

Review of Block DK044 Archaeological Impact Assessment Interim Report (2012-0218)

Prepared for:

Elphinstone Logging Focus

Submitted to:

The Squamish First Nation

and

The Archaeology Branch

and

Baseline Archaeological Services Ltd

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December 7th, 2015
Project #MR 1531

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Acknowledgements

Millennia Research would like to thank the following people for their help and co-operation during this project:

- Hans Penner and Ross Muirhead of Elphinstone Logging Focus for the opportunity to conduct this study;
- Steve Acheson at the Archaeology Branch;
- Norm Kempe of British Columbia Timber Sales for facilitating access to the stem round samples.



Management Summary

Previous conflicting reports on whether scarred trees in a high-elevation cutblock in the Squamish region are CMTs or naturally scarred are examined and discussed. In particular, a report conducted under provincial *Heritage Conservation Act* Permit 2012-0218 by Baseline Archaeological Services Ltd. is critically examined. This report concluded the scarred trees were natural, due primarily to the block's location, the low proportion of yellow cedar there, a preponderance of natural scarring, and tree-ring characteristics from several samples cut from trees in the block that are purported to have non-cultural characteristics.

We find that the same data can be interpreted with opposing conclusions in many cases. The model for the potential for yellow cedar CMTs put forward by Baseline is found to have problems, most notably too low an upper elevation limit being set; an association with salmon runs that is not supported; and a claim that the location is too far inland to have been utilized. The elevation limit is lower than these trees normally grow on the southern BC coast. An association with salmon runs seems spurious, since the season of salmon runs is often very different from the season of bark harvesting. The proportion of yellow cedar in the block (33% of the stems) would not preclude precontact people going there due to the scarcity of these trees. A stand comprised of one quarter to one third of the desired species would on the contrary seem attractive. Ethnographic evidence shows that aboriginal people of the Northwest Coast often travelled far inland over multiple days in order to gather yellow cedar bark. Ethnographic, ethnobotanical, and archaeological evidence from the Squamish area in particular, and the wider world in general, shows that montane areas were not the inaccessible and peripheral areas for people as often portrayed. Yellow cedar bark was a highly valued resource.

Contrary to Baseline, we find there are clear differences between the tree ring characteristics of the trees with scars that would normally be termed CMTs (if it were not for the block location), and those with clearly natural scars. No alternative to cultural scarring is obvious to produce the characteristics seen. Other scars were indeterminate. We suggest that the knowledge base of the tree ring reaction of natural vs cultural scarring is deficient for yellow cedars although key attributes allow an assessment of whether bark was present on the scar face.

Despite a small sample size, the pattern of scarring, where all occurred in a 300 year period, and none occurred in the most recent 360 years, seems more likely to be a result of cultural rather than natural patterns. Natural patterns would be expected to be relatively continuous (and ongoing to the present) in such a high-elevation and very long-lived forest.

The evidence at hand is not irrefutably for a cultural origin. However, in the opinion of the authors, as with redcedar scars, tall, regular, and evenly tapering scars where bark was cleanly removed from one or more sides from a large portion of the stem circumference only rarely occurs naturally (though apparently only through the agency of bears). The simplest explanation of this occurrence in Block DK044 is cultural modification.

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Introduction

Millennia Research Limited (Millennia) was contracted by Elphinstone Logging Focus Society (ELF)¹ to conduct a review of an Archaeological Impact Assessment (AIA) completed by Baseline Archaeological Services Ltd (Baseline) Grant (2015). That AIA was conducted in September 2014 under *Heritage Conservation Act (HCA)* Permit 2012-0218, on behalf of British Columbia Timber Sales (BCTS). The purpose of the AIA was to investigate whether scarred *Chamaecyparis nootkatensis* (also known as Nootka cypress, Nootka cedar, yellow cypress, Alaska cypress, Alaska yellow cedar, etc.; hereafter referred to as ‘yellow cedar’) trees within proposed cutblock DK044, north of Robert’s Creek, are likely Culturally Modified Trees (CMTs). The AIA was in response to an earlier cursory survey which had been conducted by Coast Interior Archaeology (CIA) on behalf of ELF, which suggested that CMTs were present in the block (Stafford 2014). The conclusions of Baseline’s AIA were that the evidence gathered did not support cultural origin (Grant 2015:27). A more detailed description of the sequence of events and summary of the findings of each report is included below.

Approach and Rationale

The purposes of the present study are to:

- Provide a critical review of the methodology and findings of Baseline’s AIA;
- Provide a second opinion as to the cultural or natural origin of the scars on the stem round samples collected;
- Provide an independent opinion as to whether or not the scarred trees in block DK044 may be CMTs, given all the available information at hand.

Whereas the methodology for the identification of western redcedar (*Thuja plicata*, hereafter termed ‘redcedar’) CMTs is well established, yellow cedar CMT sites are relatively rare in the provincial inventory, poorly understood, and not well documented. Moreover, very little dendrochronological work has been conducted on yellow cedar samples, and there exists a significant data gap in our disciplinary understanding of the ways in which yellow cedar responds to cultural vs natural injury. These data gaps have resulted in disagreements between archaeologists over the cultural or natural origin of scarred yellow cedar; this report examines this by examining ethnographic, archaeological, and forestry information regarding the species and its precontact use and value.

The report is divided into five sections, taking the following format. After this introduction, the next section is intended to provide background and context to the present review, and includes a description of the study area, a summary of relevant previous archaeological work which has taken place in and near block DK044, as well as a summary of the CIA PFR and a brief synopsis of Baseline’s AIA.

¹ ELF is an environmental non-profit which has been lobbying for the protection of old-growth forest in the Mt. Elphinstone region of the Sunshine Coast.



This is followed by a discussion of the present understandings of high elevation archaeological and CMT sites in coastal BC, provides several examples of such high elevation CMT sites. An ethnographic and ethnobotanical discussion of the traditional use of yellow cedar is included.

The following section includes a more thorough discussion of Baseline's methodology, approach, sampling (selection of trees to take samples from) and findings. This section also includes a detailed discussion of both the approach of Baseline's dendrochronology, and our findings of the dendrochronological analysis.

The distribution of ages of scarring, and their contrary interpretation, is discussed next. The non-cultural causes of scarring on yellow cedar is discussed; as is the yellow cedar component of the stands in question.

A conclusion completes the main body of the report. An appendix consists of the results of stem round analysis.

The stem round samples collected by Baseline were inspected. This work was carried out by Phoebe Ramsay on October 9th, 2015 at the BCTS offices in Campbell River. Samples were photographed, and tree ring characteristics were assessed for evidence of cultural origin. A detailed recount of the tree rings to determine the year of injury was not conducted due to time constraints. A more detailed discussion of the dendrochronological methodology used and findings is included as Appendix A. Original fieldnotes and photographs taken by Baseline were not requested or reviewed as part of this study.

It should be noted that as no fieldwork was carried out, the present review does not constitute a 'fieldwork audit' as defined by the BCAPA, and so the detailed policy established by the BCAPA for conducting fieldwork audits does not directly apply here (British Columbia Association of Professional Consulting Archaeologists 2005). However, the review was undertaken with adherence to the BCAPA Code of Conduct, with specific attention to the following subsections under *Section 20 Responsibility to Other Archaeologists*:

A member of the society shall:

- (4) not bring the professional reputation of a colleague into disrepute;
- (5) review the work of other archaeologists in a fair and professional manner;
- (7) in a formal evaluation of the works of another archaeologist, attempt to notify the archaeologist under review, unless such disclosures contravene an agreement for confidentiality.

Owen Grant, principal of Baseline, was informed that the review was being undertaken on August 20th 2015. Baseline will be provided an opportunity to comment on this report. In addition, Paula Thorogood, the original Project Officer on the permit, as well as Steve Acheson, Impact Assessment section head at the Archaeology Branch, were notified of the review.

Background

Study Area Description

Block DK044 is one of a series of cutblocks located within TSL A78126, on the Sunshine Coast of BC. It is within an area known as the Dakota Bowl, near the headwaters of Dakota Creek, on the northern slopes of Mt Elphinstone (Figure 1).

DK044, as well as the other nearby blocks within the same TSL, DK042, DK043, and DK044b, have been proposed for logging by British Columbia Timber Sales (BCTS). However, as of the time of the writing of this report, BCTS has postponed the sale of block DK044.

Block DK044 is located within the traditional territory of solely the *Skwxwú7mesh* (Squamish) First Nation; the traditional territory of the *shishalh* (Sechelt) First Nation is located immediately to the west of the project area according to the online Consultative Areas Database of the provincial government.

As no fieldwork was conducted as part of the present study, the following description of the study area is aggregated primarily from the Baseline (Grant 2015) and CIA (Stafford 2014) reports; but also two additional reports conducted by ecologists on behalf of ELF (Brett 2014; McCrory 2015). Block DK044 occupies an area of 36.8 hectares, with elevations ranging from 820 m to 980 m above sea level (asl) (Grant 2015). The block is located approximately 1 km south of Dakota Creek and 4 km inland from the nearest tidal waters of Thornborough Channel in Howe Sound (Grant 2015). The entire stand is classified as age-class 9 old growth forest (McCrory 2015). Forest cover includes mainly yellow cedar (*Chamaecyparis nootkatensis*), mountain hemlock (*Tsuga mertensiana*), and balsam fir (most likely *Abies amabilis*, several fir species are commonly referred to as balsam). Total stand volumes are as follows: yellow cedar 26%, hemlock 37.8%, balsam 36.9%, fir 0.2% (Grant 2015). The block is at a transitional biogeoclimatic elevation, and there are some discrepancies over the classification of the biogeoclimatic zones present. The BCTS Site Plan Maps indicate that the entire block is within the Coastal Western Hemlock, Montane Very Moist Maritime variant (CwHvm2) zone (with varied zonal site series communities within this). Brett (2014) and McCrory (2015) classify the uppermost elevations of the block, comprising an area of approximately 10 hectares, as MWmm1; Mountain Hemlock, Windward Moist Marine variant (Brett 2014; McCrory 2015). According to McCrory, this portion of the block is also a blue-listed site series plant community, HmBa-Blueberry (2015).

The understorey within the block is described by Grant as comprising huckleberry, blueberry, and salal (2015:5); and by Stafford as “mainly dense blueberry,” when present (Stafford 2014:1). Visibility is described as “good (Grant 2015:5);” Stafford comments that the area is “remarkably open and accessible (Stafford 2014:1),” with relatively few fallen trees. The block is associated with a northwest facing ridge (Stafford 2014), Grant describing the terrain as ranging “from undulating to steep and very steeply sloping with a northwestern aspect” (2015:5). Stafford describes “a significant bench feature and three small lakes” as well as “two significant creek gully’s [sic]” which bisect the northern portion of block and drain into Dakota Creek (Stafford 2014:1). A larger tributary runs along the southeastern boundary of the block (Stafford 2014).

Summary of previous archaeological work

Following is a summary of the pertinent archaeological work conducted to date within Block DK044. This summary is based in large part on the chronology provided in Baseline's AIA (Grant 2015).

- September 2011: Baseline conducted a non-permitted preliminary field reconnaissance (PFR) of a portion of Block DK044, on behalf of the BCTS and determined that the area had low potential for both CMT and non-CMT archaeological sites².
- August 2012: Baseline conducted a PFR of Blocks DK042, DK043, DK044 and DK044b on behalf of the BCTS. No archaeological resources were identified³.
- June 2014: Archaeologists Jim Stafford and John Maxwell of Coast Interior Archaeology (CIA) conducted a non-permitted PFR of block DK044 at the request of ELF. CIA found the block contained taper bark stripped CMTs with high potential for further unrecorded CMTs, and recommended that an AIA of all cutblocks in the TSL be conducted, under an *HCA* permit (Stafford 2014). The methodology and findings of the CIA study are discussed in more detail below.
- September 2014: At the request of BCTS and in response to the findings of the CIA PFR, Owen Grant and Aaron Bible of Baseline conducted an additional PFR on September 10th, followed by an AIA on September 17th, under *HCA* permit 2012-0218 (subject of the present review). Nine stem rounds were collected for the purposes of dendrochronological analysis, and Baseline concluded that the collected evidence did not support the claim of cultural origin (Grant 2015). The methodology and findings of this study are discussed in much greater detail below.
- August 2015: ELF requested that Millennia conduct a review of the findings of the Baseline AIA.

Block DK045, located approximately 2 km to the west of DK044 and originally included in the present TSL, has also been subject to several archaeological surveys and some contradicting professional opinion as to whether or not scarred cedars in the block represent CMTs. The block occupies similar terrain, elevation, and stand composition as DK044, and the events are relevant as context to DK044. Following is a summary of archaeological work completed within block DK045. As above, the following information is taken from the Baseline AIA summary, except where otherwise indicated.

- October 2011 Block DK045 was subject to a PFR by *shishalh* Nation archaeologists (now In Situ Consulting). No archaeological resources were

² This report was not reviewed as part of the present study, the extent of survey coverage and findings of this PFR are unknown to us.

³ As above

identified and based on assessed poor access and high elevation the block was deemed to have low archaeological site potential⁴.

- July 2012: At the request of ELF, CIA conducted a PFR of the block. No report was produced, but an email with accompanying photographs detailing CIA's findings was provided to Ewan Anderson of the Archaeology Branch. This email states that Stafford and Maxwell identified multiple trees, mainly yellow cedars, displaying taper scars they were confident were of cultural origin.
- August 2012: Owen Grant of Baseline conducted a survey of the block with E. Anderson of the Archaeology Branch, and Norm Kempe of the BCTS. Many of the CMTs identified by Stafford as 'definite' were not relocated during this survey. Anderson decided that the CMTs identified as 'definite' by Stafford may qualify for protection under the *HCA*, and these have been recorded as sites DiRv-9 through DiRv-15. The Archaeology Branch note on each of the site forms reads: "Identification of CMTs in this block is problematic (mixed opinions from multiple archaeologists). Following a site visit by E. Anderson (Arch Branch) the Branch has decided to assign Borden numbers to CMTs (or clusters of CMTs) identified by Stafford as 'definite CMTs' on the attached BCTS map. This site is one of those "definite CMTs". Note that according to others, some of these may not actually be CMTs, or conversely, there may be more CMTs in the area".

Apart from the DiRv-9 through DiRv-15 sites, there are no other inland archaeological or CMT sites recorded nearby, and no archaeological potential model is available for the region through the provincially maintained Remote Access to Archaeological Data (RAAD) tool. An AIA conducted under Permit 2011-082 may have been conducted in the area, according to Archaeology Branch emails; however reports for this are not available on PARL at this time, and we did not review them.

There are 12 coastal archaeological sites recorded along the western shores of Howe Sound between Port Mellon and Gibsons. These include eight shell midden habitation sites, one CMT site which contains two aboriginally logged features and one bark strip feature; and three surface lithics sites, one of which is a seated human figure bowl. Three of these archaeological sites correspond with traditional *Sḵwxwú7mesh* place names; *Ch'kw'elhp* at Gibsons Harbour, *Schenḵ* near the mouth of Gibsons Creek, and *K'ik'elxen*, at Port Mellon.

Summary of CIA PFR of DK044 (Stafford 2014)

As the Baseline AIA was initiated in response to the CIA PFR, a summary of the findings of that earlier study are summarized here.

Jim Stafford and John Maxwell of CIA conducted a PFR of DK044 on June 17th 2014, accompanied by Hans Penner and Ross Muirhead of ELF. The survey, described as preliminary, was intended to identify the potential for archaeological resources to be impacted by forest harvesting developments (Stafford 2014). Judgmental survey was completed by two crews of

⁴ The report from this *shishalh* PFR has not been reviewed as part of the present study. The description of their findings is taken directly from Baseline's AIA report, and has not been corroborated.

two; the map included in the report shows GPS tracks traversing through most portions of the block. CIA observed 33 apparent bark harvest scars on yellow cedars in 5 clusters. The location of each suspected CMT was recorded with a GPS unit. These trees were not recorded to Level 2 CMT standards: that is, no attributes such as scar height, DBH etc were recorded, although photographs and notes were taken⁵.

CIA used the following criteria to identify cultural features:

- Presence of long tapering scars with regular lobe development
- Presence of long tapering scars on one tree;
- Clustering of tree stems with long tapering scars;
- Presence of scar crust;
- Presence or indication of a 'base' where the tree was cut for bark removal, and;
- Presence of multiple termination points at the top of a visible scar

Key observations made in the CIA report are excerpted below:

While there are many scarred cedar trees in DK044 which appear to be natural, assumed to result in part from bear use, many of the trees exhibit long tapering scars with straight healing lobes on stems suitable for stripping by humans (i.e. 20-60 cm dbh). Cedar trees with several multiple long tapering scars were also noted including instances with two or more trees in close proximity to one another exhibiting long tapering scars somewhat evenly spaced around the stem of the tree. This includes several CMTs with four scars extending 7 to 10 m up one stem. Many trees showed evidence of strips being removed from opposite sides of the tree, a common bark harvesting occurrence. As well, a few examples were noted where the tips of divergent taper strips could be discerned at the top of the scar, another strong indicator of systematic bark removal by humans.

We identified other patterns on the landscape which raise our confidence in identifying the scarred trees as being CMTs... we found many probable CMTs clustered near creek margins and on a ridge. This fits well with my understanding of use of the landscape, with creeks and ridges being used as travel routes and trees near creeks and ridges being harvested first and thus these areas being more heavily used (Stafford 2014:3).

Stafford notes that “the level of confidence for assigning a cultural origin for the scars varied but we are confident that CMTs do exist in DK44 and there is high potential for further CMTs to exist in the general study area, which includes DK42, 43, and 44b” (Stafford 2014:2). CIA also observed a flat bench with potential for subsurface deposits associated with short term camps, and remarks upon what he describes as a “remarkable” density of mountain blueberry throughout the block, noting that although the harvesting of bark and the gathering of blueberries would have occurred at different times of year, established trails may have eased access to the area.

⁵ Original photographs and notes were not reviewed as part of this study

Stafford notes the advanced healing lobe thickness of the suspected culturally scarred trees, and absence of such scars on trees with a diameter less than 60cm, a pattern which he comments would be expected given the sudden decline of local First Nations populations during the 1800's and therefore a parallel decline in the volume of traditional harvesting practices.

Stafford concludes that "...while it is possible that some of the scarred trees identified as CMTs are natural, it is more likely that we are underestimating the use of this area and that a comprehensive assessment will continue to bring to light many more features and differing use areas/archaeological site types". He further notes that "the occurrence of yellow cedar CMTs near the coastal mountain tops has been under reported by archaeologists" and that "it is important to now acknowledge the Indigenous use of these high elevation areas and potential for a variety of archaeological sites to exist-including yellow cedar CMTs". Stafford goes on to recommend that an AIA be undertaken in cutblocks DK42, DK43, DK44 and DK44b under an HCA permit.

Summary of Baseline AIA (Grant 2015)

In order to provide context to the following discussion, a brief synopsis of the methodology and findings of Baseline's AIA is included here. Several of the points are discussed in much greater detail below.

The stated purpose of Baseline's AIA was to "select a population sample of yellow cedar trees from Block DK044 exhibiting the same morphological scarring patterns as culturally modified taper bark stripped trees, have them stem-round sampled and analysed" (Grant 2015:2).

The following is excerpted from the AIA report:

This assessment was initiated by a reconnaissance survey of Block DK044 on September 10, 2014 by Owen Grant and Aaron Bible. The purpose of the survey was to select a sample of scarred yellow cedar trees that would be felled and have transverse stem round cross sections taken for analysis. This was achieved through selecting scarred trees with scars and healing characteristics bearing the morphological similarities to those of cultural bark-stripped scars. The survey also attempted to revisit those trees identified during the CIA survey. Other considerations in tree selection were; proximity to the heli-pad, integrity of the tree, size of tree and faller safety. Also, prior to the sample trees being felled, each tree was visited by the falling crew and assessed for safety, accessibility and falling path. The process of hand-falling large diameter trees within standing timber is a dangerous practice and had to be approached with due care and attention. After each pre-selected tree was visited by the falling crew it was determined that only those trees closest to the heli-pad would be felled (Grant 2015:3).

Grant notes that yellow cedar is not the dominant timber type in the cutblock, making up 26% by volume, or 33% by the number of stems, and also observes that natural scarring of various sizes and shapes is abundant on all species of trees, and provides multiple examples of possible causes of natural scarring. Grant also comments that the currently accepted variables used in models for determining the potential for taper bark stripped yellow cedar would assess

the block as having low CMT potential, based on its high elevation, distance inland, low cedar content, and distance from water bodies⁶.

Samples were collected from nine yellow cedar trees. Seven of these displayed scars resembling cultural scars, one displayed a ‘definitively natural’ scar, and one displayed no scars. Photographs of each standing scarred tree, and a sample collected, is included within the Baseline report. Dendrochronological analysis was conducted on each sample, with a ring count to the year of injury. Two tables are included; one entitled “Stem Round Data” which lists the ring count results for each sample, and one entitled “Results of Applied Methodology on Stem Rounds” which indicates whether each sample displays each of six characteristics.

Grant concludes that the sample with the “definitively natural” scar, as well as “some” of the other internal scars on the rounds, displayed the same characteristics as the taper scars, and that “if the healing patterns are the same on both natural scars and alleged cultural scars then presumably these are the result [of] one causal agent” (Grant 2015:26). His additional observations are that several samples exhibited shreds of bark inside the scar boundary.

Grant concludes with the statement that “while it is true a portion of the observed scars, including the above sampled trees, resemble those caused by the collection of bark, it is the opinion of this firm that ascribing these as cultural in origin is speculative and circumstantial at best” (Grant 2015:26),” and that “given the relatively high percentage of scarred trees observed during the reconnaissance and quantified during the timber cruise in combination with the block location, the relatively low yellow cedar component and the results of the stem round analysis the evidence gathered during this study does not support the claim of a cultural origin” (Grant 2015:27).

Examining whether CMTs Could Occur in the Block Location

One of the principal arguments Grant makes is that the scars are unlikely to be of cultural origin due to the location of the block-its high elevation and location well inland; the relatively low proportion of cedar. He states that the block would not be captured by a potential model. Indeed, the crux of the rejection of the scars as cultural largely rests with their location (supplemented by some dendrochronological attributes), and the following sections provide a critical examination of whether ‘remote’ location is a reliable method to discriminate between natural and cultural scars, especially on yellow cedar.

Potential Model

There is no archaeological potential model available for the project area on RAAD (Remote Access to Online Data, a mapping tool provided by the provincial Archaeology Branch). Grant states that, “if ran through [sic] a predictive model [the block] would be assessed as having low CMT potential” (Grant 2015:9). Grant asserts, without citation, that there are accepted variables currently used in determining the potential for taper bark-stripped yellow cedar (Grant 2015:8). According to Grant, these variables are:

- Age class ≥ 100

⁶ Discussed in more detail below

- Slope \leq 80%
- Coastline \leq 3000m
- Non-Fish stream/river \leq 500 m
- Distance up fish stream/river \leq 4000 m
- Elevation \leq 700m above sea level
- Species=yellow cedar
- Salmon run past or present.

Grant points out that the cutblock exceeds most of these stated variables due to its high elevation (820 m to 980 m) and inland location (1050 m from Dakota Creek and 4 km from tidal waters). Grant does not reference which potential models use the above listed variables and values. Our review of the models currently in use on the coast and available on RAAD suggests that the parameters used and their values are not consistent between models. Specifically, the elevation cut-off of \leq 700m has not been used in predicting CMT sites by models on the coast. The coastal models include three developed by Millennia – none include an elevation cut-off—for the Squamish Forest District (Millennia Research Limited 1997); a portion of Ditidaht territory (Bonner, Eldridge, *et al.* 2001) and for part of the Campbell River Forest District (Eldridge, Parker, *et al.* 2007). I. R. Wilson developed a potential model for a Port Alberni TFL (Anaya-Hernandez 2009), which uses a weighted system rather than a cut-off criterion for elevation, wherein locations above 800 m asl are weighted lower but still included in the model. A 1995 potential model exists for the Checleset Bay and Outer Kyuquot Sound area; however further information about this model and criteria used is not available on PARL or RAAD. A model developed for the North Coast by Golder Associates uses an 1100 m asl elevation cut off (Golder Associates 2000). A model developed by Arcas for the Johnstone Strait region model references an 800 m cut-off for yellow cedar bark stripped CMTs, which was later revised to only 600 m (Arcas Consulting Archeologists Ltd. 2002, 2005). Therefore, the criterion of elevation \leq 700 m asl does not represent an “accepted” value as Grant suggests. To further examine this important variable, it is useful to examine ecological, ethnographic and archaeological evidence of the areas where yellow cedar grows and would have to be harvested.

Yellow Cedar Distribution

In the south coast region, yellow cedar is generally only present at high elevations. For this review, we consulted with Dr. Richard Hebda, Curator of Botany and Earth Sciences at the Royal British Columbia Museum, and an expert in traditional aboriginal plant use, regarding the elevational distribution of yellow cedar. He explains that “in southern BC, yellow cedar is not a lowland species” and “would not be expected to grow at elevations any lower than about 3500 ft [ca 1070 m]; or 2500 ft [ca 760 metres] on south facing slopes” (Richard Hebda 2015 personal communication). This is supported by other sources. In southwestern BC, yellow cedar is predominantly a sub-alpine species, with the exception of the hyper-moist climate of western Vancouver Island, where yellow cedar can be found at sea level in some areas (Laroque and Smith 1999; Turner, Deur, *et al.* 2011). A model giving a maximum elevation of 700 m would exclude virtually all areas where yellow cedar grows in the Squamish region.

Ease of access was also not necessarily the only factor used by people to choose where to obtain this highly valued commodity. McLaren, Stafford, *et al.* (2004) identified significant deficiencies in the potential model which was in use at that time to define cedar harvesting



potential in Ka:'yu:'k't'h'/ Che:k'tles7et'h territory on the west coast of Vancouver Island. McLaren, Stafford, *et al* interviewed Nuu-chah-nulth elders and reviewed ethnographic literature and identified a strong spiritual connection with cedar bark and remote locations. “Some cedar bark selected for ceremonial or ritual purposes would likely have been harvested in areas remote from most humans, and in locations that would not be identified based upon the existing predictive model criteria”. McLaren, Stafford *et al.* recorded several CMT sites at significant distances inland and at high elevations, and recommended that the model be updated to reflect the values of these more isolated locations. The ethnographic information in this west coast Vancouver Island report is discussed in more detail below.

Investigations into High Elevation Sites on the Northwest Coast

Squamish archaeological scholar Dr. Rudy Reimer considers that montane regions have historically been overlooked in Northwest Coast archaeology; the focus instead having been on the more visible and accessible sites such as shell midden villages located along riverbanks or shorelines. Reimer’s 2000 master’s thesis, as well as much of his subsequent scholarly work, investigates the relationship between Northwest Coast peoples (and in particular the Squamish) and high elevation parts of their traditional territories. As Reimer observes, “often archaeological sites found at high elevations in any area of the world are interpreted as being peripheral to past human cultures” (Reimer 2000:1). Reimer challenges this notion, and argues that

old concepts of mountains being barriers, places that were travelled through to get somewhere else, or as areas to seek refuge can no longer be accepted. The distribution of sites in many different mountainous regions...illustrates that many sites are not only located high above nearby villages, but also in many areas that were once viewed as remote and uninhabitable (Reimer 2003:59).

Turner et al (2011) have also written about this, observing that “with a few exceptions, these [subalpine] environments and their plant resources have received little detailed attention in ethnographic literature and their importance to Indigenous Peoples often remains unrecognized” (Turner, Deur, *et al.* 2011:5). Their work aims to reposition these sub-alpine environments as a “focus of social and economic activities and meeting places where knowledge and goods are produced and exchanged,” rather than leaving them relegated to the periphery of archaeological and ethnohistorical understandings of indigenous landscape use.

Reimer writes about the traditional Squamish use of upland areas of their territory. The Squamish hunted goats in the mountains; usually in late November but also in the spring, when the meat was said to have tasted like cedar as the animals fed on the tips of the tree’s boughs (Reimer 2000:38). Mountain goat hunters possessed special powers attained through extensive training and a spirit quest, and the areas where mountain goats were hunted were owned by individuals with high status. Deer and elk were also hunted by the Squamish in high elevation areas, and many different plant resources were gathered including yellow cedar, but also various kinds of berries and medicinal plants (Reimer 2000).

An association with salmon runs as Grant (2014:8) states is determinant for assessing potential for yellow cedar CMTs is questionable, mainly because there are few if any salmon

runs in the early spring when yellow cedar was harvested. The inclusion in the attributes may be an example of the world-view that mountains are peripheral to cultures, as noted by Reimer.

The Overview report of the 1997 Millennia model of the Squamish Forest District determined that hardly any survey had taken place above 900 m, and therefore “there exists a major data gap in regards to the higher elevation areas throughout the District” (Millennia Research Limited 1997).

This pattern of ignoring high elevation areas is seen in many areas of the province. Eldridge (2013) notes:

When I first worked on the Skeena River, as part of an archaeological impact assessment of a proposed transmission line in 1982 (Eldridge 1982, 1983), the thought of climbing the mountains to inspect the higher parts of the route never even occurred to me. I assumed CMTs would be restricted to an easy stroll from the Skeena River. I did know CMTs existed and I recorded them during that survey in a number of locations where the route was at low elevation. When I returned to work in the area 20 years later (Eldridge 2002; Owens 2002), we had to climb lower slopes, then fight our way through the accumulated slash of the transmission line to reach several proposed cutblocks even higher up the mountain. Yet well above the mid-slope power line, nearly every cedar was a CMT, and I realized with chagrin how many CMTs I must have missed in the transmission survey that would have been subsequently been destroyed.

It must be pointed out that contrary data also exists, that could support Owen’s low potential rating on the basis of an inland location. An Overview in the Campbell River Forest District did not find CMTs in limited forays to high elevation, inland locations (Eldridge, Parker, *et al.* 2007). A lack of culturally scarred yellow cedar trees in the forests of the Mount Washington ski area on central Vancouver Island, which contains a high proportion of yellow cedar, has been noted both during AIA work (Eldridge 1991) and on numerous occasions during recreation on the mountain’s trails and glades (M. Eldridge personal observation). And yet, in this area at least, tall, evenly tapering natural scars that might be confused with CMTs also appear to be absent.

High elevation yellow cedar harvesting sites

Several archaeologists have observed the comparative lack of data about high elevation CMT sites, and yellow cedar sites in particular. Jim Stafford and John Maxwell have written on this extensively. Maxwell and Stafford point out that stripped yellow cedars have been found at remarkable distances inland and at high elevations in several locations on the coast; commenting that “small and large clusters of CMTs may be found any distance from a major water body in old growth environments... particularly stands of culturally modified yellow cedar found at high elevations... These sites are highly significant and indicate the wider use of the landscape by Indigenous peoples” (Stafford and Maxwell 2006).

A brief review of both RAAD and consultant reports available on PARL reveals a number of bark stripped yellow cedar CMT sites recorded by various consultants throughout the province. Many occupy generally similar terrain to block DK044. The following descriptions

are not an exhaustive list, but are intended as examples to illustrate the existence of high elevation sites with similar topographic locations as DK044.

Sites DdSa-4, DdSa-3, DdSa-8 and DcSa-5 with 118 recorded bark stripped yellow cedars, are located at the headwaters of Loss Creek at Jordan River (Ramsay 2014b; Stafford and Maxwell 2008). These sites, which were originally recorded by Stafford and Maxwell with subsequent dendrochronological work conducted by Phoebe Ramsay of Millennia, are located at elevations ranging between 600 m and 750 m asl, 15 km upriver and 7 km inland from Juan de Fuca Strait.

Sites DeSe-48 and DeSe-49 are small sites located at the summit of Mt Rosander near Nitinat Lake, encountered during ground truthing surveys for the 2000 Ditidaht AOA (Bonner, Eldridge, *et al.* 2001). These sites occupy an elevation of between 675 and 800 m asl, and the approach slopes of Mt Rosander are generally extremely steep.

Amec Foster Wheeler recorded several high elevation yellow cedar CMT sites near Tofino. Sites DhSj-81 through DhSj-86 are all occupy elevations of between 670 m and 800 m asl, and are located approximately 2 km inland and 2 km from the confluence of Onad and Marble Creeks (RAAD accessed inventory siteforms; Diana Alexander personal communication).⁷

EaSt-27, EaSt-36 and EaSt-37 were recorded during the Ka:'yu:k't'h'/Che:k'tles7et'h territory inventory. These sites include a total of 26 taper bark stripped yellow cedars, at elevations between 540 m and 680 m asl, and are located 3.8 m southeast of the Kauwinch River, and 4 km from the Kashutl Inlet, the nearest tidal waters (McLaren, Stafford, *et al.* 2004; siteforms accessed on RAAD).

Taper bark strips, (particularly on yellow cedar), can be challenging to identify; and therefore the argument could be made that the sites described above represent natural scarring. However, rectangular bark stripped trees, which are of indisputably cultural origin, have also been recorded at high elevations and far inland. A remarkable such site was recorded by Golder Associates near Scuzzy Creek in mountains west of the Fraser Canyon (Bailey, Coates, *et al.* 1998). DkRj-1 is located within a cutblock with elevations ranging between 770 m and 1280 m asl, with exceptionally steep slopes of 70% to 80% and a northeast facing aspect. Notably, the potential model which was in use at the time did not capture the block; the survey was in response to a forestry engineer's report of suspected CMTs in the area. Golder crews encountered "a large number of culturally modified trees, despite the high elevation, steep slope and lack of level landforms in the area" (Bailey, Coates, *et al.* 1998:60). A total of 174 red cedar CMTs were recorded, including 37 with rectangular bark strip scars. Bailey et al. assign DkRj-1 high scientific significance, as "few clusters of culturally modified trees have been recorded on steep rocky slopes or at this altitude". They remark that the "the functions and importance of this site are not presently understood", and suggest that the site may be related to goat hunting or burial activities as suggested by Nlaka'pamux community members, or that spiritual or other non-utilitarian factors may have been involved in the selection of these trees (Bailey, Coates, *et al.* 1998). Bailey et al. also observe that the "discovery of CMTs in this location has implications

⁷ Work completed under permit 2011-240, final report has not yet been filed with the Archaeology Branch

for predictive modelling, as most models currently in use would not have predicted their presence” (Bailey, Coates, *et al.* 1998:66).

Sites with similar features and locations have been recorded in the Gifford Pinchot National Forest in the Cascade Range in Washington State. By 1996, a remarkable 5,877 bark stripped redcedar CMTs, the majority rectangular, had been recorded in 321 sites in the National Forest (Mack 1996) and it is likely many more have been recorded since. All of these sites range in elevation from 800 m to 1,200 m. Cheryl Mack identified a strong correlation between huckleberry patches and rectangular bark stripped CMTs, with these features being found around the periphery of berry patches; and also identified travel routes by looking at the overall distribution of CMTs on the landscape (Mack and McClure 1998).

The above discussion illustrates that CMT sites can be found at high elevations, and on steep terrain similar to DK044, and far inland; and that these factors should not eliminate cultural modification as a possibility.

Ethnobotanical and Ethnographic Context of Yellow Cedar

The inner bark of the yellow cedar was called *k’elmay* in *Skwxwú7mesh snichim*, the language of the Squamish people (Reimer 2011). This species provided the preferred material for clothing for many Northwest Coast peoples. Yellow cedar was thought to have a superior strength and yet a softer and finer quality than red cedar, reasons for which it was especially sought out for baby clothing and diapers (Stewart 1984; Turner 2014). As Hilary Stewart (1984) recounts in her seminal work “*Cedar*,” Haida weaver Florence Davidson describes that there was only a two week period when yellow cedar bark could be harvested before the pitch came into it, making it too sticky to work. Stewart also describes how Davidson valued yellow cedar bark highly as it split cleanly and evenly (Stewart 1984:125). To prepare the material to be woven into clothing, the bark would be soaked and beaten with a whale bone or yew wood bark beater, to soften and separate the fibres, a process called soft shredding. (Stewart 1984).

Several traditional stories from different Northwest Coast peoples associate yellow-cedar closely with mountains. A Hesquiaht story recounted by Alice Paul to Nancy Turner explains the origin of yellow cedar:

Three young women were down on the beach drying salmon. Raven came along and wanted their salmon, so he kept asking them if they were afraid to be there by themselves-if they were afraid of bears or wolves or other such animals. They kept saying “No” to everything he asked them about until he said, “Owls! Aren’t you afraid of owls?” At this they said, “Oh, don’t even talk about owls to us; we are afraid of owls!”

Raven went away but hid in the bushes nearby and began to imitate owl sounds. The women were so frightened they ran away into the woods. They kept running until they came partway up the side of the hill. They were so tired they decided to stop and rest. They said to themselves, “We’d better stand here now on the side of the mountain; they will call us *salhmapt*.” And they turned into yellow cedar trees. Raven snuck out and ate all their dried salmon. This is why yellow cedars are always found on the mountainsides and why they are such nice-looking trees, with smooth trunks and few branches, because they used to be attractive young women with long, shining hair.

(Turner 2005:57).

As McLaren et al. (2004) recount in their inventory in Ka:'yu:k't'h/ Che:k'tles7et'h territory on the west coast of Vancouver Island, the Nuu-chah-nulth have a tradition of a Yellow Cedar Bark Ogre, a supernatural being who dwells in the mountains. The story “The Origin of the Wolf Ritual Dance of the Yellow Cedar Bark Ogre”, in which a young man collecting bark first encounters this ogre, describes several trips made by the man to the mountains where he was specifically seeking out yellow cedar bark:

He went walking and came to the mountain to look for yellow cedar for a robe. He was gone two days and came with a lot of yellow cedar bark. He gave it to his wife....he started out again, and again he went to the mountain. He hunted for another yellow cedar. He was four days on the mountain. He started home, carrying a lot of yellow cedar bark on his back. (McLaren, Stafford, *et al.* 2004:17)

This story suggests that people made multiple-day trips far into the mountains in order to collect yellow cedar bark.

McLaren et al. also interviewed several Nuu-chah-nulth elders who described how bark from high elevations was specifically sought out for its particular properties. One elder, Aggie Peters, explained that “the higher places were better because they felt closer to their Creator (McLaren, Stafford, *et al.* 2004:20);” Annie Clappis described that “people went to the mountains to get their bark because it was better quality. The trees were a lot better and untouched” (McLaren, Stafford, *et al.* 2004:20). Another elder related how his grandfather had told him that bark was preferentially harvested inland, from the ‘third or fourth’ mountain back from the ocean, as the distance from the salt air meant the bark was of finer quality (McLaren, Stafford, *et al.* 2004:20). Ahousaht elder Stanley Sam recalled that his grandmother used to travel up into the mountains on Vancouver Island for up to two weeks at a time to collect large bundles of yellow cedar bark (Turner, Deur, *et al.* 2011:5).

McLaren et al. convey that Nuu-chah-nulth tradition holds that remote locations are also those which are the closest to the supernatural, and that it is likely people would seek out these places to harvest cedar bark which was to be used for ritual purpose, where the spiritual power of the location would be imbued in the bark (McLaren, Stafford, *et al.* 2004). Although no specific references about the Squamish holding similar beliefs about the supernatural qualities of bark collected at high elevations were found; the Squamish do regard mountains as holding spiritual power, or *sna7m* (Reimer 2011), and as locations where mythical beings resided. Turner et al. also remark upon how people from many Northwest Coast groups often express a preference for plants procured from higher elevations areas, reflecting a belief that these plants possess specific properties- medicinal, spiritual, or culinary-that their lowland equivalents do not (Turner, Deur, *et al.* 2011).

To summarize, Northwest Coast people would often go far into the mountains, for multiple day trips (up to two weeks at a time), in order to obtain yellow cedar bark. Large quantities of bark would be harvested, presumably resulting in many CMTs from each trip. This activity probably has little, if any, relationship to the location of salmon runs.

Dendrochronology

The procedure for identifying cultural scars through tree ring analysis was initially established through the pioneering work of Morley Eldridge, Anne Eldridge, Arnoud Stryd, and Marion Parker as part of the 1984 Meares Island study for MacMillan Bloedel (Arcas Consulting Associates 1984) which was then expanded to the entire island on behalf of an association of tribal groups (Arcas Consulting Associates 1986). As well as presenting criteria that could differentiate cultural from natural scars in the field, this study involved the analysis of 301 cross-sectional samples from culturally bark stripped cedars. A relatively small number of samples were cut from definitively natural scars. The study identified a set of tree ring characteristics which differentiate natural from cultural scars in cross section. These characteristics that discriminated between cultural and natural scars have evolved into the standard set of criteria used today, as set out by the provincial CMT Handbook (Archaeology Branch 2001):

- expanded growth-ring width caused by increased production of both earlywood and latewood;
- the presence of high density latewood and the absence of low density latewood; and sometimes;
- the presence of traumatic resin canals;
- presence of a scar crust; and,
- a ring termination in the annual rings formed subsequent to the injury perpendicular to the scar crust;
- healthy growth in the years immediately prior to and subsequent to injury; and,
- regular phenol staining pattern around the injury (Archaeology Branch 2001:45).

Typical tree ring features which suggest a natural scar are:

- parallel or obtuse ring termination;
- poor, suppressed growth at time of pre-injury;
- condensed ring width post injury;
- uneven or non-paired lobes or scar crust locations;
- irregular phenol staining at the edge of the scar;
- irregular or wavy healing rings or scar crust; and,
- traces of bark on the scar face.

Although these criteria are used in the (rare) mitigation projects in which yellow cedar samples are obtained, it is not clear how directly applicable the attributes are to yellow cedars, as Grant (2015:26) mentions. Only five of the samples included in the Meares Island study were from yellow cedars, the rest being red (Arcas Consulting Associates 1986).

A review of the available consultant reports on PARL reveals a lack of rigorous dendrochronological work completed on yellow cedar CMTs and are lacking in supporting data. Most of these reports provide only a list of dates, without any detailed descriptions or analysis of the tree ring morphology and characteristics observed on the samples (e.g., Marshall 2007). Only two reports were found on PARL which included photographs of yellow cedar samples. One is a study completed by Millennia of samples from Loss Creek near Jordan River (Ramsay 2014b).

The other report available was a 2004 Arrowstone report which included two photographs (Hall 2004)⁸. The Baseline report (Grant 2015), with its photographs of samples, is a third example (not on PARL at the time of writing). It is also one of very few that contains a table of tree ring attributes.

There is a significant and problematic data gap in our understanding of the ways in which the response to cultural injury is expressed in yellow cedar tree ring morphology. It is possible that some yellow cedar that are culturally stripped are presently being assessed as natural from their ring characteristics, and some yellow cedar that are naturally scarred may be assessed as cultural from their ring characteristics. The extent of this problem is unknown.

In general, this also highlights a discipline-wide deficiency in the approach to reporting on dendrochronological analysis. If photographs and detailed descriptions of the tree ring morphology and characteristics of other yellow cedar CMTs were available in the literature, it would have been a tremendously valuable tool in the present review.

Additional study of yellow cedar response to cultural injury would greatly benefit the analysis and interpretation of yellow cedar CMTs in the province. For example, a dendrochronological study of the tree ring morphology of rectangular bark stripped yellow cedars (more common on the North Coast), which are incontrovertibly cultural, may allow the refinement of a set of tree ring criteria for identifying cultural scars in yellow cedar CMTs.

In the experience of the authors (Eldridge 2004; Owens, Eldridge, *et al.* 1999; Ramsay 2013, 2014a, b, 2015), yellow cedar response to injury differs in several subtle ways from red cedar. In the 2014 study of samples from Loss Creek, it was noted that “in most cases, the regular phenol staining response which in redcedar results in the tell-tale regular rectangular rot pattern around a cultural scar is often not present, resulting in highly irregular rot patterns, often extended the entire way through the core of the sample from the scar face” (Ramsay 2014b) a characteristic commonly noted by the Millennia authors on yellow cedar samples from other projects (see references at top of paragraph). In general, scar crusts on yellow cedar tend to be more irregular and shorter than on red cedar. As Eldridge observed in a 1999 dendrochronological study of more than 25 yellow cedar samples: “A tendency was noted for scar crusts to be shorter on the yellow cedars [compared to the red] and, ...As a note for other dendrochronologists... where paired lower and upper samples [on the tree stem] were obtained, the upper sample had much shorter (even virtually absent) scar crusts and pinched termination healing lobe rings, both normally characteristic of natural scars” (Owens, Eldridge, *et al.* 1999, bracketed material added).

Notwithstanding the problems of interpreting a range of yellow cedar tree-ring attributes, two of them, the formation of scar crust (or a scar crust like phenomenon) and the converse retention of bark on the scar face, remain strong criteria for discriminating between cultural and natural scarring in yellow cedar.

⁸ There may be more, but several hours were spent on searching in PARL.

Baseline Dendrochronology Discussion

A detailed examination of the samples collected by Baseline was made at the Campbell River Forestry office. This was considered useful as new observations or insights can often be made from a direct examination of samples, compared to relying on reported characteristics and photographs. A detailed summary of these is appended to this report. A summary of the salient points is given here.

Baseline states that cultural and natural scars have “a morphological similarity in the way yellow cedar trees respond to injury”. While there are undoubtedly similarities, the tree’s response being ‘natural’, we believe the samples collected show that there are at least two groups of scars: two samples have very clearly natural scars; a few are consistent with cultural scarring; and a few have attributes of both (or are missing critical portions) and cannot be reasonably attributed.

Baseline also suggests that narrow internal scars are evidence of natural causes. However, these could be either small areas of windfall damage (natural) or test strips (cultural if human tests, natural if bear test strips). Criteria observed in the field can be used to improve confidence in assessing cultural or natural origins.

Initial non-perpendicular ring termination turning to perpendicular is curious but may be a difference between redcedar and yellow cedar injury response. This has been noted in other regions.

Healthy growth before and after scarring is present on several samples, and is more suggestive of cultural scarring than of scarring from natural causes such as die-back.

Scarred trees S3 and S4 are adjacent to each other and display strips probably made in the same year (1577 or 1578⁹, with the different count resulting from missing, microscopic, or locally absent rings). A natural cause for damage to adjacent trees might be a windstorm and windfall scarring, but this is rejected due to the large proportion of the tree’s circumference stripped and the rarity of adjacent trees being so damaged. Bear stripping is the only possible natural cause that would produce simultaneous scars with these attributes, but bear stripping has never been recorded on yellow cedar (see below) and in any case will rarely result in scars similar to cultural ones.

In summary, samples likely to be cultural do indeed display different dendrochronological characteristics than definite natural scars (S 16 and S Nat-1). The two natural scars lack scar crust completely, pinwheel, are textbook “natural scars”. In contrast, S2, S3, and S4, all display scar crust, square angle, ring shift etc. typical of cultural scars. Trees S13, S14, S15 display a mix of characteristics but are not unequivocally natural.

Baseline’s other methodology

In addition to tree ring characteristics, several other criteria are considered when determining the natural or cultural origin of a scar including the context of the tree as well as the

⁹ Note that the chronological markers “AD” and “BC” (or CE/BCE) are not used, as all CMTs in BC date to the last 2,000 years

characteristics of the scar. These standards are set out in the BC CMT Handbook (Archaeology Branch 2001). Furthermore, as set out in the Archaeology Branch's 1996 policy on standards for recording CMT sites, the minimum data required to be collected when conducting a forestry AIA is Level 2 recording standards (https://www.for.gov.bc.ca/archaeology/policies/recording_culturally_modified_trees.htm).

The shape and size of the scar window and other tree details at the Level 2, and the spatial distribution of the scarred trees themselves are important attributes to help distinguish cultural from natural scars.

The CMT Handbook (Archaeology Branch 2001:144-151) lists 13 characteristics that should be used to discriminate between cultural and natural scars; one of these 13 is comprised of a group of annual ring characteristics. If only one line of evidence is followed in making an assessment, an incorrect conclusion can be drawn; for example, bark dieback over a partial tree circumference may lend the outward appearance of a taper scar, however this would result in obviously natural tree ring characteristics in cross section. Likewise, a stem round sample could display similar healing characteristics to a cultural scar if it was stripped by a bear, but the external characteristics will usually allow for these to be identified as natural (see below).

The Baseline AIA does not provide any detailed information about these characteristics. No Level II characteristics such as scar height, window width, healing lobe thickness, or side of tree are provided for any of the trees sampled, although the inclusion of field photographs of some of the scarred trees ameliorates the lack of data. Owen's Methodology section explains that trees were selected with "scars and healing characteristics bearing the morphological similarities to those of cultural bark-stripped scars" (Grant 2015:3) and the conclusion includes the remark that there is "some uniformity and resemblance to bark-stripped CMTs in scar width, height, tree diameter, number of scars on some trees" (Grant 2015:27), but apart from these general descriptions there is no detailed information (other than the photographs) about these characteristics. Furthermore, no observations about spatial patterning or clustering are included.

Baseline likely had no regulatory obligation to record these attributes on natural scars, since the scars were deemed to be not CMTs in the field. This is how archaeologists always have worked in the province. However, because the Baseline AIA was specifically determining whether or not the scars are of cultural or natural origin, rather than the typical AIA inventory, it would have been useful to include external tree and scar characteristics.

Selection of Scarred Trees for Sampling

Grant's methodology (Grant 2015:3) states that "the survey attempted to re-visit those trees identified during the CIA survey". There is no information in the report whether the trees selected "with scars and healing characteristics bearing the morphological similarities to those of culturally bark stripped scars" (Grant 2015:3) actually corresponded to the trees recorded by CIA. An overlay of georeferenced images of the two report's maps showing CMTs and sample locations suggest that there is no direct association (Figure 2). Grant (2015:3) suggests that ease of access and safety were the dominant factors in choosing samples: "only those trees closest to the helipad would be felled". Some of the CIA trees appeared to be particularly likely to be cultural, several with divergent adjacent strip tops, and several noted to have four evenly tapering scars 7 to 10 m long (Stafford 2014:3). One tree (Tree 2) sampled by Baseline had multiple

scars, although it would not appear that this was a tree thought to be a CMT by CIA (Figure 2). The CMT locations were mapped by CIA from GPS waypoints; the Baseline report does not provide the provenance methods used. Assuming CIA was using typical consumer-level GPS, a 20-30 m error is possible under canopy and so it is possible that in some cases the trees were the same.

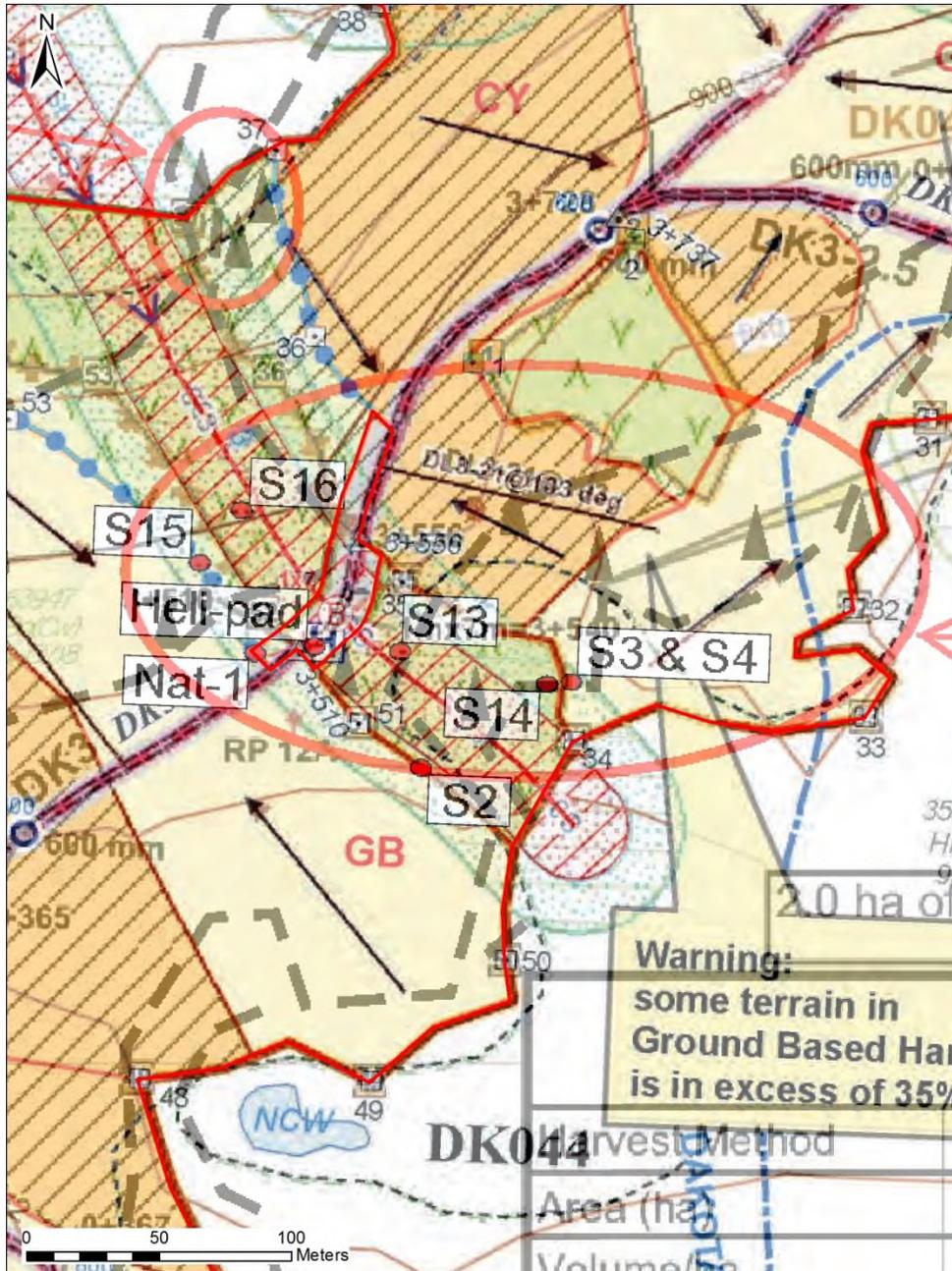


Figure 2. Baseline report Figure 2 overlain by semi-transparent Block DK44 map from CIA report. Red dots with text box numbers indicate Baseline sample locations and black tall triangles are CMT locations from CIA report. There is no apparent correspondence.

Distribution of Injury Ages

Eight injury dates were obtained by Baseline through a direct ring count (excluding Sample Nat 1).¹⁰ These dates range between 1356 and 1651, a span of 295 years. Grant uses the age distribution to support a natural origin for the scars. Grant observes that while the sample size is small, “it is noteworthy that there were no scars, other than the natural (N1) that fell into the last 150-350 year range” (Grant 2015:26). Grant further suggests that while population decline and culture change could explain a lack of cultural scars in the last 150 years, “it would be logical to assume that scars in the 150-200 year range would be more prolific and presumably there would be more obvious cultural scars to be observed in the field” (Grant 2015:26). Presumably, it is the lack of cultural-looking scars after 1651 that causes him to consider a more likely natural cause.

Grant only references major population decline as occurring in the last 150 years; in fact the Sunshine Coast region experienced depopulation at least 100 years earlier than this. Ethnographic and historical evidence indicates that smallpox was already widespread in southwestern BC by the 1770s (Boyd 1994). Charles Hill-Tout interviewed an elderly Squamish man in the 1890s, who related the effects of these very early epidemics that occurred prior to the arrival of the first settlers: “Men, women, and children sickened, took the disease and died in agony by hundreds, so that when the spring arrived and fresh food was procurable, there was scarcely a person left of all their numbers to get it. Camp after camp, village after village, was left desolate” (Hill-Tout quoted in Carlson 2010). The devastating effects of these epidemics would have been evident in steep population declines amongst the Squamish, and other nearby First Nations communities, by ~250 years ago, or close to the most recent dates in the small sample of scars from this block.

Although Grant seems to suggest that the lack of recent dates in the sample is evidence against their cultural origin, these exclusively ancient dates of scars that appear similar to accepted cultural ones seem to logically more strongly support a cultural explanation for those scars. There is a significant question of why natural events that produce scars similar to cultural ones have not occurred for over 300 years in this area? Admittedly, the sample is too small for high confidence in age patterning, but still the nascent pattern does seem, as Grant describes, “noteworthy”. If a natural agent, either normal and regular or sporadic and random, was the cause of the scarring, (e.g. bears, windfall, poor growing conditions, or disease), then the distribution of injury dates would be expected to be dispersed, and to continue through time to the present. The one clearly natural scar (N1) is from about 130 years ago. Fire might be expected to cause a (very constrained) clustering pattern of injury dates; however no evidence of fire was observed by either Baseline or CIA. We believe that natural causes are much more likely than cultural to reoccur on a regular basis over the long-term.

¹⁰ Two additional dates were obtained from second samples obtained from S3 and S14, but comments in the reference table indicate that the ring count was inaccurate due to rot, so these dates are not included here nor in Baseline’s discussion.

Non-cultural causes of scars

Grant (2015:26-27) observes that there is “some uniformity and resemblance” to taper bark stripped CMTs in the scarred yellow cedars in the block and that there are also definitively naturally scarred trees responding to “the same process”. He concludes that “given the relatively high percentage of scarred trees observed during the reconnaissance and quantified during the timber cruise in combination with the block location, the relatively low yellow cedar component and the results of the stem round analysis the evidence gathered during this study does not support the claim of a cultural origin”.

The existence of natural scars in the block does not preclude the simultaneous presence of cultural scars, and the presence of natural scars should not be used as evidence of the absence of cultural scars. Grant has cautioned against this very bias in the past. A 1998 report, of which Grant is one of three authors, includes the following statement: “The presence of ‘natural looking’ scarred trees can strengthen a surveyor’s bias against the possibility that some scars are indeed cultural. This is particularly true in areas where natural scarring agents are present. These ‘biased’ areas may generally be characterized as containing steep unstable slopes often combined with a large amount of dead or dying trees (windfall) and/or poor growing conditions” (Maxwell, Grant, *et al.* 1998:38).

Grant lists several possible natural agents which could have caused scarring: bears, fire, over-exposure to sun, windfall damage, rock damage, breaking branches, bark die-back and bark bruising. The 1984 Meares Island study identified 11 natural agents of scarring, of which only bear damage, falling trees, breaking branches, rock damage, standing water, nutritional deficiencies, lack of soils and possible fungal infections are likely to produce scars which can have the outward appearance or some of the dendrochronological attributes of a cultural scar.

Fire is eliminated as a potential cause in this case, as no evidence of fire was noted in either the Baseline or CIA report.

Yellow cedar is remarkably resistant to disease (Hennon, Hansen, *et al.* 1990; Laroque 1995). Notably few diseases occur in natural settings. Of the very few diseases, none would be expected to cause the loss of bark. Dr Paul Hennon, a senior pathologist with the US Forest Service in Alaska, has published on yellow cedar pathologies since the 1980s. He comments (personal communication 2015) that there are no insects or pathologies which would be expected to cause, alone, the immediate loss of bark from more than 50% of the circumference of a tree. The most common pathologies in yellow cedar are fungi such as the sap rot fungus, and these mainly attack exposed dead wood, following an injury, and are not the cause of it.

Windfall is a possible explanation for many scars in the block; however is cannot explain two or more strips removed from different sides of a tree in the same year; or a strip with a divided top. A windfall can only remove bark from a narrow arc, and virtually never would produce a long, evenly tapering scar with the base involving a large proportion of the tree circumference.

Breaking branches usually result in an obvious ‘knot’ at the top of a lenticular scar, rather than a clean v-shape. They will not be as long or as wide as a typical cultural scar.

Other causes listed; over-exposure to sun, bark die back, and bark bruising are possibilities to produce wide circuit, tapering scars. However, these would result in obvious

characteristics in cross section, since the bark would adhere to the scar face in the early part of the scarring process. Bark on the scar face will prevent a smooth scar crust from being formed, and the trapped double layer of bark will be visible in cross-section. Bark die-back, or partial circuit death, is a slow process, usually initiated with increasingly tight growth rings; following partial death, subsequent healing rings may slowly curl around the injury resulting in a pinwheel effect as the tree compartmentalizes the dead area (Shigo 1979). This is evident in the natural sample Nat-1, for example, or S 15. Furthermore, in trees which experience poor growing conditions or which are unhealthy, this is displayed in the growth rings, with highly constrained growth either immediately prior to bark loss, subsequent to it, or both. On the contrary, as discussed above, several of the samples displayed even, consistent growth both prior and subsequent to bark loss. The healing lobes of these curled around onto a relatively smooth scar crust, rather than pinwheeling.

The remaining possibility is bear damage which, while usually distinctive, on occasion can mimic cultural strips very closely. In managed forests, the amount of bear damage can cause significant losses to the forest industry, and a major summary of existing literature was compiled by the US government (United States Department of Agriculture Animal and Plant Health Inspection Service Wildlife Services 2003). In the spring time, bears use their claws and teeth to rip the bark off trees in vertical strips to access the sweet cambium layer underneath. The scars are typically short (about 4 feet long average), and can vary between a small patch to girdling. Bears will bite through bark at about breast height, then use their claws to strip the bark below this point (Beerbower 2006:24; Harestead, Bunnell, *et al.* 1986:18, 37) although we have observed freshly-stripped subalpine fir that were ‘frilled’ by biting through the bark at the root flare and pulling strips away from the trunk. A study by Nolte, Wagner, *et al.* (2003:1) states:

In Washington, Oregon, and British Columbia the preferred species are western redcedar and Douglas-fir, the typical age at stripping is 20-40 years, and rapidly-growing second growth managed forests following silvicultural thinning are preferred by black bears.

Interestingly, according to a study of the Golden TSA (Sullivan 2009), bear damage occurs almost exclusively on trees where the crown extends down to the ground; that is, trees where branches are present along the length of the trunk. This is opposite to the tree types selected by humans, where the preference is for a clean trunk, or at least face, free of branches (see CMT Handbook for a summary of ethnographic information regarding the size and characteristics preferred for bark stripping).

All authors we reviewed agreed that bear damage almost always occurred on quickly growing young conifers in evenly-aged stands, and that the most vigorous trees were the most likely to be targeted. Some studies suggested that bear cambium stripping might not even develop as a behaviour (as it is not universal amongst bears) where such stands do not occur. Yellow cedar, as it is so slow growing, would seem to be unlikely to contain sufficient high-sugar sap to be of much interest to bears. Nolte, Wagner *et al.* list 25 species of trees which bears are known to target for food in northern California through British Columbia; yellow cedar is not one of them. Hennon, Hansen, *et al.* (1990) do note brown (grizzly) bear scarring on yellow cedar, although in this case it seems to be non-food related.

The yellow cedars of the size suitable for bear stripping are likely present now and in the past-although they are unlikely to be the ‘rapidly growing’ trees black bears prefer. All the trees

sampled were 160 to 445 years old when first scarred (Owens 2015:29), much older than the 20-40 years typically stripped by bears as shown in the literature cited above.

Bear scarred trees can be identified (see literature cited above) by characteristics such as a short scar or an uneven scar top, fringed hanging bark attached at the top of the scar, or by vertical teeth gouges in the sapwood (which preserves longer on yellow cedar than redcedar). Bears, at least grizzly bears, occasionally remove bark strips cleanly (at least on red cedar stripped in non-food contexts) (Eldridge, Bouchard, *et al.* 1989), so this should result in a similar tree ring characteristics as cultural scars in cross section, because the tree mobilizes the same healing/compartmentalizing response.

It is likely that some of the scars in the block do represent bear scars; and indeed the block has a noted high density of black bear dens (McCrary 2015). Both Stafford and Grant noted the presence of likely bear scarred trees. Bear damage is not considered a likely explanation of the tall, evenly tapering scars similar to cultural ones. To our knowledge, no modern or relatively recent, tall tapering scars have been observed in the block or nearby blocks, so if bears did once make these scars, they apparently no longer do so.

Yellow Cedar Stand Composition

Grant (2015:8,27) states that the 33% contribution of yellow cedar is “relatively low” for the block, this is unlikely to be a factor in aboriginal use. In our experience, yellow cedar is seldom a dominant species, and a density of a quarter or third of the trees being the target species would seem to be no impediment to harvesting their bark.

Conclusion

Grant (2015:27) concludes that the scarred trees’ attributes in Block DK044 do not support cultural origin. He states that there is “uniformity and resemblance to bark-stripped CMTs in scar width, height, tree diameter, number of scars on some trees”. However, he considers that the block elevation and inland location, low cedar proportion, and preponderance of naturally scarred trees combine to suggest a natural origin. To these are added dendrochronological observations: that scar crusts, perpendicular scar growth, phenol staining, and other characteristics were present on both natural and cultural scars.

We examined the evidence for each of these claims and find that for most, a different conclusion can be drawn from the same data. The above discussion has shown that ethnographically recorded yellow cedar harvesting locations, and the locations of recorded CMT sites elsewhere, match the type of location and terrain of Block DK044. Northwest Coast First Nations, and the Squamish in particular, often went to high mountain areas. One of the reasons they did so was to obtain yellow cedar bark, valuable for clothing and ceremonial regalia. There may have been spiritual reasons for going to the most remote locations to harvest the bark. The maximum elevation to expect CMTs that Grant suggests, at 700 m, is too low to find any yellow cedar in this region. There are multiple bark stripped CMT sites, including some with rectangular bark stripped features that are incontrovertibly cultural, which have been recorded in similar elevations and terrain as Block DK044. The proportion of the overall trees that are yellow cedar in this block is about a third: this seems relatively abundant and certainly

not sufficiently rare for aboriginal people to avoid the area because of scarcity. The presence of naturally scarred trees should not be used as evidence for the absence of culturally scarred trees.

The conclusions drawn from the dendrochronological analysis by Baseline were only partly supported by the physical evidence observed by the authors. As discussed in detail above; although the characteristics displayed in several of the samples were not ‘text-book’ cultural, the statement that the clearly naturally scarred trees displayed the same characteristics as the possibly culturally scarred ones was not supported by the physical evidence.

The controversy and division of professional opinion over the origin of the scars in this block illuminates a significant and problematic data gap in the CRM discipline. It is clear that the dendrochronological assessment criteria that we as a discipline regularly use are currently inadequate for application to yellow cedar CMTs. This presents challenges for both forestry management and archaeological resource management. This point is emphasised by Grant. He states that the dendrochronological methodology is “primarily applied to the dating of culturally modified western redcedar. Historically, fewer permitted dendro-chronological studies have been undertaken that are solely dedicated to analysing and dating cultural scars on yellow cedar” (Grant 2015:4); and, “this calls into question whether these [tree ring] criteria can be used on yellow cedar” (Grant 2015:26). We concur that the present samples show (as do samples from other projects) that yellow cedar often reacts to injury differently than redcedar. Further study of scarring on yellow cedar is needed. The examination of dendrochronological ring and scar crust attributes on a sample of ancient rectangular bark-stripped yellow cedar CMTs would provide extremely valuable data that could answer uncertainties one way or another. Such CMTs can be found on the North Coast. Concentrating on yellow cedar with rectangular strips (or, alternatively, taper strips with tool marks at the scar base) would remove any circularity in deduction. Such a project would be in the provincial interest to fund. Despite the foregoing, the presence of scar ‘crust’ and trapped bark on the scar face provides valuable data on whether the scar had a freshly-stripped face or not, and this is still high relevant to the discussion of the samples at hand.

Following careful consideration of the evidence, it is the authors’ opinion that a cultural origin to the scarred trees in Block DK044 *cannot* be eliminated. In our view, the evidence supports a conclusion that some trees scarring is of cultural origin. As with redcedar scars, tall, regular, and evenly tapering scars where bark was cleanly removed from one or more sides from a large portion of the stem circumference can rarely occur naturally (though apparently only through the agency of bears); however the simplest explanation of this occurrence in Block DK044 is cultural modification.

Grant’s conclusion that the onus of substantiating a cultural cause (and protection status) for trees that would normally be recorded as CMTs, if yellow cedar and at high elevation, should rest on a researcher to substantiate the claim and to have this peer reviewed, and not on a stakeholder to test the veracity of the claim (Grant 2015:27) should rest on the qualifications and experience of the ‘researcher’. In our opinion, the balance where consensus is not present should be for protection; in the spirit of the *Heritage Conservation Act* and its interpretation by the Archaeology Branch. For instance, CMTs will often be considered protected when there is a reasonable chance that they predate 1846. CMTs are perhaps the ultimate example of a ‘non renewing resource’; the number of protected CMTs shrinks every year from natural causes and commercial logging.

Professional Statement

The information compiled in this report has been prepared in accordance with the standards of the BC Association of Professional Archaeologists. The report has been prepared by Millennia Research Limited staff and reviewed by a senior archaeologist (see signatories below).

Millennia Research Limited

Per:

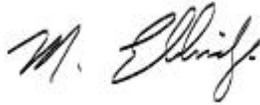
Signature:



Name: Phoebe Ramsay

Title: Archaeologist

Signature:



Morley Eldridge, MA, RPCA
President, Millennia Research
Limited



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Results of Stem Round Analysis

General remarks

Where multiple scars are present on a single sample, we have used a numbering scheme consistent with Baseline's whenever possible.

Baseline's AIA does not specify which face of the samples was sanded – the top or the bottom. For the purposes of this report, we assumed that each sample was sanded on the top to facilitate using descriptions of left and right healing lobes, except where this could be determined to be otherwise from field photographs, etc. The height from which the samples were retrieved was not recorded; however, as the common practice is to collect samples from about breast height, it is assumed that this was the case. Where more than one sample was retrieved (e.g. Sample Tree 3) it is presumed that at least one was taken from higher than breast height.

No attempt was made to recount the rings given the time constraints. Most of the samples contained areas with microscopic rings.

All trees were alive when felled.

Sample Tree 2

Sample Tree 2 (S2) displays three external injuries (at least two of which would have appeared as creases) and a small internal scar (Figure 3). The photograph included in the Baseline report only includes a single face of the tree, and depicts a long tapering scar with a fairly narrow scar window, most likely Feature 4). Baseline's report does not assign identifies to these features apart from the internal scar which is assigned Feature Number 2; therefore the feature numbers used below may not correspond with the table in Baseline's report. The Baseline report lists two samples, "S2(1)" with 3 features, and "S2 (lobe)" with one feature. As there are two lobes which make up the sample from this tree, and each possesses part of two features, it is unclear which lobe "S2 (lobe)" refers to. The left healing lobe of Feature 1 was missing from the samples examined at the Ministry of Forests office, although is pictured in Baseline's report.

Features 1, 2, and 3 appear to have all been created in the same year. The ring year of injury for Feature 2 can be easily traced around and matches with that of the right lobe of Feature 1 (left lobe is missing). The ring year of injury also appears to match that of the left healing lobe of Feature 3, however, the growth rings in this portion of the sample are extremely tight and therefore this was not completely certain. Baseline's report lists three different ages for these: 1559 for one of the features on S2 (1); 1554 for the internal feature on S2 (1), and 1558 for one of the features on S2 (lobe). A date is not provided for the fourth feature (Feature 4 in the photos below). The small differences in the scar dates in the Baseline report may be the result of locally absent rings and counts along different pathways from living outer rings.

Feature 1 displays a marked ring shift, regular phenol staining, and a slightly irregular scar crust (Figure 4). The healing rings pinch out slightly immediately adjacent to the wound, and then come in at a perpendicular angle within about a decade. Even growth is evident both before and immediately subsequent to injury, then growth rings become microscopic about 15 years after the injury. The scar was apparently either quite narrow overall, or was short and the

sample captured its tapering top. The width of the scar could not be measured as the left lobe was missing.

Feature 2 is a small internal scar measuring 4 cm in total width (Figure 5). A ring shift is evident. The healing rings on this feature pinch adjacent to the injury initially, and then begin to come in perpendicular against a regular scar crust within 5 years. The scar is completely healed over within 25 years. Small internal scars like this may represent one of several related events, and have been observed on other CMT samples, as in the example in Figure 6. The scar may represent a narrow test strip. The scar could also represent a physical injury such as a windfall, which caused a small section of bark to peel cleanly off, however, the contemporaneity with other scars suggests that windfall damage is unlikely.

Feature 3 displays healthy growth prior to the injury, but extremely suppressed growth subsequent to it. In the left healing lobe microscopic rings are evident immediately subsequent to the injury, in the right healing lobe the suppression occurs 10 years after the injury (Figure 7, Figure 8). The right lobe shows apparent perpendicular ring termination immediately subsequent to the injury (growth patterns are difficult to discern in the microscopic rings of the left lobe), and both lobes display fairly regular scar crust. The injury appears to date to the same year as Features 1 and 2 although the microscopic rings make this difficult to determine without further study.

Feature 4 occurred roughly 50 years prior to Feature 3, ca. 1500 (no ring count for this feature was provided in the Baseline report, a rough count was conducted by Phoebe Ramsay at the BCTS offices). The healing rings immediately surrounding the injury are missing, however no ring shift is evident in the stem adjacent to the injury. The healing rings present on the right lobe appear to be growing at a perpendicular angle, but against a very irregular scar crust (Figure 9). Smooth, regular scar crust, if it had ever been present, would likely have endured, as it has in other samples. It is concluded that Feature 4 represents a natural scar.

Given that the injuries that caused Features 1, 2, and 3 apparently were all made in the same year on different sides of the tree, and the tree ring characteristics are consistent with cultural scars, we consider it likely these three are of cultural origin.



Figure 3. Sample Tree 2. Note four injuries, including a small internal scar. Feature numbers indicate left and right sides of injury



Figure 4. Right healing lobe of Feature 1. Note even growth prior to injury, ring width expansions after injury, and healing rings pinching out adjacent to injury



Figure 5. Small internal scar on sample S 2



Figure 6. Internal scar on redcedar CMT from Port Renfrew, similar to Feature 2 on S2



Figure 7. Right healing lobe of Feature 3. Note even growth both before and immediately subsequent to injury and square angle of ring intercept against fairly regular scar crust.



Figure 8. Left healing lobe of Feature 3. Note exceptionally tight rings throughout entire lobe subsequent to injury, but apparent healthy growth immediately prior (visible in small sanded portion, indicated by red arrow).



Figure 9. Above: left healing lobe, below: right healing lobe to Feature 4. Highly irregular scar crust suggests healing over an uneven face, suggestive of a natural injury.

Sample Tree 3 lower

Sample Tree 3 (S3) displays a single scar, which Baseline dated to 1578. The photograph provided by Baseline of the standing tree shows a long tapering scar with no HAG, apparently facing upslope. The top of the scar is not pictured.

Two samples were collected from Sample Tree 3 (S3). Unfortunately, only one sample was available at the BCTS offices, “S3 Lower,” which is in poorer condition than the upper sample which is the one photographed in the Baseline report. This lower sample displays considerable decay (Figure 10), and the Baseline report notes an inaccurate count for this sample due to rot. The height from which the sample was removed is unknown.

Interestingly, where the upper sample depicted in the photographs in Baseline’s report displays a regular phenol staining response, resulting in the classic rectangular rot pattern usually associated with a cultural stripping event, the lower sample displays a highly irregular rot pattern (Figure 10). Unfortunately, the height from which each of the samples was retrieved on the stem is not noted. A similar differential pattern of attributes was noted in the 1999 analysis of yellow cedar samples from Muchalaht Inlet (Owens, Eldridge, *et al.* 1999); wherein one sample from a taper stripped CMT would display even scar crust, a second sample from a different height on the scar would have very narrow, or non-existent scar crust. It may be simply that rot has progressed much more on the lower bole, with discolouration due to processes other than phenol staining.

As the rot on this sample prevented a polish from being obtained, the presence or absence of a ring shift was hard to discern, and characteristics for this sample are not noted in the Baseline AIA. A square angle of intercept was evident in this sample, as well as apparent healthy growth both pre and post injury. The square angle of ring termination appears to begin immediately subsequent to injury; however, again, this was difficult to discern with confidence due to rot. Very smooth and even scar crust was present on the right lobe (Figure 11); the healing rings had curled around embedding the scar crust on the left lobe, but it appeared similarly smooth and even (Figure 12).

The strip removed more than half of the bark from the circumference of the tree, approximately 65%. Given that this quantity of bark was lost in an apparent single event, combined with the above characteristics, we consider it likely this tree is culturally modified.



Figure 10. Sample Tree 3 (lower sample). Note irregular rot pattern.



Figure 11. Right healing lobe of S3 (lower). Note smooth scar crust and square angle of ring intercept.



Figure 12. Left healing lobe of S3 (lower). Healing rings have curled over, embedding scar crust.

Sample Tree 4

Sample Tree 4 (S4) is located adjacent to S3. The photograph included in Baseline's report shows a long tapering scar with no HAG, on an apparent side-slope orientation. Baseline's ring count dates the injury to 1577 (virtually identical to the date of the scar on the adjacent tree). Baseline notes the tree had a diameter of 19 cm pre-modification (Grant 2015).

The scar width was measured to be approximately 25 cm, and removed the bark from just under half of the circumference of the tree. Interestingly, a remarkably uniform rectangular rot pattern is evident in this sample, a characteristic usually associated with cultural scarring in redcedar as it is the result of the tree's defence system mobilizing a phenol staining response and "boxing off" or compartmentalizing (Shigo 1977) the exposed scar face. However this phenomenon has not been noted in culturally scarred yellow cedar samples in the past by the authors; rather, an irregular rot pattern is usually present.

The sample displays even healing lobes with scar crusts. The left scar crust is 2.5 cm long and is smooth (Figure 13); the right scar crust measures 4 cm and is slightly irregular, even immediately adjacent to the injury (Figure 14). A ring shift is evident subsequent to the ring year of injury and can be traced around the sample. Healthy and consistent growth is noted both immediately before and subsequent to injury; the rings prior to injury are tight but not exceptionally so compared to other portions of the sample. Decay/insect damage on the right lobe adjacent to the injury prevented a good polish from being achieved, but the healing rings appeared to come in perpendicularly immediately subsequent to injury on both lobes. These are all characteristic of cultural scarring (on redcedar). The first decade or so of rings post-injury are slightly 'wobbly' a characteristic usually associated with natural scars in redcedar (but are

sometimes present on incontrovertibly cultural scars). However, this may not apply to yellow cedar.

Given the above characteristics, in particular the wide width of the scar and the healthy growth before and after injury, and the likely simultaneous injury of the adjacent tree, this sample likely represents cultural scarring. This constellation of characteristics is very different to those of the natural scars seen on Sample Tree 16 and Nat 1.



Figure 13. Left healing lobe of S4. Note regular rot pattern, ring shift



Figure 14. Right healing lobe on S4. Decay prevented even polish, but apparent ring shift and perpendicular ring termination is evident



Figure 15. Ring shift subsequent to ring year of injury can be traced around the unstripped part of the stem

Sample Tree 13

Sample Tree 13 (S13) displays a single, very wide scar, which Baseline dates to 1358. The injury would have removed at least 50 % of the bark from the circumference of the tree. The sample is highly fragmented and missing several sections, including the entire right healing lobe,

as well as the section immediately adjacent to the injury in the left lobe (Figure 16). These sections were also not present for Baseline’s analysis. The field photograph in Baseline’s report shows a very long scar with a wide, open face, slightly irregular healing lobes, and a slight twist at the top.

The left healing lobe, the only lobe present, displays an irregular, undulating healing surface (Figure 17, Figure 18). The rings subsequent to the injury, and throughout the entire lobe, are microscopic. The portion of the lobe immediately adjacent to the injury is unfortunately missing, so some attributes important to discriminating between cultural and natural scarring cannot be evaluated. We conclude the cause of this scar to be ‘uncertain’.



Figure 16. Sample S13.



Figure 17. Left healing lobe of S14



Figure 18. Left healing lobe of S 14. Note undulating 'scar crust' healing surface

Sample Tree 14

Two samples are from Sample Tree 14 (S14), both of which were available at the BCTS office (Figure 19, Figure 20). The field photo in the Baseline report depicts a tapering scar with no HAG, and an obviously natural wound on the left healing lobe. Note that given the photograph clearly depicts the wound is on the left healing lobe on the standing tree, the samples must have been sanded on the underside, and the 'right' and 'left' lobes are reversed in the photographs below. The 'true' right and left lobes are labeled in the photographs and used in the

following discussion. The single scar removed about 50% of the bark from the circumference of the tree (Figure 19).

The right healing lobe displays very similar characteristics on both samples, with healing rings which initially pinch adjacent to the injury but then grow in at a perpendicular angle against a fairly regular, wide scar crust (Figure 21). A ring shift was evident in the stem in both samples subsequent to the injury (Figure 22). The growth rings are rather narrow prior to the injury, but not overly so, suggesting the tree was reasonably healthy and poor growing conditions not the reason for scarring. The left healing lobe displays a much shorter scar crust (Figure 23, Figure 24), slightly narrower on the upper sample than the lower. Decay present in both samples prevented a polish from being achieved in this area, and so the ring termination was not clearly discernible. However, the rings appear to pinch, coming in at a parallel angle initially, and begin to terminate at a perpendicular angle 10-15 years thereafter. The tree's response to injury was to increase growth under the remaining bark (Figure 22), again suggesting that the tree was healthy at the time of injury.

We conclude that the scarring is most likely to be cultural in origin.

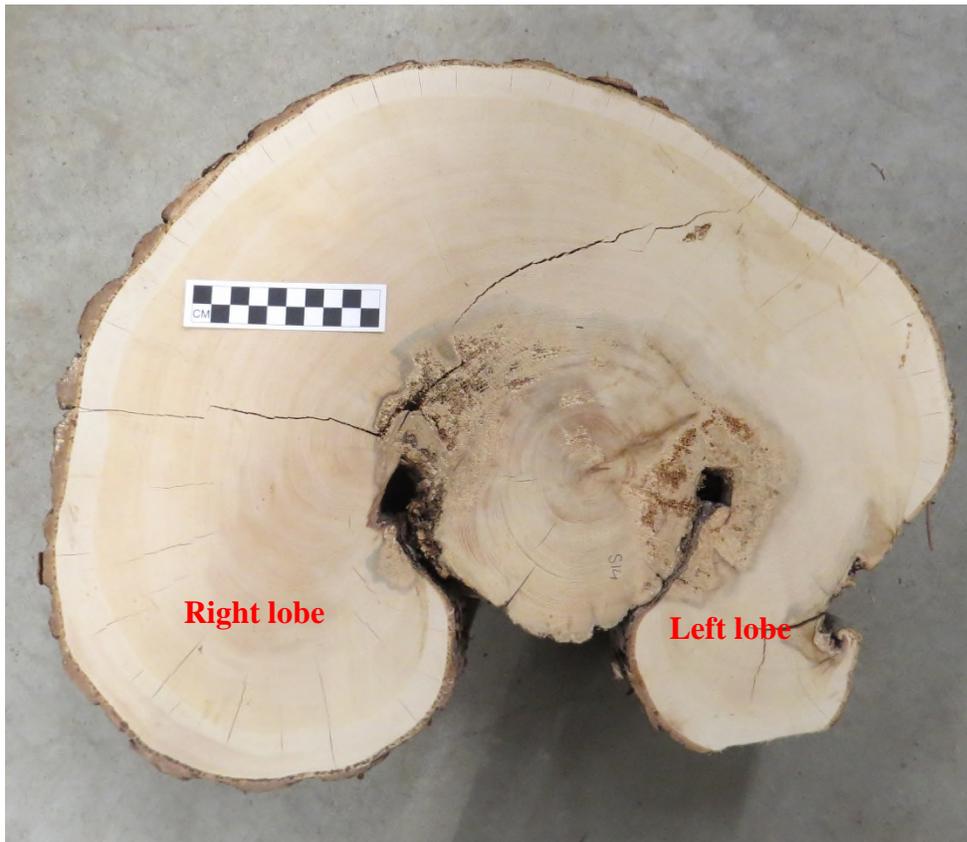


Figure 19. S14 (lower). Note sample was sanded on the underside.



Figure 20. S14 (upper). Note sample was sanded on the underside.

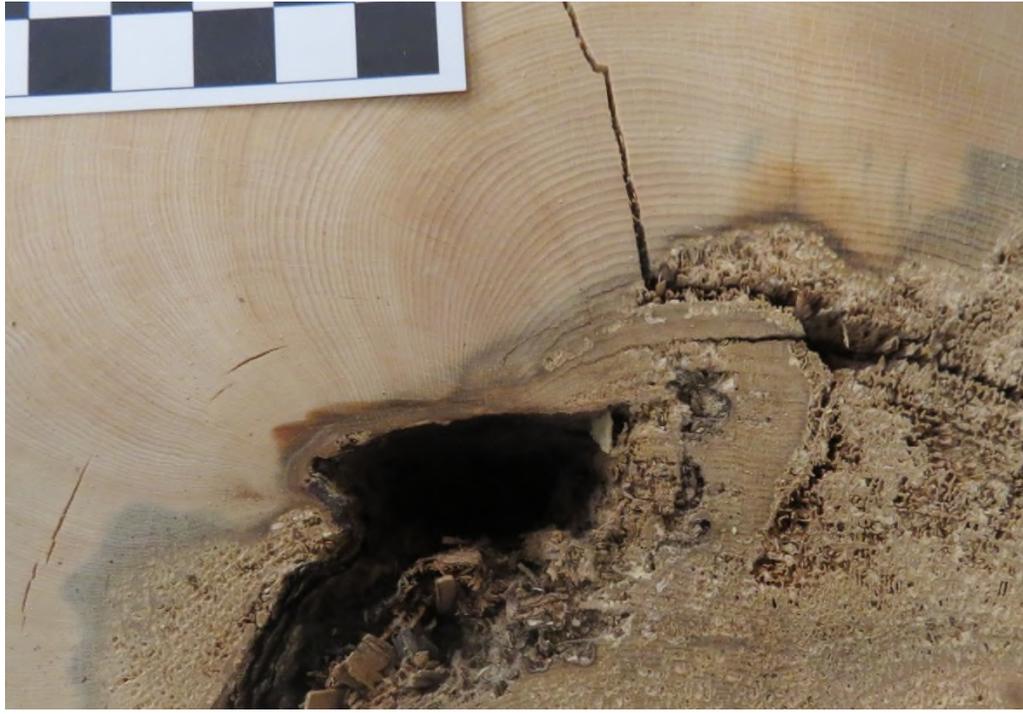


Figure 21. Right healing lobe (lower sample). Note scar crust, healing rings pinch initially





Figure 22. Ring shift evident subsequent to ring year of injury

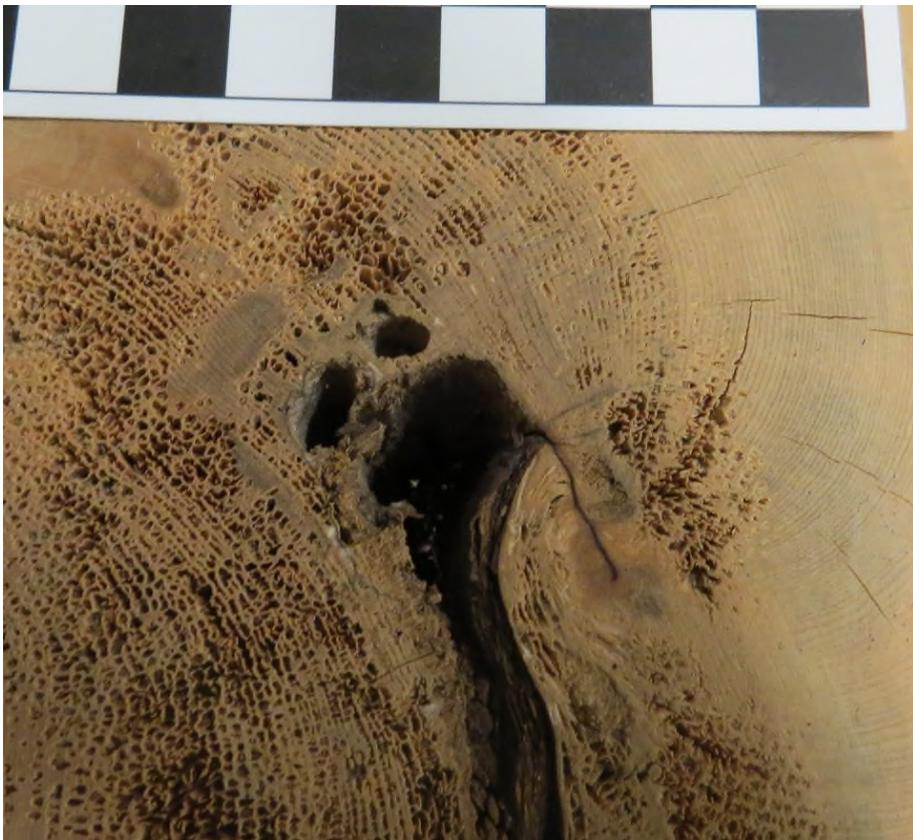


Figure 23. Left healing lobe (upper sample).



Figure 24. Left healing lobe (lower sample)

Sample Tree 15

Sample Tree 15 (S15) displays a single scar which Baseline has dated to 1445 (Figure 25). The photograph provided in the Baseline report shows this scar as long and tapering, with even scar lobes, and no HAG. The scar top is not visible in the photograph. This tree is by far the largest of those sampled overall; and the diameter at the time of stripping ~42 cm, is also the largest. The scar measures approximately 65 cm in circumference, and removed approximately 40% of the total circumference of the tree's bark at the time of stripping.

The sample was broken into three sections. No ring shift was evident subsequent to the ring year of injury as identified by Baseline (Figure 26). Even growth prior and immediately subsequent to the injury is apparent in the sample, with a period of constrained growth beginning about ten years subsequent to the injury (Figure 26). The area of the sample immediately adjacent to the injury in the right lobe is unsanded and a portion is missing. However, there appears to be microscopic growth immediately subsequent to the injury, followed eventually by a perpendicular termination against fairly smooth scar crust (Figure 28). The smooth scar crust is 3 cm in length, after which it becomes much more uneven, presumably as the scar face decayed over time and became irregular in texture. The left healing lobe is unfortunately missing the section which would have borne the smooth scar crust, if it was present, and is sanded on the underside, so it could not be matched up easily with the stem section which was sanded on the opposite face. This lobe displayed very tight rings throughout (Figure 27), which do come in at a square angle against irregular scar crust.

This sample displays a mixture of cultural and non-cultural characteristics, and it is therefore uncertain whether or not this represents a CMT. The constrained growth and lack of ring width shift point to a natural cause; however the presence of smooth scar crust, and the large quantity of bark missing, suggest a cultural explanation. An 'uncertain' final decision is appropriate.



Figure 25. Sample Tree 15. Left healing lobe is sanded on the underside.

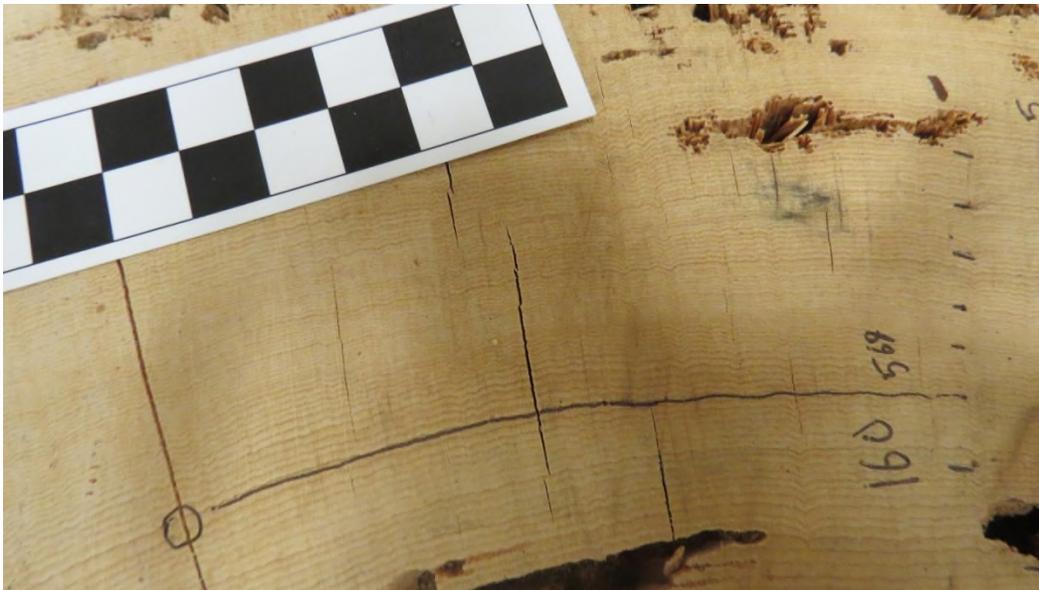


Figure 26. Ring year of injury on S 15 identified by Baseline. Note lack of ring shift; growth is constrained several years after injury



Figure 27. Left healing lobe of S 15, portion adjacent to injury missing. Note microscopic rings and rough scar crust healing surface.



Figure 28. Right healing lobe of S 15.

Sample Tree 16

Sample Tree 16 (S 16) displays a single scar of natural origin. The field photograph provided by Baseline of the standing tree shows a long tapering scar extending to the ground, with an irregular scar top, and a lesion appearing to extend from the point of the crease. The injury includes approximately 70% of the circumference of the tree; however shreds of bark remain on the central stem, especially obvious inside the left healing lobe, so it appears the healing response was precipitated by factors other than massive bark loss.

This is an excellent example of the characteristics of a definitively natural scar. Figure 30 clearly shows the hard, dark ‘scar crust’ forming against the bark remaining on the face of the central stem. This ‘scar crust’ is high uneven and irregular, very different to the crusts which form over a smooth scar face from which bark has been cleanly stripped. Pinwheeling, characteristic of many natural scars, is evident immediately adjacent to the injury, most obvious on the right healing lobe (Figure 31). In the more advanced portions of the healing lobes, subsequent to the initial pinwheeling (after at least a century of growth) the healing rings begin to come in somewhat perpendicular to the central stem, against the uneven scar crust substance. Extensive decay was present in the sample surrounding the ring year of injury, and it was difficult to discern the growth patterns in the rings, but tentatively it appeared that growth was somewhat, but not significantly, depressed prior to the injury, and a ring shift is present in the years subsequent. This may suggest the injury was the result of physical factors which resulted in partial circuit death.



Figure 29. Sample Tree 16, displaying a single natural scar

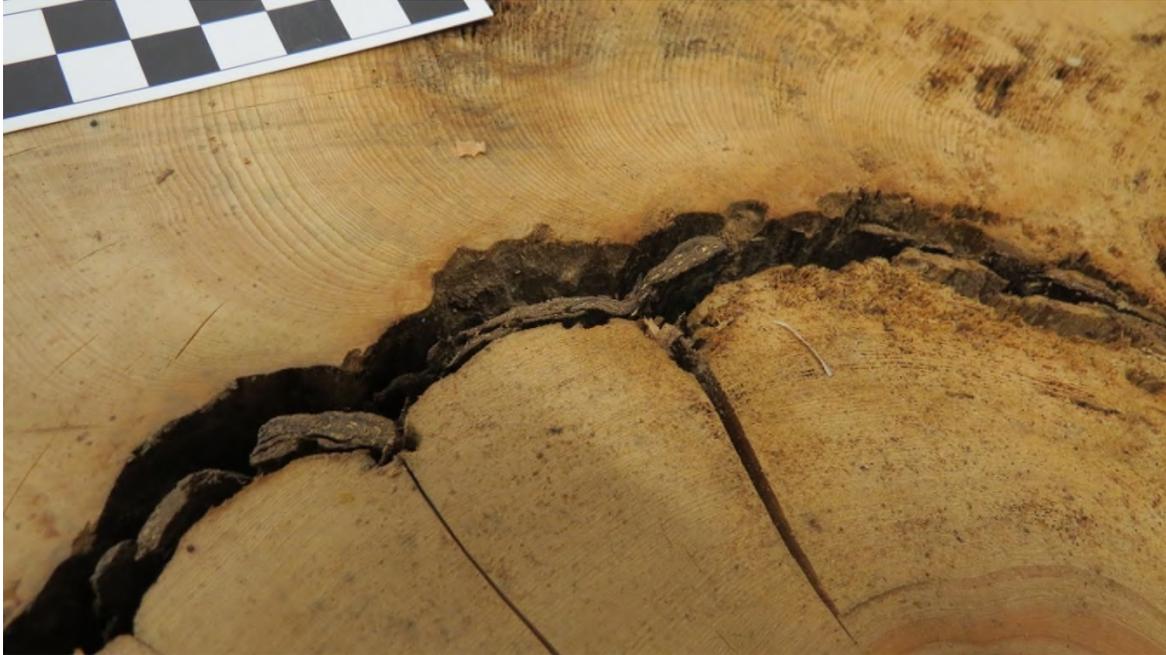


Figure 30. Left healing lobe on S 16, showing a highly uneven 'scar crust' forming against the bark remaining on the stem



Figure 31. Right healing lobe of S16, note healing rings pinwheeling immediately adjacent to injury

While Baseline uses this tree as an example of the natural origin of all the scarred trees in the site, we see it as a good example of the distinctive characteristics of natural scars; the attributes of this scar are very different from, for instance, Sample Tree 4.

Sample Tree Nat 1

Sample Tree Nat-1 displays a scar described by Baseline as having a “definitively natural” outward appearance. The photograph provided shows a lenticular shaped scar, with a HAG at a considerable height off the ground. This scar shape is consistent with either windfall damage or a branch breaking.

The sample contains two scar features (Figure 32). The first is a natural scar, in which we concur with Baseline. No smooth scar crust is present, the ring year of injury cannot be identified, and the healing rings pinwheel against a highly irregular healing surface, similar to that present on S 16 (Figure 33). Consistent growth is present both prior and subsequent to the injury, with no ring shift.

The second feature is a narrow internal scar, 6 cm in width. It is very similar to the internal scar present on S2, and displays perpendicular healing rings but now ring shift. As noted in the discussion regarding the internal scar on S2, this scar could represent a cultural feature; it could be the tapering top of a short test strip. This scar could also represent an area where a narrow section of bark was cleanly removed through a natural agent such as a bear strip, and so the healing response mimicked that of a cultural scar in this particular section of the stem. Additional samples from lower down on the stem might help select between the possibilities.



Figure 32. Sample Nat-1, displaying two scars. Feature 1 is a natural scar, Feature 2 is a small internal scar and may represent the tapering top of a short cultural test-strip scar, or a natural scar



Figure 33. Left and right healing lobes of Sample Nat-1, displaying pinwheeling, irregular rot, and highly irregular ‘scar crust’ healing surface against an uneven face.



Figure 34. Internal scar on Sample Nat-1