point is a key datum point for determining such analysis as ring rock loading.

It is interesting to note that Hanna found a strong statistical correlation between depth and weight of ring rocks (1991:196). Ring rock weight is central to the octant loading hypothesis, but, as Burley noted (1990:354), the weighing of ring rocks is costly and time consuming. Burley suggested the substitution of simple stone counts. Quigg and Brumley mentioned in passing taking sample weights along with depths (1984:84), but did not include weights in their summary of suggested limited stone circle observations (they included sample depths). Furthermore, rock weights were not included amongst the data collected on the 'Limited Stone Circle Observation Form' shown in Brumley and Dau (1988:334), although sample depths were included. Although this is not generally spelled out, it would appear that the combination of rock counts and sample depths may be sufficient data to use in ring rock loading analysis, especially in light of Hanna's observation.

3.2.4 General Discussion and Conclusions

It was clear from both the workshop discussion and the literature review that stone circle researchers agree that ring structure data (feature data) is important, and should be collected. The main problem that stone circle researchers are currently faced with is how to collect such data. More specifically, there is a need to find a happy medium between cost effectiveness and maximal data retrieval. Moreover, it is also clear that current methods of analysing feature data have not met with widespread success, and that there is a need to develop better theoretical constructs which can use stone circle structure data to provide meaningful information. Given the fact that ring structure information is frequently the only type of data that can currently be derived from many sites, the refinement of this avenue of research will probably continue to be forefront in stone circle studies.

One point that was reiterated in the literature as well as during the workshop, is that data retrieval methodologies must be based on research design; they must be aimed at testing specific theoretical constructs. This becomes more important with increasing levels of data reduction. The less data collected, the more important the research design.

Quigg and Brumley (1984) and Brumley and Dau (1988) have developed a series of hypotheses about the kinds of information that can be derived from stone circle structure. They have developed a cost effective methodology for collecting such data, 'Limited Stone Circle Mapping', versions of which have been applied to at least three large reservoir projects (Forty Mile Coulee, Old Man River and Rafferty/Alameda) involving multi-year

heritage resources impact assessment and mitigation on very large numbers of stone circle sites. To date, these projects appear to have met with limited success in terms of proving or disproving the constructs they were designed to test. Furthermore, the type of analysis involved (i.e. matching ring rock loading with seasonal wind direction statistics) often meets with even less success when used by other researchers on smaller sites or smaller data bases (see Finnigan 1982:128; Hanna 1991:197; Van Dyke and Head 1983:227). These problems have led some researchers to question the wisdom of the systematic reduction of the feature data collection involved in 'Limited Stone Circle Mapping'. They feel that it is important to collect as much feature data as possible, so that other avenues of research on feature data can be explored.

Workshop participants agreed that the ideal situation would involve full feature maps (scaled ring drawings) of all features subject to impact. This was also indicated to some degree in the literature (Quigg and Brumley 1984:85, Dill 1984:8, 13). However, there was an obvious reluctance to commit to this ideal, both in the face of the prohibitive costs involved in fully mapping the hundreds of stone circles encountered during large projects and given the possibility of encountering an unexpectedly large number of stone circles on a project limited by a fixed budget. The basic difference of opinion revolved around the best way to reduce the data. Some researchers felt that it was preferable to collect more extensive data (full feature maps) on a smaller sample of features, while others preferred to collect more limited data on a larger sample (preferably all rings in the impact zone).

As long as the debate is on data reduction, this argument could go on endlessly. The need for current levels of feature data reduction is not firmly established. If feature data is important, and if it is the only thing we can currently recover from many stone circles, perhaps what is called for here is a change in attitude towards reducing costs at the expense of the remaining stone circle data base. Full feature mapping could come to be considered a necessary expense, even for reservoir projects containing large numbers of stone circle sites. According to Dill (1984), full feature mapping has been made a requirement for any stone circles recorded within the impact zone in North Dakota. They have recognized the problem of unexpected expenses incurred on fixed budgets by incorporating a two stage impact assessment process for larger stone circle sites, with separate survey (inventory) and evaluation (site assessment) stages. Presumably, the budget for the evaluation stage is not fixed before the total number of features is known. In any case, feature data collection is ultimately a mitigation procedure. The ideal practice would be to set the mitigation proposal and budget after the assessment is complete and the number of features is known. Many of the problems with feature data reduction stem from the tendency to incorporate feature data collection into the assessment phase when other types of mitigation (i.e. excavation) are not deemed appropriate. This is done for obvious practical reasons, but it has essentially magnified the necessity for data reduction in feature recording.

Since a reluctance to change the above mentioned *status quo* is anticipated, perhaps feature data collection standards should be based on site size, or more accurately, on the number of stone circles within the impact zone. Where smaller numbers of stone circles are

involved, and costs of data collection are therefore not prohibitive, full feature mapping should be a standard requirement. As larger numbers of rings are involved, full feature mapping should remain an option, but a minimal standard should be enforced combining full feature mapping of a specified number or percentage of the features and limited data collection on other features.

3.2.5 Recommendations For Feature Data Collection

The best method for collecting feature data is by full feature mapping, producing an accurate, scaled drawing of the feature, using the tipi quick system, a photo boom or a 20 cm grid (larger grids are unacceptable). Full feature mapping should be considered an option at any size of stone circle site. However, it is recognized that full feature mapping is not always practical at larger sites. Therefore the following minimum guidelines are recommended:

For sites containing up to 20 stone circles subject to impact:
- at least 5 rings should be full feature mapped. This should include a representative sample of the variety present in the impact zone,
- all excavated rings should be included in the full feature mapping sample, and
- the limited data specified below should be collected on all remaining rings subject to impact.

For sites containing 21 to 40 stone circles subject to impact:
- 25% of the rings to be impacted should be full feature mapped, including a representative sample of the variety present in the impact zone,
- all excavated rings should be included in the full feature mapping sample,
- the limited data specified below should be collected on an additional 50% of the rings.

For sites containing more than 40 stone circles subject to impact:
- 10 rings or 10% of the rings to be impacted (whichever is the greater amount) should be full feature mapped, including a representative sample of the variety present in the impact zone,
- all excavated rings should be included in the full feature mapping sample,
- the limited data specified below should be collected on an additional 20 rings or 25% of the site, whichever is the greater amount.

Full feature mapping should be performed using the tipi quick method, a photo boom, or a 20 cm grid. All feature maps must be presented in the final report or in an appendix volume which is submitted to be curated along with the final report. Each feature map must contain: Borden number, feature number, a scale, and an arrow indicating true north. Sample depths for a minimum of four ring rocks (one from each of the cardinal or intercardinal directions) should be collected for each mapped ring, and the ring rock for which the depth was collected should be indicated on feature maps.

Limited feature data collection (the term 'mapping' is very misleading) should be conducted using an orientation to true north. Feature data collected for **each** individual stone circle must be presented in the report or in an appendix volume which is submitted along with the final report. The presentation of site averaged data alone should not be considered acceptable without inclusion of a hard copy of the full data set for use by other researchers.

Limited feature data collection should include the following data:

- both inside and outside diameters in the cardinal directions,
- number of rocks per octant, with the octants oriented in the cardinal and intercardinal directions, so that each cardinal (N, S, E & W) and intercardinal direction (NE, SE, NW, NW) is in the **centre** of an octant,
- a record of any gaps present, and an estimation of width and orientation of gap,
- a record of any central or ancillary features, including number of rocks composing such features, as well as their location relative to the ring,
- a notation as to presence or absence of visible clustering on ring rocks,
- an estimation of ring definition (good, moderate, poor or amorphous),
- an estimation of general depth of burial, presented in percentage of the ring rock below surface (i.e. rocks are generally 75% buried),
- shape of ring (i.e. round, oval),
- number of courses or layers (i.e. single walled, double walled),
- disturbances and disturbance factors,
- visible artifacts or other cultural material,
- slope (level to gentle, moderate, steep) and slope direction.

3.3 Mitigation 2: Excavation

3.3.1 Workshop Discussion (Moderated by Jim Finnigan)

The session on excavation was one of the least contentious, but at the same time produced one of the clearest calls for changes in current standards. There was a great deal of agreement on a number of procedures that need to be more consistently implemented in the future.

Participants recognized that one of the strongest deficiencies in stone circle research was the paucity of chronological information. A problem that was repeatedly raised throughout the workshop is that of contemporaneity of surface features like stone circles, particularly in the case of larger sites. In the past, this problem was difficult to surmount, since surface sites did not normally produce adequate material for the existing dating techniques. However, current techniques have advanced considerably; radiometric dates can be obtained from much smaller samples, and fire cracked rock, burnt hearth matrix and potsherds can now be dated by Thermoluminescent dating. Participants felt that stone circle research is lagging behind the treatment of other archaeological site types in efforts expended on dating sites. There was strong agreement that a far greater effort should be made to date stone circle

sites. Many participants felt that an attempt should be made to collect dates from every ring excavated. Given the expense of dating procedures, adequate budget coverage should be allotted for these procedures, and included in project proposals.

The problems associated with dating surface and shallowly buried sites with multiple occupations were discussed at some length. In such sites, there is always the possibility that dates (or diagnostics) obtained within or near any particular feature are not necessarily associated with that feature. Mention was made of some current research on dating microscopic patina on the underside of ring rocks. However, this method has only been successful in desert conditions to date. The possibility of dating ring rocks is something that should be kept in mind, but for the time being, efforts should concentrate on obtaining more radiocarbon and thermoluminescent dates on items found in or near individual rings. Stone circle researchers will simply have to make the assumption that collected dates and diagnostics are likely associated with the rings from which the samples were gathered.

There was some discussion regarding the merits of fine screening. Once again, it was generally felt that this should be a standard procedure. Sample size and exact methodology would depend upon research design and the nature of the site, but it was agreed that fine screening should at least be tested at all excavated stone circle sites to determine its viability. This should be a standard excavation procedure. If the data is not relevant to the particular research design developed for that site, it should still be collected and curated for future research. Consultants were warned by representatives from regulatory agencies that fine screen samples submitted for curation must be processed before curation; they will not accept large samples of unprocessed soil.

The degree to which a stone circle should be excavated (i.e. % of ring), and the degree to which the outside areas around the ring should be excavated were also discussed at length. Most people felt that if the inside of the ring is excavated, a 100% sample is generally needed. However, they definitely felt that there should be a generous degree of flexibility in this rule to accommodate differences in research designs. It was also recognized that artifact density at stone circle sites is generally higher inside rings than outside, and therefore the important goal of obtaining tighter chronological and cultural control on stone circle sites is usually better realized by the excavation of ring interiors. However, strong reservations were expressed on concentrating on ring interiors to the exclusion of exterior areas. It was generally recognized that there is a need to start working on developing models of behaviour conducted outside habitation structures. None of the participants were willing to suggest a standard ratio of inside to outside ring excavation areas. Everyone felt that this, once again, depended strongly upon research design.

Considering that outside-ring areas are usually the least productive areas (in terms of artifact density) of a type of site that is already notorious for its problems with poor artifact density, a number of methods for overcoming this problem were considered. Suggestions included bulk screening, trenching with screening, blading, sod removal and discing. Blading, sod removal and cultivation were all pointed out to be problematic, because they

are difficult to employ on rocky surfaces. Since there is an understandable correlation between stone circle sites and rocky soils, terrain should be considered before such methods are incorporated into research designs. There was also a recognition of the destructiveness of these methods; they should not be used in sites that are not slated for total destruction without a very strong research design argument.

There was general agreement that more attention should be paid to stratigraphy at stone circle sites. Participants did recognize that stratigraphic excavation is not always practical or necessary, but they felt that the possibility of stratigraphic separation or the collection of other pertinent stratigraphic information should at least be tested.

The discussion returned repeatedly to the necessity of dependence upon research designs. Although there is definitely agreement on a number of standard methods that should be employed in excavation in the future, the level to which such practices are incorporated into stone circle investigations should be determined by the research design employed. The importance of research designs should therefore be stressed, and stone circle investigators should concentrate on writing stronger research designs.

3.3.2 Literature Review

There are a variety of excavation methods and strategies that have been employed when investigating stone circle sites. This is to be expected as different archaeologists follow their own specific research interests. However, Burley has warned that archaeologists have demonstrated little understanding of stone circles beyond "descriptive statements about ring structure" (1990:343). There is obviously a need for more baseline research to understand this site type.

There has been some controversy about what kinds of rings archaeologists should be excavating. Should researchers continue to excavate rings only where there are indications of large amounts of materials, or should they divert more of their efforts to less productive rings? Davis decries the 'treasure hunting' syndrome that appears to have taken over many mitigative projects (1983a:4). He feels that the key to understanding stone circle sites might be to better consider the very thing that drives researchers away in the first place, the paucity of artifacts and ancillary features. While aware of this situation, most investigators continue to concentrate excavation on rings with highest densities of cultural materials.

There are also numerous procedural problems in excavating large ring sites. For instance, in the last decade excavations have been completed at two large and complex ring sites in Alberta - the Ross Glen Site (Quigg 1986) and the Crawford Site (Stuart 1990). In both these cases it was difficult to determine contemporaneity when dealing with sites containing such a large number of features and artifacts. Stuart in particular has expressed frustration with the difficulty of correlating different rings and outside activity areas, because of the range and numbers of features, cultures and radiometric dates present at the site he was

researching. Burley (1990:351) has been highly critical of the excavation of large ring sites, especially as few of the features are dated in order to determine contemporaneity.

The excavation of smaller, less complex ring sites is less problematic in terms of contemporaneity. Furthermore, a number of researchers have noted that most ring sites are in fact quite small (usually containing less than four rings), and that these sites probably reflect the norm on the plains (Adams 1978:14, Finnigan 1982:11, and Morris 1989:239). Small sites are indicative of the nomadic, kin based groups that would likely have operated on the open prairie during the summer.

A related problem centres on which rings, and how much of each ring, should be excavated within a site. Stone circle researchers often opt for a sampling methodology where either a percentage or representative sample of all identified rings are excavated (Adams 1978; Brumley and Dau 1988). They also tend to excavate only a portion of the ring itself, although most research designs would allow for full excavation of productive rings (Brumley and Dau 1988; Stuart 1990). Quigg (1986:136) and Stuart (1990:214) argue that the delineation of spatial patterning within a ring usually requires large excavation blocks, especially considering the paucity of the materials usually present.

There is general agreement in the literature that at least a portion of the outside of stone circles should be excavated (Adams 1978; Deaver 1983:70; Brumley and Dau 1988:340-343; Quigg 1981:79). Unfortunately, outside activity areas are extremely difficult to identify and large areas of excavation are usually required to locate and investigate such areas.

Some of the above mentioned problems with identifying exterior features might be alleviated with the use of mechanical stripping. Some researchers that have used some of the various techniques that can be employed (mechanical stripping, sod stripping, cultivation, roto-tilling and bulk screening) have been impressed with the results (Quigg 1986; Brumley and Dau 1988:104). This technique reveals a considerable number of ancillary features and quantities of cultural material that probably would not have been otherwise identified. Many development projects strip soil during initial phases of construction and it is suggested that it might be wise to monitor these activities in the future.

Quigg (1981) argued that more attention should be paid to excavating buried rings because they could offer even greater potential for research. Since surface sites have notoriously poor preservation of ceramic and faunal materials, a better understanding of spatial relationships might be recognized with buried remains.

Excavation techniques are generally dependent upon research design, but nevertheless tend to be fairly consistent. Most archaeologists employ grid excavation with constant unit volumes when investigating stone circles (Calder 1979:7; Quigg 1979:262; Finnigan and Johnson 1984; Stuart 1990:23-24). A few researchers continue to use different techniques, usually based on the circular shape of the ring itself. Davis (1983b:253-355), Deaver (1983:63), Hull (1987:775) and others (Kennedy, Wright in Burley 1990:348) have used

circular, quadrant, pie and ring annuli based units. One problem with these techniques is that it is very difficult to compare the generated data to other grid-excavated habitation sites, because of the unequal sized units.

There was agreement in the literature reviewed that some sort of stratigraphic control is necessary even when excavating what is presumably a single component site. Early investigations into stone circles quickly discovered that few of these sites have identifiable living floors (Mulloy 1954, Kehoe 1960, Malouf 1961). However, Flayharty and Morris (1974:163) have indicated that ring rocks and hearths are usually of equal depth.

In the last two decades, a number of researchers (Deaver 1989; Fredlund et al. 1985; Hull 1987; Stuart 1990) have been able to locate strong evidence of spatial patterning within tipi rings. Stuart (1990:211) advocates careful horizontal control (including point provenience) to identify spatial patterning. Janes (1989:854) has warned that a good understanding of transformation processes is necessary when interpreting this kind of spatial information. Foot traffic, disposal practices and rodent burrowing can all affect the patterns that are observed in the record.

Fine screening does not appear to have been a commonly employed technique in stone circle excavations. Quigg fine screened all ancillary features at the Ross Glen Site (1986:56). Hull (1987) examined micro-debitage patterns from fine screening and was able to find strong evidence of spatial patterning within rings at the Bow Bottom site in Alberta. Results from flotation of soil samples gathered at stone circle sites were not reported in any of the stone circle literature reviewed.

Considerable time, effort and money has been devoted to the excavation of ancillary features at tipi ring sites. When identified, these features are usually fully excavated with positive results. Identified features include hearths, smudge pits, storage pits, rock alignments, cairns and manufacturing and processing areas.

Hearth features are generally a focus during excavation. Janes (1989) believes that hearths give researchers the best opportunity for identifying specific activities that might have occurred at the site. These features often contain abundant amounts of debitage, bone, fire-broken-rock and charcoal (Flayharty and Morris 1974:163). However, Janes (1989) warns that this data may not always be consistently present, since hearths were often cleaned.

Other archaeologists have tried to determine seasonality using hearths. Brumley and Dau (1988) considered the use of internal hearths to be associated with winter sites, such as those located in river valleys and terraces. Since most rings located during the Forty Mile Coulee project did not seem to contain hearths, they postulated that these sites were occupied from late April to early September when temperatures remained above the freezing point. Stuart, on the other hand felt that summer nights would sometimes have been sufficiently cold to justify the use of hearths (1990:201). Hovde suggested that the presence of both interior and exterior hearths at a stone circle at the Hermosa Tipi Ring

site indicated diurnal temperature change, with the interior hearth being used for heating during cooler parts of the day and the exterior hearth being used for cooking during the warmer parts (1983:33). Adams noted that by careful examination of the distribution of charcoal outside of the hearth, paleo-wind direction might be surmised (1978:107).

Finnigan and Johnson (1984) suggested that Besant sites might have had small smudge pits along the edge of the ring to drive off insects. Wilson (in Finnigan 1982:9) has located ribs with evidence of sharpening and battering on opposite ends which he believes were used as tipi pegs.

Many researchers called for more radiometric dates and diagnostics in order to better understand variation in the prehistoric record. Burley (1990:351) was highly critical of the lack of diagnostic and radiometric information currently available. His survey of ring sites in Alberta located less then 1.5% with chronometric dates listed on the site forms. He felt that it was impossible to understand inter- and intra-site patterning without dates, since contemporaneity can not be assumed. These arguments are especially important in light of the ongoing debate about ring size and age. The idea that Besant phase rings are larger than other rings has been the subject of considerable debate in recent years (Brumley and Dau 1988:36; Finnigan and Johnson 1984; Stuart 1990:192). Kehoe suggested that proto-historic tipis were larger than earlier rings because of the adoption of the horse and polygyny (1960:435). Most researchers who have tested this hypothesis archaeologically have not been able to confirm it (Quigg 1981:264; Roll 1981:84; Brumley and Dau 1988:121). However, it has been suggested that the sites themselves might have been larger during the proto-historic period (Roll 1981:84). Other hypotheses regarding stone circle size include the theory that Alberta rings are larger than those from Wyoming, and that Middle Prehistoric rings might be larger than later varieties (Wilson 1983:132-133). Larson (1981:99) suggested that stone circles from this period are not the remains of tipis but of wickiups. Tighter chronological control may enlighten some of these issues.

There has been some suggestion that measuring boulder flow could be used to relatively date rings within sites (Dormaar 1976). Testing of this hypothesis by various researchers has met with little success since numerous taphonomic processes can adversely affect the results (Adams 1978; Brumley and Kooyman in Finnigan 1982; Finnigan 1982).

3.3.3 General Discussion and Conclusions

The Stone Circle Workshop and the literature review revealed some dissatisfaction with currently employed excavation methodologies. Many archaeologists feel that stone circle research is lagging behind in the implementation of some of the newer analysis techniques. They would like to see some of these new procedures become standard archaeological practice for stone circle research.

While the participants would like to see the implementation of certain new excavation techniques, there was a strong consensus that they should be given ample room to develop their own research procedures. This is a healthy attitude; it promotes original research that will help better interpret the past. They feel that there should never be a 'cook-book' approach to the investigation of stone circles. Guidelines must be able to accommodate new and original research. However, this research will always need to be justifiable in terms of the anticipated degree of site impact. Stone circle researchers cannot ignore the fact that the sites they are investigating are a limited resource and deserve to be properly investigated if they are to be destroyed.

There was consensus in both the workshop and the literature that large excavation blocks within a ring are needed in order to fully understand interior spatial distribution patterns. On the other hand, most participants and many of the authors reviewed have cautioned against ignoring areas outside the ring. Unfortunately, these areas are so large that there is a degree of uncertainty in the ability to locate activity areas outside the ring in even the best sampling strategies. While some researchers may find the idea of surface stripping somewhat repugnant, this method seems to be one of the few ways to consistently locate outside features and activity areas. However, surface stripping should be limited to sites subject to impact. The use of magnetometers might prove to be a less destructive and equally effective technique of identifying outside features.

The workshop participants were unanimous in calling for more radiometric dating of stone circle sites. Current dating techniques require only a small sample of dateable material, and have in recent years fallen considerably in price. Radiometric dates should be obtained on virtually every ring that contains dateable materials.

There was a general consensus during the workshop discussion that rings should be excavated following natural stratigraphy if possible, or at most in 5 cm levels. While the use of pie shaped units may have some merit considering the circular nature of the stone ring, it was felt that gridded, constant volume sized units would generate data that is easier to understand and that could be more easily compared with data from excavations of other habitation sites.

A greater use of fine screening (2 mm mesh) during stone circle excavation is warranted. Hearth features in particular should be fine screened. Researchers have commented on the fact that these features were often used as a dump and thus contain a large, representative sample of the cultural debris present in the rest of the site. Overall, a five percent sample of initially excavated materials could be fine screened at all sites with little cost in time and effort. Where results turn out to be unsatisfactory, this procedure could be abandoned.

3.3.4 Recommendations for Stone Circle Excavation

The quantity and location of excavation units must be dependant upon research design. Methodology should be formally linked to the research design, and the research design should be justifiable in terms of anticipated degree of impact as well as characteristics of and variety within the portion of the site subject to impact. However, the following recommendations can be made with respect to the excavation of stone circle sites:

- excavation should follow natural stratigraphy when possible, and limit size of arbitrary levels to 5 cm;
- a representative sample of excavated fill from all stone circle sites should be fine screened (2 mm mesh);
- hearth features should be fine screened;
- all research designs should contain adequate budgets for radiometric dates and all stone circles with suitable samples of dateable materials should be radiometrically dated;
- all research designs should contain adequate budgets for soil analysis, palynology and floral analysis;
- mechanical stripping is a destructive technique and should only be used when sites are definitely slated for full destruction within two years of the termination of archaeological investigations;
- mechanical stripping must not be a final mitigation procedure - adequate time should be allowed after stripping to fully examine and interpret results.

The following research approaches are encouraged:

- full excavation of stone circles; and
- excavation of areas outside the stone circle.

3.4 Reporting Standards

3.4.1 Workshop Discussion (Moderated by Kimball Banks)

Although 'reporting standards' was not anticipated to be a particularly contentious issue, discussion on the topic brought forward a number of problems involving current consultant's reports. Most of these centred around the fact that a consultant's report is written for a variety of levels of readers with very different concerns. It must supply regulatory agencies with the types of information they require to make informed decisions about the management of the heritage resources involved. It must meet certain scientific standards, contributing appropriately to current archaeological knowledge. It must also provide certain base level data in an easily accessible format to future researchers. Last, (but certainly not least) it must inform the client, in clear layman's terms, what conflicts exist between the development in question and heritage resources. These readers all have different requirements, and this should be kept in mind when producing the report.

It is important for the regulatory agency that the report be clearly written, and be carefully proofread before being submitted. Conclusions regarding the significance of heritage resources involved, and recommendations for the management of impact to those resources should be accompanied by background arguments and substantiating evidence, presented logically and concisely.

In terms of scientific standards, it was generally agreed that a research design and supporting methodology was necessary. There was some discussion as to the receptiveness of clients towards conducting research (analysis) as opposed to pure data collection. Two main arguments were offered in answer to this question. First, unless the client is willing to pay for total and very detailed data collection of **every** aspect of the resource in question, sampling procedures must be employed, and a research design is necessary to justify sampling design. Second, most research conducted on stone circle sites is done by consultants in the form of impact assessments and mitigation. If researchers continue to collect data without proper analysis, the science of stone circle research will never advance, and ultimately, that data collection will become a useless exercise. Analysis can help refine our methodologies of data collection, and ultimately reduce some of the excess data currently collected.

Given the necessity of a research design, one further point on scientific standards repeatedly came up throughout the entire workshop. Data presentation should not be limited to summaries applicable only to the writer's research design. Relevant data should be presented in a basic manner that is useable to other researchers that may have different research designs. For example, there was a general agreement that all feature maps should be included in the report. Data not relevant to the current research design could be retrieved from feature maps by future researchers. Basic artifact counts, weights, and measurements should also be presented. There was agreement that this type of data belonged in appendices.

One type of data that seemed to be of particular concern for both regulatory agencies and stone circle researchers is worth special mention here. Site maps received considerable coverage during this session. They need to include a level of detail that will allow for the relocation of both the sites, and the individual features within the site. They should, of course, have a north arrow and a scale. They should also include topographic detail, and should be tied into a permanent datum point. Stone circles are notoriously difficult to relocate, particularly in long grass, and there was some discussion as to a means of permanently marking rings, or at least a 'datum' ring. Suggestions included use of a 1 inch square of heavy copper, which may be relocated by means of a metal detector, or use of plastic survey stakes. There was also some concern that the report should specify how the map data was obtained (i.e. specify if map was paced).

It is important to remember that impact assessment and mitigation reports are most often used by groups of people with entirely different needs. These are the clients, and frequently other consultants working on other projects in the area. Although these two groups may

have rather different goals, their needs are similar. They need a short but detailed summary of relevant resource management data presented in an easily accessible format; they do **not** want to have to read the entire report to find what they are looking for. The abstract or management summary is the obvious answer to these needs, but from the discussion it appears that a number of report writers do not understand the value of the management summary, and the type of data that should be included. Examples of relevant data cited in the discussion include total area surveyed or excavated, percentage of development covered, total number of sites encountered, interception rates, etc. A need was also expressed for easily accessible locational data, down to the level of quarter section. This data should be included in the abstract for smaller projects, but it may be more practical for larger projects to provide summary maps with survey transects and sites plotted. Other suggestions to meet the needs of the 'report scanner' included the use of indexes for larger reports, or more detailed tables of contents, with page numbers.

Finally, a great deal of concern was expressed regarding public accountability, and accountability towards the native community. These are areas which will increasingly require careful consideration, both on the part of resource managers and consultants.

There was a strong feeling that the public in general, and natives in particular should be involved in the actual field work wherever the size of the project and accessibility of work site allows. This involvement can take various different degrees and fulfil different capacities, such as that of visitor, volunteer, and advisor. There was general agreement that incorporating a program of public involvement could be both costly and time consuming, and therefore should be written into the terms of reference of contracts for larger projects.

Another aspect of accountability to the public and/or native community discussed was reporting of results. It was agreed that it would be impossible to produce one report that is suitable for the public as well as fulfilling legal (permit) requirements and resource management concerns. The public doesn't need or want all the details required for a full permit report. The abstract or impact management summary is also not suited to this purpose, as it supplies locational information that is both classified and not of interest to the public. Perhaps the most useful suggestion was the inclusion of a public narrative. This could be similar in nature to the abstract, but limited to information of interest to the public, and written with that audience in mind.

3.4.2 Literature Review

The archaeological literature does not contain much discussion on reporting standards, with the notable exception of Quigg and Brumley (1984) and Dill (1984). Since a comprehensive critical review of non-published permit reports is well beyond the scope of this report, the literature review will be limited here to the discussion of the two publications mentioned above.

Quigg and Brumley devoted a whole chapter to the evaluation of reporting procedures for stone circle sites. They initially reviewed 88 documents dealing with stone circle investigations, and eventually reduced the sample to 34 reports whose contents were examined in greater detail (1984:32). They reviewed the quality of general reporting, stone circle data, analysis, reporting of methodology, and reporting of environmental conditions. Of these categories, the reporting of information concerning site environment was by far the most consistent and specific. In general, they felt that stone circle investigators lacked well formulated research designs, and that the resulting reports were generally of poor quality and limited usefulness (1984:46). They recommended that researchers develop clearly defined objectives for each project, and place the information within a workable framework; in other words, develop a good research design. They also recommended that cultural resource management agencies establish minimum standards for reporting procedures (ibid.:38, 47).

Using Quigg and Brumley's review document and recommendations, the State Historical Society of North Dakota issued a set of guidelines for recording, evaluation and mitigation of stone circle sites in North Dakota (Dill 1984). The guidelines on report contents introduced in that document are both specific and thorough. The required contents are worth listing here:

- site forms;
- total area, volume and percentage of the site excavated;
- number of features tested or excavated;
- exact counts of the artifacts noted, recovered, and/or analyzed;
- descriptions of artifact densities and distributions;
- description, comparison, and analysis of artifacts recovered;
- illustrations of all artifacts recovered, or representative examples;
- summary tables of whatever data can be more easily compared in that form;
- descriptions of stratigraphy, including consideration of stratigraphic placement of ring features and recovered artifacts;
- inter- and intra-site interpretations, comparisons and synthesis of data from each site/group of sites considered;
- description and definition of measurements taken, especially those related to the computation of ring feature diameters;
- description and definition of methodologies and techniques applied to excavations, mapping, shovel probe/test unit targeting, and feature and artifact analysis;
- photographs of the site and all tested/mitigated features and at least a representative sample of the remaining features on the site (ibid.:15).

3.4.3 General Discussion and Conclusions

Quigg and Brumley (1984) stressed the need for reporting standards, and this need was echoed to a certain degree in the workshop discussion. Because stone circle sites often produce limited information, and because stone circle researchers are still trying to perfect

ways of interpreting that information, the accumulation of data from numerous stone circle studies is particularly important. The main source of such data are reports prepared by heritage resources consultants.

The immediate priority in producing a report is to provide the client and the regulatory agency with the information they need to make decisions about the management of the resource in question. However, one of the main purposes of heritage legislation is to preserve heritage information that would otherwise be lost in the face of development. The information supplied in reports on stone circle sites is usually all that is preserved from those sites. It is therefore important to present that information in a manner that is both accessible and useful to other researchers. Reports that do not meet the requirements of future researchers and resource managers are ultimately a waste of the client's money, a waste of the time and effort expended in establishing heritage resource legislation, and a waste of finite heritage resources.

The recommendations for reporting standards presented below reflect many of the concerns expressed by Quigg and Brumley (1984) and are generally similar to the report content guidelines outlined by Dill (1984:15). However, the concern expressed during the workshop with accessibility of data within the report is reflected here in a greater emphasis on report organization.

The management summary/abstract, and a detailed table of contents are key elements allowing for the easy access to data. Since their importance is often overlooked, they have been dealt with in some detail in recommendations section.

Quigg and Brumley emphasized the importance of developing a good research design and a methodology specifically designed to support the research design (1984:46). This also came up repeatedly throughout all the workshop discussion sessions and was reiterated in verbal and written feedback received after the workshop. The feeling that methodology should be tailored to research design was the greatest factor in the reluctance of the workshop participants to commit to specific numeric limits (minimal or maximal) for data collection, testing and excavation at stone circle sites. For these reasons, recommendations for the presentation of a well argued research design and supporting methodology are specified below.

As discussed in the session on goals, the two most positive qualities of stone circle sites lie in the unique potential they provide for the analysis of settlement patterns and spatial patterning. Both of these analysis types require very specific topographic and locational information that is most easily presented in a map format. The quality of site maps is therefore particularly important for stone circle research. Quigg and Brumley specify a number of problems in the quality and presentation of site maps in the reports they reviewed (1984:39). This concern was also reflected in the workshop discussion. Accordingly, standards for site maps are specified in the recommendations section. Summary maps of site locations and survey transects in relation to topography are also

important for stone circle research, since both the locational distribution of stone circle sites and areas where sites were not found provide further geographic and topographic data for settlement strategy studies.

Quigg and Brumley note that while "Most reports reveal sufficient data...to permit a general understanding of what they were discussing", specific data were often missing (1984:27). The concern with access to basic data for other researchers was also expressed in the workshop, and was the subject of some of the fiercest debate over feature data recording. Recommendations regarding the inclusion of specific stone circle data have therefore been provided in the following section under the 'Appendices' heading.

The issues of public accountability and native involvement in archaeology have been a concern for some time now, but it would seem that they are coming to the forefront in the 1990's. From the workshop discussion, it was obvious that they are of prime concern to the participants. However, the discussion was relatively unfocussed, and failed to come up with any definite solutions. Since these problems are complex, and are not specific to stone circle research, they are probably better dealt with elsewhere. This issue would best be addressed as the subject of another workshop.

3.4.4 Recommendations for Reporting Standards

The following recommendations are meant to apply to standard impact assessment and mitigation reports dealing with stone circle sites. The information listed should be considered essential, although the exact organization of the information may depend upon the size and nature of the report. In the case of very large areal studies, the inclusion in the management summary of all legal descriptions in the project area or lists of all sites investigated might be impractical. In these cases, the page numbers upon which summary lists or maps can be found should be referenced in the management summary. Smaller reports, on the other hand, might include some of the data, listed here under appendices, within the body of the report.

Reports on impact assessment and mitigation studies dealing with stone circle sites should include the following:

a. a **Management Summary** which includes

- total area examined, and whether the survey was linear or block,
- legal descriptions or a summary of legals in the project area,
- total number of sites investigated, counts of site types,
- listings of Borden numbers (if less than 10),
- a summary of excavation, including total number of square meters excavated,
- the total number of features mapped, limited data collected, tested and/or excavated, and
- a summary of diagnostic affiliations;

b. a detailed **Table of Contents** with page numbers;

c. a **Research Design** and supporting **Methodology**, which are both fully described,
- presentation of all relevant data, followed by
- discussion which provides reasonable support for the conclusions and recommendations;

d. a **project summary map**
- on 1:50,000 NTS map or copy, with plots of
- all areas investigated, and
- all sites encountered;

e. **site maps**
- for all identified sites,
- with plots of all identified features,
- an indication of which features were tested, data collected/mapped, excavated,
- a scale, an indication of true north, datum point, key, and site numbers,
- detailed topographic and environmental data (trees, sloughs, rivers, major breaks in slope or depressions, etc.);

f. **Appendices**
- including all ring maps,
- all collected feature data,
- photos and/or drawings of all formed tools, diagnostic ceramics, and
- a listing of results for each shovel test (e.g. Test 1: 7 flakes, 1 scraper, 2 bone fragments).

3.5 Resource Management Goals

3.5.1 Workshop Discussion (Moderated by Gary Adams)

There was a brief discussion of regional management plans specific to research goals for stone circle sites. From the discussion, regional management plans of this sort seemed to have met with more widespread acceptance in the United States, but such plans have not been fully developed or implemented in Alberta and Saskatchewan. There was a reluctance among the Canadian participants to see this as a responsibility, or even a prerogative, of the regulatory agencies. It was generally felt that it is up to the individual to keep up to date on current research problems, and up to the professional community to come together in sessions like the current workshop to discuss goals and gaps in the archaeological record. The discussion then turned to a number of general research problems and goals that should be kept in mind by both consultant and regulatory agencies.

There was some expression of concern regarding the treatment of stone circle sites as entities distinct from other types of habitation sites which may have differed only in the use of wooden pegs or other means besides stone cobbles to hold down the tent edges. It was felt that there is some merit in comparing small stone circle sites with small lithic scatters, and larger ring sites with larger buried campsites. However, the discussion continually came

back to the fundamental and unique advantages of stone circle sites. These generally fell into two categories.

The first advantage of stone circle sites is that they provide an observable feature that delineates what we know to have been the interior of a habitation structure. This allows for the types of spatial analysis of activity areas that are seldom possible for buried campsites (i.e. inside versus outside activities). A related point made was that the presence of ring rocks in specific configurations may allow determination of the original lodge orientation (doorway orientation), which also presents a unique opportunity to study how space was allotted prehistorically. There was concern that some consideration be given to developing models of spatial patterning of activity areas outside the stone circle and avoid concentrating solely on activity areas inside the ring.

The second advantage of stone circle sites that was pointed out was in the realm of larger settlement pattern studies. Stone circle sites are usually surface sites, with easily visible indications of prehistoric occupation. Their frequency and distribution in relation to landscape factors can probably give us more information about settlement on the open prairie setting in a much more cost effective manner than any other type of site.

The discussion kept shifting between the unique advantages of stone circle sites and the need to treat them like any other habitation site, with no one apparently willing to disagree with either point. Ultimately, the closest thing to a solution to this problem appeared to be a call to use stone circle sites to develop models of behaviour in the areas of spatial patterning and settlement strategies, and then to apply these models to their analogues in other types of habitation sites. For example, models about the allotment of space could be developed using small, single component stone circle sites, and applied back to small lithic scatters. This need for the development of models applicable to other site types definitely seems to be a desirable goal for future stone circle research.

A second, surprising but very important point that often came up throughout this session was the research value of smaller stone circle sites. For a number of reasons, there has been a definite trend in the past to allot higher significance values to larger stone circle sites, and to concentrate greater amounts and more intensive types of research on those larger sites. However, a concern frequently expressed throughout the course of most of the sessions in this workshop was the problem of contemporaneity and lack of temporal control for the larger stone circle sites. Some very compelling arguments were raised for the importance of investigating smaller, presumably single component sites. Furthermore, most of the research questions addressed in this session have been oriented towards the more intensive study of these smaller sites. There was a general feeling that although larger sites should still be considered an important part of the stone circle site sample, there is a need to shift emphasis to a certain degree towards preserving and investigating a better sample of smaller sites, at least to the point where we can use these sites to develop models about spatial patterning and settlement strategies that can then be applied to the larger, more problematic sites. This emphasis has definitely been lacking in the past, and both regulatory agencies

and contractors need to reconsider some of their priorities when allotting significance to stone circle sites on the basis of site size.

Finally, a number of the workshop participants expressed a need to evaluate our methodologies and models. It was generally agreed that this type of evaluative study would not come from the academic community; that the resource management community is on its own where stone circle sites are concerned. Furthermore, evaluative studies probably cannot be justified in the case of most impact assessment/mitigation work. There is a role for such studies in large scale reservoir projects, but there does not appear to be much in the way of large reservoir studies planned for the near future. There was some discussion regarding obtaining grants for evaluative studies, but the problem was essentially left unresolved.

A rather fitting end to the summary of this session and to the workshop itself would be to paraphrase an opinion from Don Hanna (University of Calgary), that in spite of all the negative hype surrounding stone circle sites, it was clear from the discussion that took place during the workshop that stone circle research is currently in a healthy, critical, evaluative stage.

3.5.2 Literature Review

There are a number of relevant discussions in the literature on resource management goals for stone circle sites. These range from general goals to specific hypotheses to be tested.

As early as 1978, Gary Adams identified a number of goals for future work on stone circles, many of which remain relevant today. He recommended attention to stratigraphy to determine possible superimposition of cultural components, and an attempt to date as many sites as possible (1978:110). He also identified as worthy of further investigation: environmental setting, inside versus outside distribution of artifacts, central hearths, other ancillary features, and doorway location (ibid.:111).

Davis and Kehoe provided introduction and retrospectus articles in the 1983 *Plains Anthropologist* memoir on stone circles (Davis ed. 1983). In his introductory article, Davis tended more towards discussing the history of stone circle research, but he did note a basic need to develop ways of distinguishing low-yield from high-yield stone circles in advance of excavation (1983a:4). In his summary article, Kehoe noted a number of areas that required more work; investigation of settlement strategies, spatial separation and chronological ordering of stone circles within a site, relative changes in stone circle size through time, Pelican Lake phase stone ring sites, and developing ways of isolating settlement events and episodes (1983:342).

Quigg and Brumley (1984:76-78) set out a series of eight specific hypotheses and briefly discuss methods of testing each. These include the much discussed wind direction hypotheses.

Ronaghan (1989) provided a method for evaluating significance of stone circles. Although not expressed in the form of goals, his significance model does indicate traits in stone circles that should be recognized as being worthy of further study. These include chronological information, integrity of occupation, degree of feature variety, presence of structural information, presence of patterned artifact distribution, and uniqueness at the local and regional levels.

The most extensive and critical review of stone circle research was done by David Burley (1990). He emphasized the need to continually review goals and approaches in stone circle research (ibid.:343). Specifically, he questioned the ability to predict tipi size from stone circle size, since this requires certain assumptions regarding which dimension of the stone circle represents the perimeter of the tipi. Burley also questioned the ability to investigate settlement patterns and social structure at stone circle sites on the assumption that the various features are contemporary, without having dated the features used in the analysis. He felt that without extensive dating of stone circles, intra-site spatial analysis is of limited value (ibid.:354).

3.5.3 General Discussion and Conclusions

The session on resource management goals was the most free flowing of all the sessions, and yet was extremely productive in terms of establishing directions for future research. Stone circle researchers obviously do not lack for ideas regarding directions for future research; they are merely struggling with ways to apply such ideas to the practical world of contract archaeology, where the great majority of stone circle research takes place.

Perhaps the most prevalent goal reflected in both the workshop discussion and in the literature on stone circle research is the need for tighter temporal control on stone circle sites. Workshop discussion during the session on excavation and the session on goals emphasized the importance of dating stone circle sites in general, and particularly the individual features within the sites. The recovery of both absolute dates and cultural diagnostics such as projectile points and ceramics was felt to be necessary for as many features as possible at stone circle sites. This concern was reiterated in the literature; it was mentioned by Adams (1978:110), Kehoe (1983:342), and was one of the main points of Burley's critical analysis (1990:354).

The concern for the treatment of stone circle sites in a similar manner to the treatment of other habitation sites was mentioned a number of times during the workshop discussion. Specifically, participants suggested that square units of excavations should be used, excavation should not be limited to feature interiors, and attention should be paid to site

stratigraphy, chronology and spatial distribution of artifacts. This concern was generally not strongly expressed in the literature on stone circle sites, but was mentioned several times during the panel discussion and audience participation during the stone circle site session held during the 1981 Plains Anthropological Conference in Bismark, reported in *Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, (Davis 1983 ed.: 352). The idea that information on spatial patterning at stone circle sites could be used to develop models for other habitation sites was also suggested during that session (ibid.:356).

The potential advantages of stone circle sites for investigating both spatial patterning and settlement strategies had been recognized by both Adams (1978:111) and Kehoe (1984:342), and formed the basis for most of Quigg and Brumley's eight testable hypotheses on stone circles (1984:76-78). The workshop discussion demonstrated that these areas of research still need our attention.

The stress placed on the importance of smaller stone circle sites during this workshop is a relatively new trend which has not found strong expression in the literature to date, although it is occasionally mentioned in passing (Tratebas 1983:44). However, it is difficult to argue with the logic of developing models of spatial patterning and settlement based on sites that are more likely to have resulted from single events. Of course, larger aggregate sites cannot be ignored in the study of settlement patterns. Furthermore, factors such as the fact that larger stone circles are more difficult to avoid and thus more likely to require mitigation, may continue to bias the record. Artifact density may be higher at larger sites, given the likelihood of repeated occupation, but this has to be balanced against the chances of definitively associating artifacts to any particular ring or ring component at the site. In any case, smaller sites warrant closer scrutiny in the future.

The need to evaluate our methodologies and models was emphasized during the workshop discussion. This was also stressed in Burley's review (1990:354). This may prove to be difficult under the auspices of heritage resource management projects, but the need to strive towards such a goal is an important component of any science. The workshop itself was a powerful form of evaluation, and the fact that it was well attended by individuals involved in heritage resource management attests to the importance they place on establishing standards and/or goals for future work on stone circle sites.

3.5.4 Recommended Resource Management Goals for Stone Circle Sites

Since goals do not lend themselves well to minimum standards, the recommendations below are meant more as ideals to strive for in future stone circle research.

- Greater efforts should be made to date stone circle sites, and to date the individual features within such sites. This will require a greater budget commitment to dating analysis in research proposals for stone circle investigations.
- Smaller stone circle sites should be given greater significance consideration than they have been given in the past.

- Stone circle sites should be excavated in a manner that allows for easy comparisons with other types of habitation sites. Information regarding settlement patterns and activity areas at stone circle sites should be used to build models of settlement and spatial patterning that can be applied to other types of habitation sites.
- Evaluation of the methodologies and models used by stone circle researchers should be a priority.

4.0 SUMMARY AND CONCLUSIONS

In the spring of 1993, the authors were contracted to organise and report on a workshop devoted to the treatment of stone circle sites in Saskatchewan. This report summarizes both the workshop discussion and the published literature on stone circle research. One of the stated goals of the contract was to formulate recommendations for minimum standards that reflect both the workshop discussion and the views expressed in the literature. This was not always possible, as neither the literature nor the workshop participants were in total agreement on all issues. In such cases, an attempt has been made to arrive at recommendations that reflect a compromise. There were also a number of issues that the workshop participants felt should be left up to the research design of the particular project undertaken. As this view was very strongly in the majority, it has been reflected in the absence of recommendations on certain topics in this report. For example, recommendations are not provided for minimum number of shovel test used to assess a stone circle or for the quantity and location of excavation units.

Recommendations for impact assessment dealt with a number of issues, including survey sampling, feature testing and site form data. Standards are suggested for incorporating both low and moderate potential areas into survey samples and for sampling both interior and exterior of rings during testing. The relative proportions of such samples should be left to the research design. For testing stone circles, 30 centimetre auger tests were considered an acceptable alternative to shovel tests. However, where testing would impact a feature (i.e. disturbance to ring walls, cairn or hearth structure) full excavation techniques should be employed.

Changes are suggested to current site forms to standardize the collection of certain data such as distance to wood and to both permanent and seasonal water sources. Information on environmental regions and topographical locations should also be standard features on site forms.

Since there was a considerable amount of debate in the workshop regarding the relative merits of full feature mapping versus limited feature data collection, a compromise is proposed in this report. This is based upon the number of features subject to impact. For example, for sites with up to 20 stone circles, a minimum of 5 rings should be full feature mapped, and limited data collected on the remaining rings. Specific data requirements for both full feature mapping and limited data collections are also recommended.

There was a strong consensus in the workshop regarding the need for certain methodological standards for stone circle excavation. Consequently, recommendations are made regarding the use of fine screening, stratigraphic excavation and mechanical stripping. Furthermore, stone circle researchers are advised that project proposals should contain adequate budgets to ensure proper soil, palynological, floral and radiometric analysis. Full excavation of stone circles and excavation of large samples outside of the circles is also encouraged.

Specific recommendations were made for including certain components in reports as standard features. These include a table of contents, a management summary, a project summary map, site maps and appropriate appendices. Permit reports should also contain all relevant data and supporting arguments, in order to facilitate an informed assessment of the authors research design, conclusions and recommendations.

A number of research goals were identified specific to stone circle sites. In the future it would be beneficial to shift emphasis from larger, more complicated ring sites to studies of smaller ring sites. These sites tend to provide better chronological and spatial control. Another goal of stone circle research should be the refinement of models on settlement and spatial patterning that can be applied to other types of sites on the Northern Plains. Finally, the ongoing evaluation of the methodologies and models used by stone circle researchers should continue to be a priority.

Stone circle research has considerable potential for contributing to the development of an understanding of past lifeways on the Northern Plains. It is clear from the positive response to this workshop and the animated discussion that took place that the refinement of methodologies and models is an ongoing concern of stone circle research. Hopefully, the discussion and recommendations that developed from this workshop will stimulate further research on these ubiquitous features.

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APPENDIX I: ANNOTATED BIBLIOGRAPHY

Adams, Gary
1983 Tipi Rings at York Factory: An Archaeological Ethnographic Interface. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 7-15. Plains Anthropologist Memoir 19.

The relationship between the archaeologically observed remains of tipis and what is know ethnographically is discussed in light of excavations at the York Factory in Manitoba. Archaeologists have long ignored the significance of anchoring devices necessary to hold down the tipi, doorway and interior liner. The latter would be virtually mandatory in all tipis in order to protect the inhabitants from winds, condensation and rain entering from the open smoke hole. Archaeological evidence in the form of post-holes were located at the historic York Factory rings.

Adams, Gary
1978 *Tipi Rings in Southern Alberta: The Alkali Creek Sites, Lower Red Deer River.* Archaeological Survey of Alberta Occasional Paper No. 9, Edmonton.

This document contains the results of a second season of archaeological study on the lower Red Deer River.

Adams first describes the results of a resurvey of the area, which provided a sample of 197 ring sites (1200 rings). He found exposed and variable terrain with a good view and readily available ungulate populations to be the most preferred locations. Virtually all sites had access to seasonally available water, although river terraces and coulee rims with year round access to water were the least densely occupied. Few sites were encountered on sheltered terraces or next to creeks or rivers.

Five sites were excavated during this season. Rings were fully excavated and the exterior area was rigorously sampled. Some clustering of artifacts was observed in a number of rings. Other sites had virtually all of the artifacts distributed in various activity areas outside the ring.

Adams also includes a literature review. He discusses the early debate on stone circle function, and reviews some information on tipi structure present in the ethnographic literature. He discusses a number of excavation reports in light of the results of the Red Deer River excavations, and comes up with a series of characteristics of tipi ring sites. These include exposed location, standard ring size and standard rock size, lack of ring patterning, presence of artifacts, predominance of unifacial tools and poor bone recovery. Half of the sites (or more) contained hearths, fire broken rock, charcoal, bone fragments, projectile points, unifaces, choppers and bifaces. A small but significant number of the rings contained ceramics, rock-bordered hearths, doorway gaps, external hearths and small rock

piles. Living floors, internal features, bone tools, double rings, ground stone tools and pit hearths were rare.

Adams concludes with a series of problems to be considered by future tipi ring investigations. He recommends taking into consideration time depth (chronology), environmental setting, unusually shaped rings, inside versus outside artifact concentration, central hearths, associated features and doorway location.

Adams, Gary

1976 *Prehistoric Survey of the Lower Red Deer River, 1975.* Archaeological Survey of Alberta Occasional Paper No. 3, Edmonton.

Adams' examination of the distribution of stone circle sites in the lower Red Deer River in Alberta resulted in the observation of the following trends under statistical analysis. Most sites (88%) are located in the open prairie or on terrace edges and can be found associated with a dramatic elevation change. Few sites are on flood plains and coulee bluffs. Access to ungulate ranges (85%) and stone cobbles (85%) seem to be preferred to the availability to permanent water (mean distance: 2.95 km) or wood (mean distance: .98 km). Seasonally available water was however readily accessible. There seemed to be little pattern to ring site size (1 - 200 rings), distance between rings (1 - 20 m apart), or stone circle size (mean: 4 - 6 m).

Brasser, Ted

1982 The Tipi as an Element in the Emergence of Historic Plains Nomadism. *Plains Anthropologist* 27:309-321.

The origin of the tipi on the Northern Plains has long confounded researchers. Brasser introduces evidence to suggest that people were living in small conical lodges previous to the introduction of the tipi. This lodge was made of a number of skins, mats or pieces of bark spread over a frame of poles. The tipi was an "adaptive response" to the high winds of the Plains environment. The need for a smoke hole formed part of this adaptation. Tipis were thus centred around the Canadian Plains, Montana, Wyoming and northern Colorado. The four pole variety found in the western Plains was first invented around 5000 BP and is linked to the use of dog travois. The canid faunal remains from the Gray Site for instance, show trauma associated with the use of travois. The three pole variety did not originate on the Plains, but was brought in by the Cree around 450 BP.

Brumley, J. H. and B. J. Dau,

1988 Historical Resource Investigations Within the Forty Mile Coulee Reservoir. Archaeological Survey of Alberta Manuscript Series No. 13, Edmonton.

This report describes the results of a multi-year impact assessment and mitigation program of the Forty Mile Coulee Reservoir project. A major emphasis is on the development and implementation of a data recovery methodology for stone circles, focusing upon the stone circles themselves as specific units within a site. This includes the development of a Limited Stone Circle Mapping system, which does not actually involve mapping the rings (only excavated rings were mapped), but involves the collection of a set of specified data, such as a series of diameters and octant rock counts. An associated auger testing program is developed, using 10 small-bore auger holes drilled in specified patterns. These patterns are arranged within a framework of 'Analytical Units' based on directional segments and relative distance from the centre and/or walls of the ring.

Some hypotheses regarding stone circle feature characteristics are tested using analysis developed in relation to the above mentioned methodology applied to the Forty Mile Coulee data. To supplement the data from the 70 Forty Mile Coulee ring sites, data from an additional 93 ring sites compiled under a number of other Ethos projects (i.e. Verdigris Coulee, Ross Glen, Suffield) were added to form a Stone Circle Data Bank, against which all results could be tested.

A number of patterns are observed. Site use (based on number of features) increased with topographic relief and access to water and wood. The largest sites occurred on coulee, stream and river terrace edges. Since these sites are also more likely to contain hearths and higher artifact densities, a winter occupation is hypothesized. However, the majority of sites were small (less than 4 rings), contain the remains of only one bison, and do not have hearths. This is thought to indicate that group size was based on small, transient extended families through most of the year.

Feature data analysis looks at stone circle size, stone placement within octants, and stone circle shape. Emphasis is on patterning in grouped and mean feature values rather than individual feature variables. Ring size increased only slightly between late prehistoric and historic sites. Octant rock loading generally corresponds to yearly mean wind velocity, although little correlation is found between any given month of the year and any stone circle data set. Doorways are proposed to be in the northeast to southeast octants, on the basis of rock distribution. Octant rock loading is not found to be helpful in establishing contemporaneity. Shape, based on long axis orientation is found to be "not always well defined with difference between various axes values often being no more than a few centimetres" (p.133).

Artifact distribution from the auger, shovel testing and excavation program is examined (along the analytical units) in light of ethnographic data on interior activity areas and inferred and/or recorded male/female activities. Material was most dense inside and

immediately adjacent to the ring. Items thought to be indicative of male activities (projectile points and exotic lithics) were usually associated with this area. Items associated with female activities (scrapers and utilized flakes) had a more generalized distribution.

Burley, David

1990 Tipi Rings and Alberta Prehistory: Toward a Historical and Critical Review of a Legislated Archaeology, *Plains Anthropologist* 25: 343-357.

Burley describes tipi ring archaeology as a product of legislated concern. Although tipi ring sites are generally scarce in data other than the ring rocks themselves, they are highly visible and abundant, and are frequently found to be in conflict with land development programs. Heritage resource legislation has resulted in the detailed documentation and excavation of sites that might otherwise be ignored in a pure research context. The resulting reports are often limited to descriptive statements on ring structure, or on highly tentative interpretations of paleo-wind direction.

Archaeologists have experimented with a wide variety of excavation and recording techniques for tipi rings, encompassing sampling design, excavation unit types and excavation methods (augers, sod strippers, backhoes), as well as a number of other approaches to data recovery or enhancement (vegetation patterns in relation to buried rings, boulder flow for relative dating). These analyses are often costly, and are hard to justify given the results. On the other hand, Burley cites major improvements in methodology for mapping and recording both rings and ring sites. These include the 'Tipi Quick' method of ring mapping, systematic recording routines ('Limited Stone Circle Mapping') and use of aerial photography in providing scaled site maps.

Related to the development of several of these recording methodologies are developments in theoretical and analytic approaches to the study of tipi rings. These include the study of temporal and ethnic affiliation based on ring size and form and, more frequently, the study of the tipi ring structure to infer population dynamics (number of individuals, poles, hides, dogs, length of occupation), tipi architecture (interior liners, 3 or 4 pole structure, door location, activity areas), seasonality (wind direction) and settlement and subsistence patterns (water sources, availability of resources, weather patterns, and carrying capacity). For example, analysis of ring rock placement in the light of wind direction statistics is now commonplace.

The main problem with much of this research is the lack of absolute dating and temporal associations between features at these sites. Less than 1.5% of the rings in the Alberta inventory are listed as having associated temporal information, such as radiometric dates or cultural diagnostics. The assumption that the features at multi ring sites are contemporaneous could lead to false conclusions about settlement patterns, and social structure and tends to simplify Northern Plains Prehistory into a single, static cultural system. Burley also takes issue with the use of Blackfoot ethnography from the historic

period to build models of cultural systems, as well as the use of complex transformational models based on questionable assumptions on relationships between ring size and tipi size.

Finally, Burley calls for a push towards cost effective research, using as an example Brumley's 'Limited Stone Circle Mapping' system. In particular, he questions the weighing of ring rocks as time consuming and not very productive, especially when simple stone counts might serve equally well.

Calder, Jim

1979 *Stone Circles at Chin Coulee.* Archaeological Survey of Alberta Occasional Paper 13, Edmonton.

Forty-eight rings were identified in Chin Coulee, Alberta. All sites were mapped and photographed from the air. Each ring was also individually mapped and certain data recorded: size and shape, depth of ring rocks, number and weight of ring rocks, spacing of ring rocks, scattering and ring robbing, rock piling, door position, hearths, external features, and clustering of rings.

Campbell, Kenneth

1981 Remote Sensing: Conventional and Infrared Imagery for Archaeologists. In *Megaliths to Medicine Wheels: Boulder Structures in Archaeology*, edited by Michael Wilson, Kathie Road and Kenneth Hardy, pp. 1-8. University of Calgary.

This report examines the use of aerial photography and infrared sensing to help locate tipi ring sites. Infrared imaging can actually locate buried components. However, it is somewhat impractical to implement in most surveys due to the high costs involved.

Campbell, Walter

1915 The Cheyenne Tipi, *American Anthropologist* 17:685-694.

1927 Tipis of the Crow Indians, *American Anthropologist* 29:87-104.

In these two articles Campbell examined the traditional structure of tipis amongst the Cheyenne and Crow. In general, tipis were 4.5 to 15 m in diameter with doorways that tended to face east. If the tipi became much larger, the secondary poles would tend to clog the smoke-hole. The author identified two distinct styles of tipis in use on the Northern Plains: the three-pole and the four-pole base. The three-pole variety was found amongst the eastern tribes including the Arapaho, Arikira, Assiniboine, Cheyenne, Gros Ventre, Kiowa, Mandan, Oto, Pawnee, Plains Cree, Ponca, Teton Sioux and the Witchita. The four-pole variety was found amongst the western tribes including the Blackfoot, Comanche, Crow, Flathead, Hidatsa, Nez Perce, Kutenai, Omaha, Sarsi, Shoshone and Ute. The three-pole

variety tended to be more stable in high winds than the four-pole. The floor of the three pole variety was also ovoid while the four pole variety tended to have somewhat elliptical floors.

Dau, Barry

1981 Three Methods for Rapidly Recording and Testing Archaeological Sites. In *Megaliths to Medicine Wheels: Boulder Structures in Archaeology*, edited by Michael Wilson, Kathie Road and Kenneth Hardy pp. 39-46. University of Calgary.

Three methods are described here to facilitate the recording and testing of tipi ring sites. Mapping techniques include the use of a photo boom and a mapping board (a variation on the tipi quick method). Testing can be quickly completed using SPEED, an excavating machine devised by John Brumley.

Davis, L. B.

1983 Introduction to Tipi Ring Problems and Research. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 1-5. Plains Anthropologist Memoir 19.

The value of tipi rings have historically been down-played by archaeologists leading to an ongoing bias against these numerous features. Early research first disagreed whether or not stone circles were in fact tipi ring remains. Researchers then dismissed them as not being worthy of investigation, or as being so difficult to excavate because of the paucity of artifacts that the time and effort needed was not warranted. Attention to cultural historical models further reduced interest in these diagnostically poor sites. It is argued that an important part of archaeologists understanding of the Plains lifestyle is being ignored. The need for large artifact numbers to justify excavation can be considered a western bias; a key to understanding these materials might be to interpret the data by the actual paucity of materials or absence of specific artifact or feature types.

Davis, L. B.

1981 Aerial Photogrammetry of Stone Circles and Piled Stone Alignments at the Pishkun State Monument, Montana. In *Megaliths to Medicine Wheels: Boulder Structures in Archaeology*, edited by Michael Wilson, Kathie Road and Kenneth Hardy, pp. 9-29. University of Calgary.

Davis laments the 'give away' attitude that has developed in recent years in regards to tipi ring research. This is due in part to the large numbers of such features found on the Northern Plains and a lack of standardization in research methodology. More information is needed on settlement patterns to develop meaningful hypotheses on the potential of these sites. Standardized two-dimensional recording of stone circles would be a meaningful

starting point. With large ring sites the most cost effective method would be to use aerial photography to produce detailed maps of both the site and individual rings. The collection of temporal and functional information should also form part of all research designs.

Davis, William E.
1983 A Morphological Analysis of Stone Circles From the Copper Mountain Project, Shoshoni, Wyoming. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 71-79. Plains Anthropologist Memoir 19.

Faced with a series of stone circle sites which produced few artifacts during excavation, Davis concentrates on a functional analysis of the features themselves. He compares morphological variation in the stone circles within a number of sites from the Copper Mountain project with ethnographic traits associated with the plains indian tipi.

Davis looks at association between such variables as presence of central feature, number and spacing of ring rocks, presence of double rings and size of ring. He concludes that double-course stone circles with diameters of 4.0 to 6.0 m, containing 50-105 stones spaced 10-50 cm apart are most likely to be the remains of tipis.

Deaver, Ken
1989 Identifying Ring Site Occupations, in *Households and Communities*, edited by S. MacEachern, D. Archer and R. Garvin pp. 256-265. University of Calgary.

Research in Montana and North Dakota has led Deaver to a number of conclusions regarding stone circles. Most tipi rings are either Besant or early Old Women's phase (2000-800 BP). The density of the materials and ring rocks would seem to indicate occupations of short duration. Contemporaneity might be indicated by similar long axes in large tipi ring sites. A useful seasonality marker when traditional indicators are not present could be the density of the ring rocks. Fewer ring rocks would probably be used in the summer in order to allow warm breezes to pass through the tipi. Conversely in the winter there would probably be more stones used in order to keep out the wind and to trap heat inside. It is therefore important to expose all ring rocks when plan views are drawn or photographed.

Deaver, Ken
1983 Rings at the Johnson Bison Kill Site, 24PH8. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 59-70. Plains Anthropologist Memoir 19.

Deaver describes excavations at a very large stone circle site (184 rings). A total of 378.5 square meters of excavation revealed that the site was a multi-component occupation. Diagnostics and 21 radiometric dates indicated two or more occupations each from the Middle Prehistoric and the Late Prehistoric periods.

Deaver argues that test pits smaller than 4 x 4 m are probably not cost effective, and that at least one quarter to one half of a ring should be excavated to understand the ring contents. He notes that excavation of over one half of the ring has not proven, in his experience, to produce significantly more information that what was recovered from the first half. He also advocates testing of areas outside the ring.

Deaver, Sherri

1989 Space, Worldview and Architectural Form, in *Households and Communities*, edited by S. MacEachern, D. Archer and R. Garvin pp. 243-255. University of Calgary.

Deaver discusses the placement of rings in the landscape as a result of a number of cultural decisions that reflect traditional views of privacy and proper social distance. Age and marital status and ring function might also affect ring size. Hence, ring size might not indicate the number of people occupying the tipi and currently employed population estimates are probably much to high. The average was probably only 4 adults to a 4.5 m diameter ring. Using this estimate, Deaver goes on to calculate tipi ring weight, the hide number, number of dogs needed for transport, and the daily caloric input needed to sustain a band.

A pattern was observed where tools associated with male activities, such as projectile points were made from exotic lithics. Tools associated with female activities, such as scrapers and grinding stones, were made from locally available lithics. She hypothesizes that this resulted from males having larger "core areas" than females.

Dill, C. L.

1984 *Guidelines for Recording, Evaluation and Mitigation of Adverse Effects to Stone Circles in North Dakota*. State Historical Society of North Dakota, Bismarck.

This document was written in response to the review of stone circle research and recommendations which Quigg and Brumley were commissioned to prepare for the North Dakota State Historical Society (1984). Dill recommends two alternate standard investigation strategies, based on the number of stone circles present at a site.

For sites with 25 or less stone circles, Dill recommends a two stage approach. The survey stage requires the completion of site forms, recording of ring diameters, site mapping, feature mapping, definition of site boundaries, shovel probing, and depending upon the

results of the shovel probes, either mechanical stripping or limited formal testing. Where sites are rated as significant, a second stage, mitigation, will be implemented. Reports are required for each of the stages.

For sites with over 25 stone circles, a three stage approach is recommended. The survey stage requires the completion of site forms, completion of a sketch map of the site, definition of site boundaries, shovel probing, and depending upon the results of the shovel probes, optional limited formal testing. The assessment stage requires the recording of ring diameters, site mapping, feature mapping, formal testing, and depending upon the results of the formal testing, optional mechanical stripping. Where sites are rated as significant, a third stage, mitigation, is implemented. Reports are required for each of the three stages, prior to progression into the next stage.

Dill also gives a detailed set of guidelines for report content.

Dormaar, J. F.

1976 Effect of Boulder Flow on Soil Transformation Under Tipi Rings. *Plains Anthropologist* 21:115-118.

In an effect known as boulder flow, it has been documented that water running through sites can modify ring rock depths. Dormaar hypothesizes that ring rock depth could be used as a relative dating method at multi-ring sites. Research at two ring sites in Alberta appear to confirm this hypothesis but radiometric dates were not obtained to test this supposition.

Finnigan, James. T.

1983 Tipi To Tipi Ring: A Transformational Model. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 17-28. Plains Anthropologist Memoir 19.

Finnigan sets up a transformational model for the progression from tipi to tipi ring, and applies it to a single Besant stone circle site near Kindersley (EiOj-10). He mentions an ethnographic reference to the adding of stones holding down the tipi in the face of windy or cold weather. He also talks about ring thickness being increased by differential rolling of small versus large rings when the tipi is being removed, and an increase in size of the ring due to rocks rolling outward during tipi removal.

Finnigan, James T.

1982 *Tipi Rings and Plains Prehistory: A Reassessment of Their Archaeological Potential.* Archaeological Survey of Canada Mercury Series No. 108.

This manuscript opens with a useful definition of the tipi and a summary of tipi ring research up to the date of publication. It examines in some detail the historic and ethnographic information available on tipi ring use on the Northern Plains. The tipi is made up of five components, cover, poles, fasteners, liners and anchoring device. The cover was made of bison hides up until historic times when it was replaced by canvas. Generally, the more hides used the larger the tipi. Size was limited only by the weight that dogs could carry. Presuming a portion of the tipi hides would be lain out on to the ground, he estimates a mean diameter of 3.89 m for tipi bases. Weight could be reduced by dressing the hides thinner resulting in an increase in ring diameter to 4.85 m. Shorter tipis or the use of two liners would also result in weight reduction and wider diameter rings. These diameters conform well in to what has been observed in the archaeological record.

Finnigan believes that pole length and weight probably increased significantly with the adoption of the horse. There were two pole foundation patterns linked to the Plains. Following Campbell, he assumes that the three pole foundation was used in the east and was presumably more stable than the four pole pattern found in the west. Four pole tipis tend to be somewhat circular while three pole tipis are oval.

Anchoring devices are not limited to cobble stones. They can include blocks of sod, logs and bone and wood pegs. The use of boulders would be selected for their abundance, ease of placement and removal and because there is no need to transport them. Pegs are heavy, difficult to place in some soils and hard to make without metal tools. They could be used in such times as the winter when stones become either difficult to find or frozen in the soil. Cobble use might then be seasonal. Summer use of rings is also argued for because of their location near water, away from wood, and in windy exposures away from insects.

Finnigan argues that there would be little movement of ring rocks when the hides were removed. Kehoe had felt that there might be an increase in size of some 25 cm from the actual tipi to the archaeologically observed stone circle.

Living floor arrangements were portrayed as fairly uniform. Opposite the door, behind the central fireplace was an alter; to the sides were the beds; and the front was reserved for storage. Finnigan follows Wedel in estimating a mean of 1.86 m per person occupying a tipi.

The majority of the thesis is devoted to using this ethnographically derived data to develop complex mathematical formulae to determine cultural patterns from the archaeological record. These include the size of the floor necessary for any given number of people, the actual diameter of the tipi floor needed for these people, the cover area in relation to ring diameter, the number of hides in relation to cover area, the number of poles in relation to tipi ring circumference; the overall weight of the tipi, and ring rock loading in compensation

for wind velocity. These indices presume tipi ring size is determined by population size rather then wealth or social status. They also presume that taphonomic processes have not adversely affected the stone circle.

Variables are used in conjunction with inside and outside diameters include: ring rock thickness, number and weight, and distribution of stones by octants. Using the British Block Cairn Site (EdOp-1) as an example, it was suggested that sites with 10 rings or less would probably represent band sites of around 50 persons. Bigger clusters such as camp circles would represent larger gatherings of people for various communal activities. An attempt was also made to prove that tipi ring size and wind velocity were the variables that would most affect the number and distribution of stones. While there is some correlation when examining variation within individual tipi ring clusters, difference are much more evident when examining large sets of ring clusters.

Finnigan, James T.
1980 Interpreting Tipi Ring Structure. *Na'pao* 10(1&2):1-6.

This article is a summary of some of Finnigan's thesis research. He looks at tipi ring structure at EdOp-1, the British Block Cairn site. Rings at this site are not patterned in terms of rock weighting, although the greatest number of rocks occur in one of three octants (S, SW or W) 60% of the time, a distribution significant at a 95% level of confidence. Furthermore, a number of rings in a hypothesized camp circle arrangement show some patterning according to placement in the circle; rings in the west leg are almost twice as heavily weighted as the rings along the bottom and in the east leg of the circle. The rings in the east half of the camp circle show a minor cluster in the south, southwest and west segments while the rings in the west half show no pattern at all, with most of the rocks in the NE, SE, S and NW segments. If the data for the east and west half of the rings was combined, the overall pattern is random, while if they are dealt with separately, a functional pattern emerges, with the rings in the west leg providing partial shelter for those in the east and south legs.

Finnigan also provides a list of very relevant questions for further research, including the degree of distortion from removing the tipi from the anchoring stones and the ability to predict the presence of an inner lining and doorway location.

Finnigan, James T. and Eldon Johnson
1984 The Elma Thompson Site: A Besant Phase Tipi Ring in the West-Central Saskatchewan Plains. *Saskatchewan Archaeology* 5:27-35.

Excavations were undertaken at the Elma-Thompson site, a Saskatchewan Besant Phase tipi ring site, dated at 1675 BP. Twenty-seven square meters were excavated, the majority of which were allocated to the inside of the ring. Inside diameters (4.68 m), ring rock depth

and rock weights by segment were recorded. Two features were identified, a hearth and rock lined pit. The hearth is located on the east side of the ring and the pit is on the west. The lack of a central hearth and the close proximity to a spring indicated to the authors a spring or summer occupation.

Several hypotheses regarding Besant Phase tipi ring use are generated. Besant rings tend to be larger. This could be the result of more hides being available; some sort of residential change; or in the way the rocks were removed from the ring. There is also a trend for these tipis to have fewer ring rocks. It is further hypothesized that Besant phase spring and summer sites usually have small hearths located along the edge of the ring that would serve to drive off mosquitoes and other insects.

Flayharty, R. A. and Elizabeth Morris

1974 T-W-Diamond, A Stone Ring Site in Northern Colorado, *Plains Anthropologist 19*, 161-172.

Forty-seven stone circles were examined and mapped at the T-W-Diamond Site in northern Colorado. The rings are found along the top edge of a ridge. A concentration of rocks facing the prevailing winds from the north-west was observed in most rings. Excavations at 17 of these rings recovered few artifacts and no living floors. Although all the hearths that were excavated had little ash available for dating, they did have a large proportion of the recovered artifacts. It was commented on that without the presence of these stone circles, it is doubtful that this site would have been identified.

Fredlund, Lynn B., Dale Herbort and Gene Munson

1985 Investigations at a Besant Stone Ring Site (32OL270) in Central North Dakota. In *Contributions to Plains Prehistory*, edited by David Burley, Archaeological Survey of Alberta Occasional Paper No 26, pp 116-154. Edmonton

This paper describes investigations at a very productive stone circle site. Two rings were fully excavated with *in situ* recording. A large area outside/between rings across most of site was scraped for ancillary feature location. Lithic analysis included spatial analysis of different stages of lithic reduction and tool repair; a hypothesis was forwarded that a relatively sparse scatter of lithics along east and west interior edges represents sleeping areas. Lithics recovered included 50 Besant points and two Pelican Lake points. Numerous features were discovered outside the stone circles, including hearths, refuse dumps, bone uprights (suggested anchoring devices for stone circles), and lithic reduction areas. Some patterning of outside features recognized, these occurred mostly between 4-6 m outside rings, hearths occurred both inside and outside rings, and six of seven bone uprights were located south to southeast or east to northeast of rings. The authors also did analysis of ring rock placement for the two excavated stone circles, finding higher concentrations of ring

rocks in the northeast quarter in one ring and the southeast quarter in other. They assumed that this pattern suggested East winds. The authors also examined testing methodology for stone circle sites. They suggest a testing strategy for stone circle interiors based on four .5 m shovel tests, 1 m from centre. They also suggests that features outside rings will be between 3 and 6 m from outside circumference of rings, but do not specify a particular testing strategy for this zone.

Frison, George

1967 The Piney Creek Sites, Wyoming. *University of Wyoming Publications* 33:1-92.

In this article Frison first broached the idea that ring rocks tend to be clustered in a single part of the circle in order to compensate for the strong winds of the Plains. Furthermore, he suggested that seasonality might be inferred by correlating this clustering to the prevailing winds in each of the seasons.

Grasspointer, Andreas

1980 *Archaeology and Ethno-History of the Milk River in Southern Alberta.* Western Publishers, Calgary.

Grasspointer identified 63 stone circles in a survey of the Milk River basin in Alberta. While most of these stone circles are in fact tipi remains, many could also be medicine wheels or death, sweat, menstrual or ceremonial lodges. Most of these rings were located along the edges of high ridges. There were considerable problems in identifying specific seasonal and temporal affiliations because of low artifact and feature densities.

Hanna, Donald T.

1991 Architectural Variability in Prehistoric Stone Circles Near Empress, Alberta. In *Archaeology in Alberta 1988 and 1989*, edited by Martin Magne, pp. 173-198. Archaeological Survey of Alberta Occasional Paper No. 33, Edmonton.

Hanna looks at structural data from 8 stone circles at EdOm-13 (33 km south of Empress, Alberta). He makes a case for the use of tipi-quick data recording without mapping (recording numeric data on angle, distance and size of each ring rock using the mapping board technique to measure the variables), and using the data to generate computer analysis. He especially argues for the determination of the centre of the circle using computer based statistical programs, as a more objective and replicateable approach.

Hanna tests a number of theories about stone circle structure using a series of computer programs. His data do not support Quigg's (1986) theory that differential depth of rock burial between features can be used to distinguish between non-contemporary features at a site: depth of burial appeared to be a function of weight of rock rather than age of

occupation. They also do not support Brumley & Dau's (1988) theory that octant with maximum number of stones is opposite the octant with least number of stones, the maximum value being interpreted as representing the windward side and the minimum as representing the doorway. Nor do they confirm the related theory that the longest diameter should coincide with maximum/minimum axis with the shortest diameter being perpendicular. Furthermore, his data also do not support the idea that weight loadings reflect wind direction at time of occupation, since maximum weight loadings were encountered in seven of the eight possible octants, in a sample of only eight stone circles.

Hanna argues that significant cultural information is stored in feature data, but it "cannot be extracted using the minimalist and subjective techniques that are now becoming prevalent" (p.198). He notes that architectural analysis used in tandem with more conventional forms of archaeological inquiry should be more successful.

Hovde, David M.

1983 The Hermosa Tipi Ring Site (39PN375). In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 29-33. Plains Anthropologist Memoir 19.

The Hermosa Tipi Ring site consisted of 30 stone circles in 3 clusters. Three circles were tested by 'test trenches'. Six artifacts, 16 artifacts and 75 artifacts were recovered from the trenches in three different rings. The most productive ring was completely excavated, including a number of 1 m squares along the exterior.

Artifact content of the exterior squares ranged from 0-14 artifacts per square meter, while interior squares ranged from 9-41. In all, 485 artifacts were recovered from the excavated ring. Artifacts were mostly concentrated along the interior edge of the ring, but a concentration of 182 flakes in the southwest interior and a concentration of 60 flakes between the outside of the stone circle and an exterior hearth to the south-southwest of the ring were also noted.

Cultural affiliation was made on the basis of two point fragments identified as McKean complex, and 1 flake point identified as Pelican Lake.

Hull, Kathleen

1987 Identification of Cultural Site Formation Processes Through Microdebitage Analysis, *American Antiquity* 52:772-783.

The paper compared the distribution of micro and macro-debitage in three tipi rings at the Bow Bottom Site in Alberta. Differences that were present were likely the result of cultural site transformation processes. Ethnographic evidence and Binford's ethnoarchaeological

work has shown that primary and secondary refuse are often discarded in meaningful ways. For instance, activity areas would be located in the centre of the ring away from furniture and away from the back of the ring where religious functions occurred. Secondary refuse would then be discarded into the hearth or ring wall. It was postulated that, with this evidence, specific activity areas could be identified. To the back and to the right of the tipi, male activities such as tool making would occur; while to the front and to the left female activities such as tool use and resharpening would take place.

Janes, Robert

1989 A Comment on Microdebitage Analyses and Cultural Site-Formation Processes Among Tipi Dwellers, *American Antiquity* 55:851-855.

This article was written in reply to Hull's 1987 paper on site formation processes. Janes argues that Hull overlooked a number of cultural and ecological taphonomic transforms when interpreting the distribution of cultural materials at the Bow Bottom tipi rings in Alberta. Hull did not take into account the intentional disposal of waste flakes away from the point of use or the smearing and blending that must have occurred with heavy foot traffic and rodent disturbance. Neither occupation nor abandonment refuse were distinguished.

Janes' own ethnographic research with Dene tipis in the boreal forest failed to discover any spatial patterning. Door location was dependent on the local conditions and varied considerably. There was no regularity to the placement of household items, and different activities, while regular, could occur in the same area. Furthermore, the messiest activities were often done over hides and the refuse disposed of elsewhere. Hearths seemed to contain the best possibilities for analysis as they are regularly placed and often contain refuse from all the various activities that would have occurred in the tipi. Janes feels that stone rings should thus be thought of as generalized activity areas and nothing more.

Kehoe, Thomas F.

1960 Stone Tipi Rings in North-Central Montana and the Adjacent Portion of Alberta, Canada: Their Historical, Ethnological and Archaeological Aspects. *Bureau of American Ethnology Anthropological Papers*, No. 62, Smithsonian Institution, Washington.

With this landmark paper, Kehoe offers the first systematic evidence to prove that most stone circles are archaeological manifestations of tipi structures. The sheer number of stone circles, their location in good camping locations, the correlation of average diameter with historic lodge sizes; the uniform shape, the absence of overlapping rings, uniform rock size, and presence of interior hearths all argue for the classification of stone circles as tipis.

Historical and ethnographic records also contain a number of references to the use of stone cobbles to weigh down the hide cover of the tipi. These rocks were used to keep the wind from blowing the tent over and to help keep warm air from escaping. Hearths and inner liners could also be used to help keep the tipi warm and might be observed archaeologically. With the introduction of metal wood working tools, cobbles were replaced by wood pegs.

Ring size is hypothesized to have increased after the introduction of the horse and a polygynous marriage system. The horse obviously could carry larger loads then dogs. In support of this hypothesis, Kehoe noted that larger rings tend not to be as deeply buried as the smaller rings. There was also plenty of evidence for larger tipis being used for ceremonial and political purposes. By sewing two covers together, tipis that could hold up to a 100 people were produced.

Tipis are often found in open areas, probably in order to better watch for enemies and to escape spring time flooding. In the winter rings would be more likely to be located in sheltered valleys. As would be expected from such a pattern, there seems to be a correlation between the number of rings and topography. Larger sites tend to be located in what would be the more sedentary winter camp spots. However, almost two-thirds of the 137 sites identified on the Blackfoot reserve in Alberta contain less then 4 rings and are in the type of open terrain that is felt to be indicative of a summer occupation.

Kehoe, Thomas F.

1958 Tipi Rings: The "Direct Ethnological" Approach Applied to an Archaeological Problem. *American Anthropologist* 60(5):861-873.

This article is a condensation of Kehoe's masters thesis. It deals first with the function of stone circles, lists a number of authors who participated in the functional debate and lists numerous ethnographical references regarding the use of stones to anchor tipis. Kehoe also did some of his own ethnological interviews with the Blackfeet on the reservation on which he did his tipi ring research, and offers some good quotes from reserve residents regarding the use of rocks to anchor tipis. He goes on to deal with number and frequency of stone circles, correlations between location of rings and physical settings favourable for camping, the fact that the rings often indicate patterned camps, and the size of rings relative to depth of rock burial, implying a temporal change in tipi size.

Keyser, James

1979 Variations in Stone Ring Use at Two Sites in Central Montana, *Plains Anthropologist* 24:133-143.

This paper reports the results of investigations at two stone circle sites in Montana, the Teton Ridge and Dutton Sites. The Teton Ridge site is a large tipi ring site (28 rings)

located on a high butte. Ring size was between 3.66 and 7 m. Numerous artifacts and features were recovered from this site.

At the Dutton Site, three rings varying in diameter between 4.25 and 5.25 m were located next to a small lowland swamp. The rings were made up of small cobbles piled two to three deep. In 10 m2 of excavation, no features and only two pieces of debitage were identified. While ring size was equivalent to the Teton Ridge Site, Keyser suggests that the paucity of artifacts and features, the piled cobbles and the poor location indicate that this site was a vision quest locale, not a tipi ring/habitation site. He suggests that the construction, morphology, association and site locale should be studied before arbitrarily assigning the function of tipi ring to all stone circles. These same variables should also be useful in determining seasonality and settlement patterns. Keyser also notes the need for more temporal diagnostics if variation in the archaeological record is to be understood.

Larson, Thomas

1981 Dated Stone Circle Sites in Wyoming. In *Megaliths to Medicine Wheels: Boulder Structures in Archaeology,* edited by Michael Wilson, Kathie Road and Kenneth Hardy, pp. 93-100. University of Calgary.

Four radiometrically dated tipi ring sites were examined in Wyoming. It was hypothesized that differences between Middle and Late Prehistoric stone circles might exist. Middle Prehistoric rings tend to have better defined living floors and evidence of reuse. They tend to be smaller and somewhat irregularly shaped as they are usually made up of fewer numbers of cobbles. Larson speculates that, rather then being tipi ring remains, these stone circles might in fact be stone and brush wickiups.

Malouf, Carling

1961 The Tipi Rings of the High Plains. *American Antiquity* 26:381-389.

This early paper was concerned with refuting Mulloy's hypothesis that most stone circles were not the remains of tipis. While Malouf agreed that some rings are in fact ceremonial (i.e. medicine wheels), it is impossible that most rings are ceremonial. Malouf insists that the sheer numbers and location of these rings indicate that they were habitation dwellings. He reasons that the paucity of artifacts and the occasionally great distances from water are indicative of a nomadic culture. He suggests that more artifacts might be located in sites associated with communal hunting activities since that activity would require a higher degree of sedentism.

Morris, Elizabeth

1989 Considerations of Tipi Ring Data From A Colorado Point of View: A Trial Application of HRAF Attributes. In *Households and Communities*, edited by S. MacEachern, D. Archer and R. Garvin, pp. 237-242. University of Calgary.

Morris suggests that tipis have three functions, protection from the weather and predators, a focal area for families, and a locational centre for larger aggregates of people. The quantity of single ring sites appears to indicate that family units spent a considerable amount of time alone. Conversely, there is also evidence of large seasonal aggregations in the presence of larger ring sites. This pattern is supported by the ethnographic record; most tribes practised kin-group exogamy and the recognition of tribal leaders. This would support a model where, at certain times of the year, a number of small nomadic family groups might gather together for communal activities.

Morris, Elizabeth Ann, Daniel Mayo, Richard C. Blakeslee and Patrick W. Bower

1983 Current Perspectives on Stone Ring Structures in Northeastern Colorado. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 45-58. Plains Anthropologist Memoir 19.

Most of this paper is devoted to describing the sample of 32 stone circle sites from a number of different projects. The hypothesis that larger rings are related to the introduction of the horse is presented. Data on number of rings per site, size range of rings by site, and quantity of different artifact types by site is presented. Compared to non-ring sites, the stone circle sites had more scrapers, equal proportions of points and bifaces, and fewer grinding slabs and/or hammerstones.

Mulloy, William

1954 Archaeological Investigations in the Shoshone Basin of Wyoming, *University of Wyoming Publications* 18, 1-69.

In this early paper, Mulloy argues that most stone circles on the Plains are not the remains of tipi structures. He feels that stone circles contain far more stones then is necessary for holding down a cover. He also argues that the low artifact density at excavated ring sites, the paucity of hearths and fire-broken-rock, the scarcity of post holes, prepared floors or cache pits, the absence of a door gap, the great variation in diameter, and the locale which is usually away from water and wood and in windswept, rocky, indefensible positions all suggest that stone circles are not habitation sites. He concludes that most stone circles are in fact ceremonial structures.

Quigg, J. Michael

1986 *Ross Glen: A Besant Stone Circle Site in Southeastern Alberta.* Archaeological Survey of Alberta Manuscript Series No. 10. Edmonton.

Extensive excavations at the Ross Glen site in Medicine Hat investigated 18 stone circles, recovering large amounts of cultural material and exposing 15 ancillary features within the rings and 27 ancillary features outside the rings. There was an unusual variety in the types of ancillary features present, including hearths, post molds, and fire broken rock concentrations.

A total of 754 square meters were excavated, with a slightly greater area excavated outside the rings as opposed to inside the rings. Artifact densities were approximately twice as large inside the rings, and was mostly concentrated in the centre and eastern portions of the rings.

The quantity of fire broken rock at the site and tool types suggest extensive meat and hide processing activities at the site. Coupled with the exposed location of the site, this suggests to Quigg that the site was occupied in the fall.

The main occupation at the site was determined to be Besant, dating to 500 A.D., although one ring and one ancillary feature were either dated to or contained diagnostics indicating a Middle Prehistoric occupation. Another two rings were relegated to an undated occupation which Quigg suggests is later than the Besant occupation, because they are less deeply buried. Quigg groups the rest of the rings into two clusters of rings which he suggests represent two Besant hunting groups which were occupying the site simultaneously.

Quigg, J. Michael

1981 Stone Circle Excavations in Alberta to 1978: A Summary. In *Megaliths to Medicine Wheels: Boulder Structures in Archaeology,* edited by Michael Wilson, Kathie Road and Kenneth Hardy, pp. 47-67. University of Calgary.

This article is a summary of the data collected on stone circles in Alberta up to 1978. Forty ring sites encompassing 440 stone circles had been identified. Only 23 of these sites (80 rings) were tested or excavated. Temporal information was minimal, 11 rings had been C14 dated, 28% had diagnostics. Artifact recovery was also low, only 30% of the surface rings had more than 200 artifacts. Bone preservation was usually poor due to low soil deposition and fire broken rock was poorly reported on. Quigg notes that this information tends to be better preserved in buried components. He states that Kehoe's hypothesis that proto-historic rings are larger then those in the prehistoric does not appear to be valid. However, he notes that there is evidence that some prehistoric cultural traditions, such as Besant, might have larger rings.

A number of recommendations are made in this article. Quigg feels that, since not all stone rings are tipi rings, they should be called stone circles until testing proves otherwise. He

also feels that the interior and exterior of rings should be extensively excavated in order to delineate cultural activity areas. Finally, he recommends the collection of palynological data from all hearths.

Quigg, J. Michael
1979 Comments on the Significance of Stone Circle Excavation in Alberta *Plains Anthropologist* 24:261-266.

Quigg conducted an examination of the 11 stone circle sites (37 rings) excavated in Alberta during the 1970's. He stressed that certain information must be consistently recorded in the future: vertical control, mapping of all features, ring rock weight, number and distribution, inside and outside ring diameter, temporal and cultural affiliation, and environmental and locational data. Excavation should include sampling outside of the ring feature in order to identify ancillary features like hearths and lithic concentrations. Such information may be useful in interpreting seasonality; sites with few outside activity areas and high concentrations of materials inside the ring may be winter habitation sites. High artifact quantity might also be an indicator of a longer length of occupation depending, of course, on the site function.

Quigg, J. Michael
1978 The Lazy Dog Site. In *Tipi Rings in Southern Alberta*, Archaeological Survey of Alberta Occasional Paper No. 8, Edmonton.

Nine single component stone circles and four cairns were located at the Lazy Dog Site in Alberta. Two of these rings were fully excavated to 2 m beyond the ring rocks, and an additional 12 m2 was excavated between the two rings. A single hearth was centred in one of the rings.

Nearly 90% of the lithic materials recovered came from outside the rings. While no specific patterning was discerned, it was possible to associate the outside materials with those located inside the rings. Quigg felt that the high numbers of locally available pebble cherts and quartzite was indicative of a lithic work station.

Quigg, J. Michael
1974 *The Belly River: Prehistoric Population Dynamics in a Northwestern Plains Transitional Zone*. National Museum of Man Mercury Series No. 23, Ottawa.

Following a survey in the Belly River valley in the Alberta foothills, Quigg noted several observations about spatial patterning and seasonality. The camp sites containing foetal bison remains were located in sheltered environments on the east side of the valley with easy access to wood, water and game. He inferred a winter occupation for these sites. The

stone circle sites were located on high ground on both sides of the valley, which led him to believe that they were probably occupied outside of the winter months.

Quigg, J. Michael and John H. Brumley

1984 Stone Circles: A Review Appraisal and Future Directions. Report prepared for and published by the Division of Archaeology and Historic Preservation, State Historical Society of North Dakota.

Quigg and Brumley review 37 stone circle reports from Alberta and the northern United States with respect to field investigation procedures, analysis and reporting methods. They found field techniques, data collection procedures and reporting of results to be inconsistent, irregular and haphazard, producing reports of generally poor quality and limited utility. They attribute this problem to poor understanding of stone circle sites, and a lack of well formulated goals.

This report proposes the adoption and enforcement of minimal standards for stone circle investigating (i.e. types of feature data to collect, testing program, etc.). They present a series of eight general testable hypotheses regarding stone circles.

This report also includes a review of the ethnographic literature regarding stone circles, including a detailed index of ethnographic references prepared by Leigh Heikkila.

Roll, Tom

1981 Tipi Rings in North-Central Montana: Expressions and Analysis, in *Megaliths to Medicine Wheels: Boulder Structures in Archaeology*, edited by Michael Wilson, Kathie Road and Kenneth Hardy, pp. 93-100. University of Calgary.

After examination of 83 sites encompassing over 1000 rings in Montana, Roll concludes that there is little evidence to support Kehoe's argument that proto-historic rings are larger than those in the prehistoric. Roll suggests that differences in size could instead be the result of seasonal differences related to increased ventilation or heat effectiveness. However, it is possible that the introduction of the horse might have increased site size. Following Kehoe's idea that polygyny was a relatively late introduction to the Plains, there would tend to be more dwellings used rather then an increase in tipi size.

Ronaghan, Brian

1989 Oldman River Dam Tipi Ring Significance Model. In, *Guidelines for Archaeological Permit Holders in Alberta*, Appendix M. Archaeological Survey of Alberta, Edmonton

Ronaghan outlines a method for evaluating three types of significance. Cultural historical significance is measured by presence/absence of information on chronological identity (C14 dates, points, ceramics or other diagnostics), integrity of occupation (lack of mixing), and degree of variety of features.

Behavioral significance is evaluated on whether information can be gathered regarding the tipi structure (from feature data), on the family size, structure and inside-shelter activities (through patterned distribution of cultural material within and outside the ring), and whether information can be gathered on group behaviour (on the basis of physical site characteristics).

Spatial significance is evaluated on whether they are unique or representative at the local level, at the regional level and with respect to addressing 'specific research questions' (this appears to mean paleoenvironmental studies).

The model is fairly complex, so examples are given of a number of stone circle sites from the Old Man Dam project, and how they would be evaluated using this system.

Schneider, Fred E.

1983 Artifact Distribution at Tipi Ring Sites: A Cautionary Tale. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 93-100. Plains Anthropologist Memoir 19.

During excavations and analysis of the Sprenger Tipi Ring site, North Dakota, Schneider focused on spatial distribution of artifacts. Although more artifacts and debitage were recovered from ring exteriors than from ring interiors, Schneider makes the point that, while the quantity of artifacts and debitage is greatest outside the rings, the density of these materials is greatest inside the rings. Since most artifact categories occurred both inside and outside the rings, Schneider suggested that preliminary testing of stone circle sites should focus on ring interiors for gathering information concerning site cultural affiliation, age, and cultural content. Once this important information is gathered, the expansion of site excavation could proceed according to research design.

Smith, Michael

1974 A Rapid Method for Recording Stone Circles. *Archaeology in Montana* 15:47-59.

An outline is given for rapidly recording tipi ring sites in the field. This involves placing a stake in the centre of the ring and measuring the distance and direction each ring stone is from this datum.

Stuart, Glenn S. L.

1990 The Cranford Site (DlPb-2): A Multicomponent Stone Circle Site on the Oldman River. Archaeological Survey of Alberta Manuscript Series No. 17.

At the Cranford site in Alberta, Stuart identified and mapped 87 rings. Thirty-eight rings were excavated using a 2 x 2 m excavation unit in the centre of each ring and adding subsequent 2 x 2 m units to the north, then east, south and west where warranted by productivity. Six different cultural traditions spanning the Middle to the Late Prehistoric were identified. Some spatial patterning was also observed, including the observation that the majority of materials were found away from the centre and into the ring walls. Stuart felt that this pattern would not have been perceived without complete and very careful excavation (i.e. point provenience). Ring loading was also detected in one of the two rings that was completely excavated.

Numerous materials were recovered outside the rings, but it was impossible to associate activity areas with particular rings. Attempts to associate particular tool typologies, manufacturing stages, horizontal distribution patterns and stone circle architecture with particular cultural traditions met with little success because the association of artifacts with any particular cultural tradition was difficult considering the complexity of this multi-component site. However, Stuart had some success in associating preferences for particular lithic material types with some cultures.

In light of his results, Stuart makes several recommendations for future stone circle research. He repeatedly emphasized the need for *in situ* recording, and he also recommended that excavation of stone circles should encompass at least half of the ring interior.

Tratebas, Alice M.

1983 Getting Architecture From Stone Circle Remains: A Southern Black Hills Example. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 35-44. Plains Anthropologist Memoir 19.

Excavations at the Lost Bumper Tipi Ring site (39FA392) revealed several lines of information thought to be indicative of a winter habitation, including a large central hearth, extensive charcoal staining within the ring, and a depressed floor that would probably have been impractical in warmer weather when it would have retained water runoff from rains.

Tratebas notes a concentration of artifacts between the hearth and the south end of the ring, which contains a large gap in ring rocks and is interpreted as a doorway.

Finally, Tratebas calls for concentration of some research on single ring sites or smaller sites, which she argues are most likely the remains of small family unit winter habitations.

APPENDIX II: LIST OF WORKSHOP PARTICIPANTS

SASKATCHEWAN:

Carlos Germann	Archaeology - Heritage Branch, Regina
Melanie Keisig	Archaeology - Heritage Branch, Regina
Lee-ann Irvine	Archaeology - Heritage Branch, Regina
Pat Froese	Cottonwood Heritage Services, Regina
Kit Krozser	Cottonwood Heritage Services, Regina
Eldon Johnson	Lithic Laboratories, Saskatoon
Lawrence Melit	Regina Archaeological Society
Margaret Hanna	Saskatchewan Museum of Natural History, Regina
Ian Brace*	Saskatchewan Museum of Natural History, Regina
Butch Amundson	SENTAR Consultants Ltd., Saskatoon
John Brandon	SENTAR Consultants Ltd., Saskatoon
Barb Parr	SENTAR Consultants Ltd., Saskatoon
Jim Finnigan	Western Heritage Services Inc., Saskatoon
Terry Gibson	Western Heritage Services Inc., Saskatoon
Peggy McKeand	Western Heritage Services Inc., Saskatoon
Maureen Rollans	Western Heritage Services Inc., Saskatoon
Ben Hjermstad	U. of Saskatchewan, Saskatoon
Allyson Ramsay	U. of Saskatchewan, Saskatoon
Grant Clarke*	U. of Saskatchewan, Saskatoon
Tina Clavelle	U. of Saskatchewan, Saskatoon
Marcel Corbeil*	U. of Saskatchewan, Saskatoon
D'Arcy Green	U. of Saskatchewan, Saskatoon
Geoff Robinson	U. of Saskatchewan, Saskatoon
Joe White Bear	U. of Saskatchewan, Saskatoon
Rob Wondrasek*	U. of Saskatchewan, Saskatoon

ALBERTA:

J. Roderick Vickers	Archaeological Survey, Prov. Museum of Alberta, Edmonton
Tom Head	Bison Historical Services, Calgary
Stan Van Dyke	Bison Historical Services, Calgary
Gary Brewer	Environmental Management Associates, Calgary

Barry Dau	Ethos Consultants Ltd., Medicine Hat
Don Hanna	University of Calgary, Calgary
Mack Shortt*	University of Calgary, Calgary
Dale Walde*	University of Calgary, Calgary

MANITOBA:

Gary Adams	Canadian Parks Service, Winnipeg

MONTANA:

Lynelle Peterson	Ethnoscience, Billings
Stony Vander Steen	Ethnoscience, Billings
John Brumley	Ethos Consultants Ltd., Havre
Patrick Rennie	Ethos Consultants Ltd., Havre
David Ferguson	GMC Services, Inc., Butte
Mark Baumler	Montana State Historic Preservation Office, Helena

NORTH DAKOTA:

Kimball M. Banks*	U.S. Bureau of Reclamation, Bismark

Note: Highlighted names were session moderators; names with an * were not present both days.