McAbee Fossil Site Assessment

Final Report July 30, 2007

Revised August 5, 2007

Further revised October 24, 2008

Contract CCLAL08009

by

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Executive Summary

The McAbee fossil site is a fossil mining operation operated by claim holders David Langevin of Kamloops and Robert Drachuk of Utah. The fossil site is contained within the Zugg 1 mineral claim.

The fossil-bearing strata are part of the McAbee beds, an informally named rock unit that is contained within the Kamloops Group of Eocene age. It is located east of Cache Creek, B.C., and west of Kamloops, lying just north of and visible from Highway 1/97.

This report was prepared after making inquiries of both professional scientists and amateur and semi-professional collectors as to the history and significance of the fossil site. A thorough literature review was also carried out, and a site visit was made to the fossil site itself and also to interview local interested persons and to view collections of fossils in private and institutional collections in Kamloops.

Fossils are collected regularly at McAbee by professional collectors, amateurs and school groups, and occasionally by scientists. Fossils from the site are variously retained by collectors for their private collections, sold on the internet and by other means, or donated or sold to institutional collections such as that of Thompson Rivers University in Kamloops. Institutions holding fossils from the site include museums and universities in British Columbia, Alberta, Saskatchewan, Ontario, New York, Illinois, and Washington State. Some of those museum holdings result from purchases from dealers or claim holders.

The fossil site is the most diverse known in British Columbia for species of plants and insects of Eocene age, although only a small fraction of the diversity has yet been formally described or at least identified to genus and species. Nevertheless there are more scientific papers about McAbee fossils than any other Eocene site in B.C. There is also a low-diversity fish fauna, and occasional finds of birds, spiders, and crayfish. Compared to other sites in British Columbia, it has a much greater diversity of known fossil species of plants and insects (and probably a greater potential for future discoveries of new species). Its advantages include its accessibility, the abundance, diversity, and intact preservation of its fossils, and their ready recognition by collectors in the field and by the public. Some aspects of the fossil preservation are exceeded by fossil localities elsewhere in the province, most notably by the Horsefly beds (because of the annual diatom layers of that deposit) and by the Princeton Chert (because of the cellular-level plant anatomy). Nevertheless the McAbee deposit has the greatest known taxonomic diversity by far in the region, offering a unique window into the animals and plants living in B.C. during one of the warmest periods in the history of the earth.

Some scientists are concerned about the barriers to scientific research caused by the activities of the claim holders, and about the loss of scientifically valuable fossil specimens through accidental destruction, excavation activities, private collecting, and sale for profit. The claim holders and certain serious amateur collectors believe that the activities of the claim holders are bringing numerous important specimens to light for scientific study and that most scientists have made too little effort themselves toward doing serious scientific research on the deposit, relying instead on specimens made available to them by the collectors. Individuals on both sides desire to see a museum or interpretive centre on site for public education and other purposes, though the details of this vision differ between the scientists and the collectors.

The McAbee fossil site is already one of the two or three most significant sites in British Columbia for scientific study of Cenozoic (early Eocene) fossils. Given its key advantages of high taxonomic diversity, fossil abundance, site accessibility, excellent preservation, and recognizable fossils, the McAbee site has the potential to become as useful for scientific, educational, museum exhibition, and tourism purposes as the Florissant Fossil Beds National Monument in the USA.

McAbee Fossil Site Assessment

Introduction

The McAbee fossil site is a fossil mining operation operated by claim holders David Langevin of Kamloops and Robert Drachuk of Utah; other collectors at the site include John Leahy of Kamloops and, formerly, John Fraser of Ashcroft. The fossil site is contained within the Zugg 1 mineral claim.

The fossil beds are part of the McAbee beds, an unnamed rock unit that is contained within the Kamloops Group of Eocene age, and is approximately correlative with the Tranquille Formation, which is exposed north of the eastern end of Kamloops Lake and in nearby areas.

The McAbee site is located east of Cache Creek, B.C., and west of Kamloops, just north of and visible from Highway 1/97 (Figs. 1, 2). The area of the claim is west of an open pit industrial mine in the same fossil-bearing rock formation. About 4 km farther west is another exposure of the same formation from which a limited number of fossils have been obtained in the past (Fig. 2). Immediately adjacent to the claim on its east and west sides there is a limited area of exposure of the McAbee beds that potentially could yield fossil material in the future were they to be investigated systematically (Fig. 2).

Fossils are collected regularly by professional collectors, amateurs, and school groups, and occasionally by scientists. Fossils from the site are variously retained by collectors for their private collections, sold on the internet and by other means, or donated or sold to institutional collections such as that of Thompson Rivers University in Kamloops. Institutions holding fossils from the site include museums and universities in British Columbia, Alberta, Saskatchewan, Ontario, New York, Illinois, and Washington State.

The fossil site is the most diverse known in British Columbia for plants and insects of Eocene age, although only a small fraction of the diversity has yet been formally described or at least identified to genus and species (see Appendices 2 and 5). Along with the extremely diverse flora and insect fauna, there is a low-diversity fish fauna, and occasional finds of birds, spiders, and crayfish.

Some scientists are concerned about the barriers to scientific research caused by the activities of the claim holders, and about the loss of scientifically valuable fossil specimens through accidental destruction, private collecting, and sale for profit. The claim holders and certain serious amateur collectors believe that the activities of the claim holders are bringing numerous important specimens to light for scientific study and that most scientists have made little effort themselves toward doing serious scientific research on the deposit, instead choosing to rely on specimens made available to them by the amateur and semi-professional collectors. Some individuals on both sides express the desire to see a museum or interpretive centre on site for public education and other purposes, though the details of this vision differ between the scientists and the collectors.

The purpose of this report is to provide a professional and qualified assessment of the McAbee fossil site (Zugg 1 claim) so that Government officials have the facts needed to make appropriate decisions about the future of the site.

This report was prepared after making inquiries of both professional scientists and amateur and semi-professional collectors as to the history and significance of the fossil site. A thorough literature review was also carried out, and a site visit was made to the fossil site itself and also to interview local interested persons and to view collections of fossils in private and institutional collections in Kamloops.

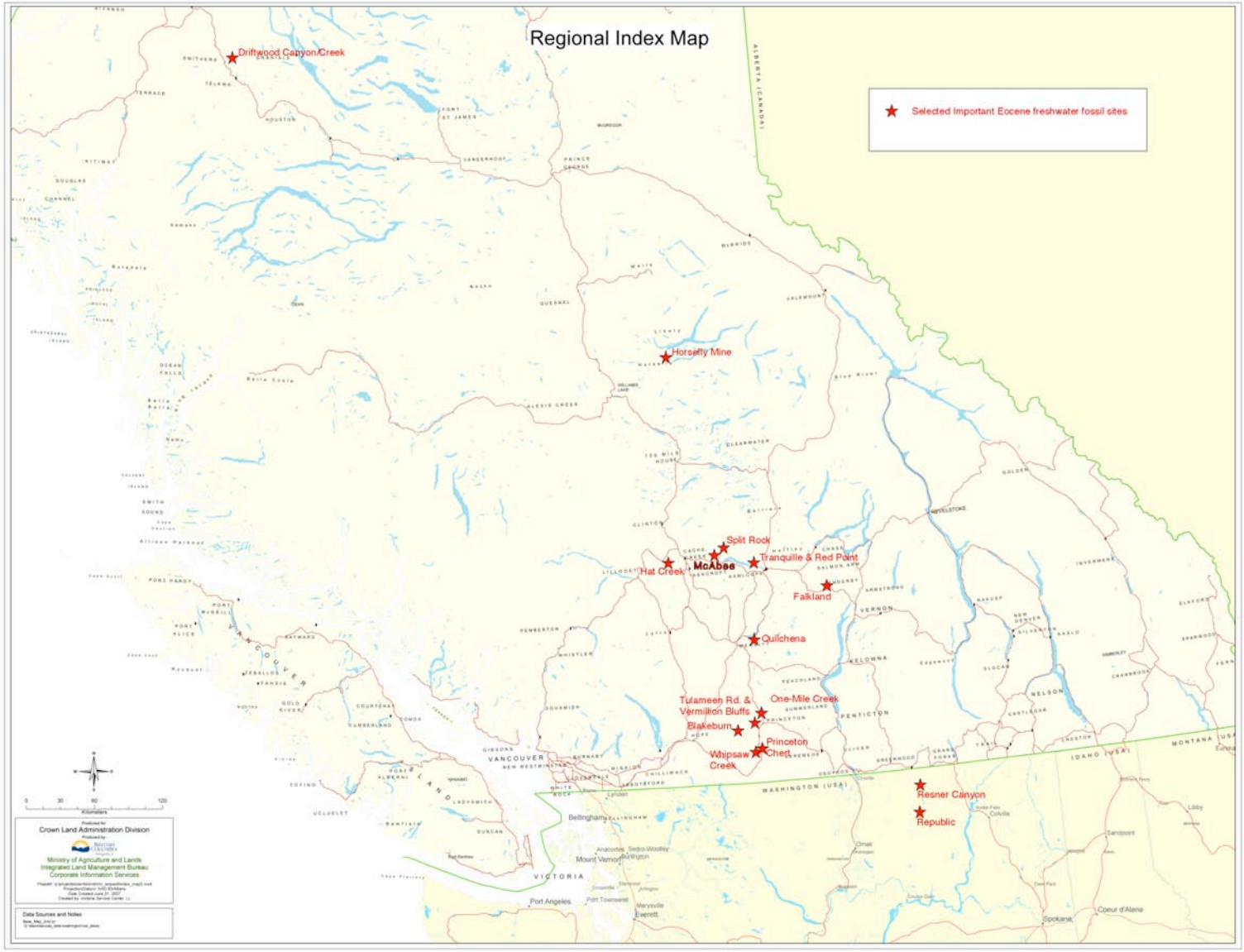

Fig. 1. Regional map showing the locations of important Eocene fossil localities in British Columbia and Washington. Key comparisons are with Republic in Washington, and with Princeton area sites, Horsefly Mine, and Driftwood Canyon in British Columbia.

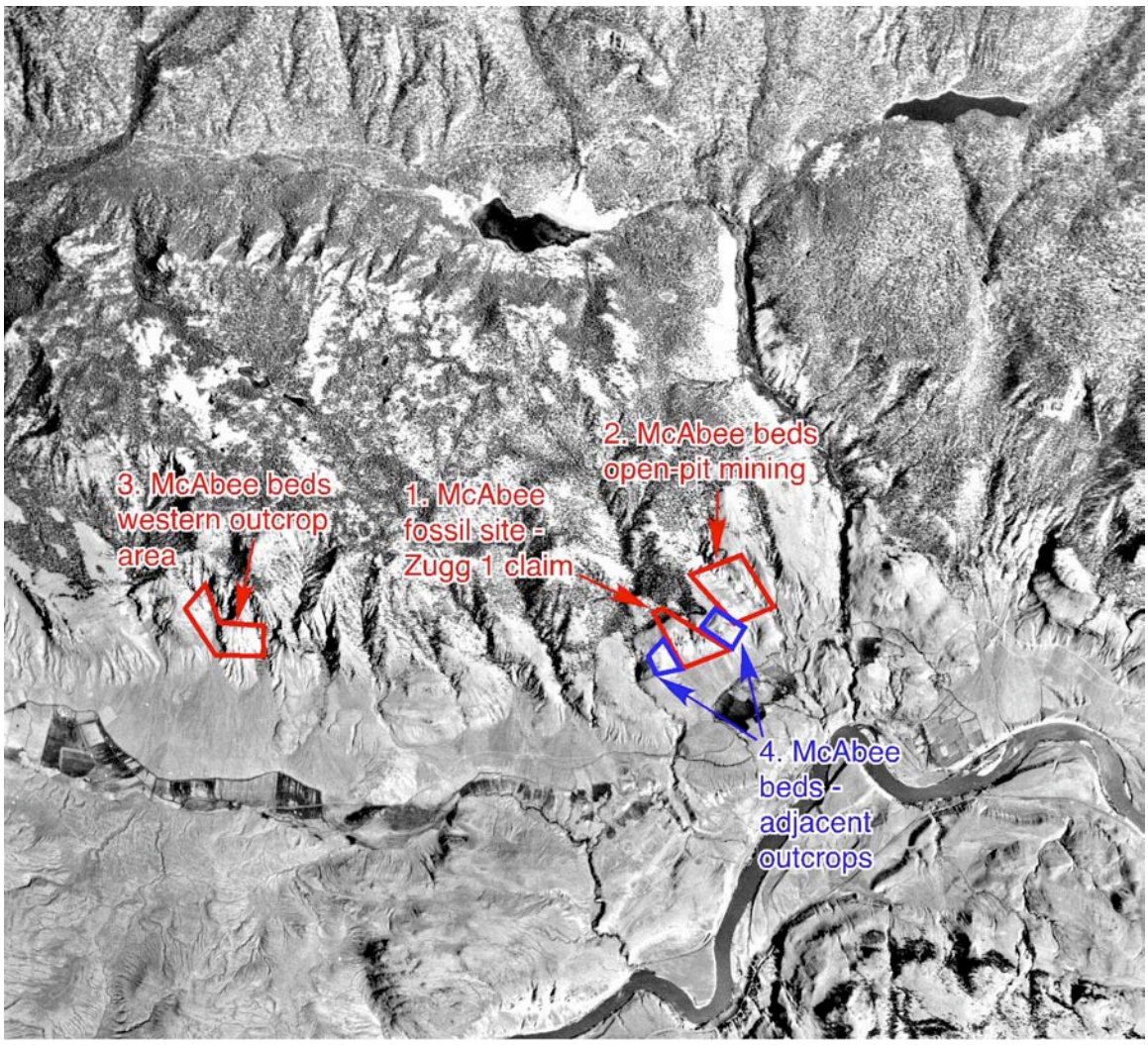

Fig. 2. Local area historical air photo, taken in 1951, showing the main outcrop areas of the McAbee lake beds of Eocene age.

- Red:
    1. McAbee fossil site (Zugg 1 claim)
    2. nearby open-pit mine to the northeast
    3. western outcrop area of McAbee beds ~4 km west of the claim
- Blue:
    4. two smaller areas of exposure/outcrop of the McAbee beds adjacent to the Zugg 1 claim but not currently being exploited.

The author was told that some of the eastern adjacent outcrop area (blue) had been staked in the past by local amateurs, reputedly to prevent mining operators from doing so. Most institutional and private collections originate from either the Zugg 1 claim itself (red) or the nearby open-pit mine. The University of Alberta also has a small collection made by the author in the 1970s from the western outcrop area (red).

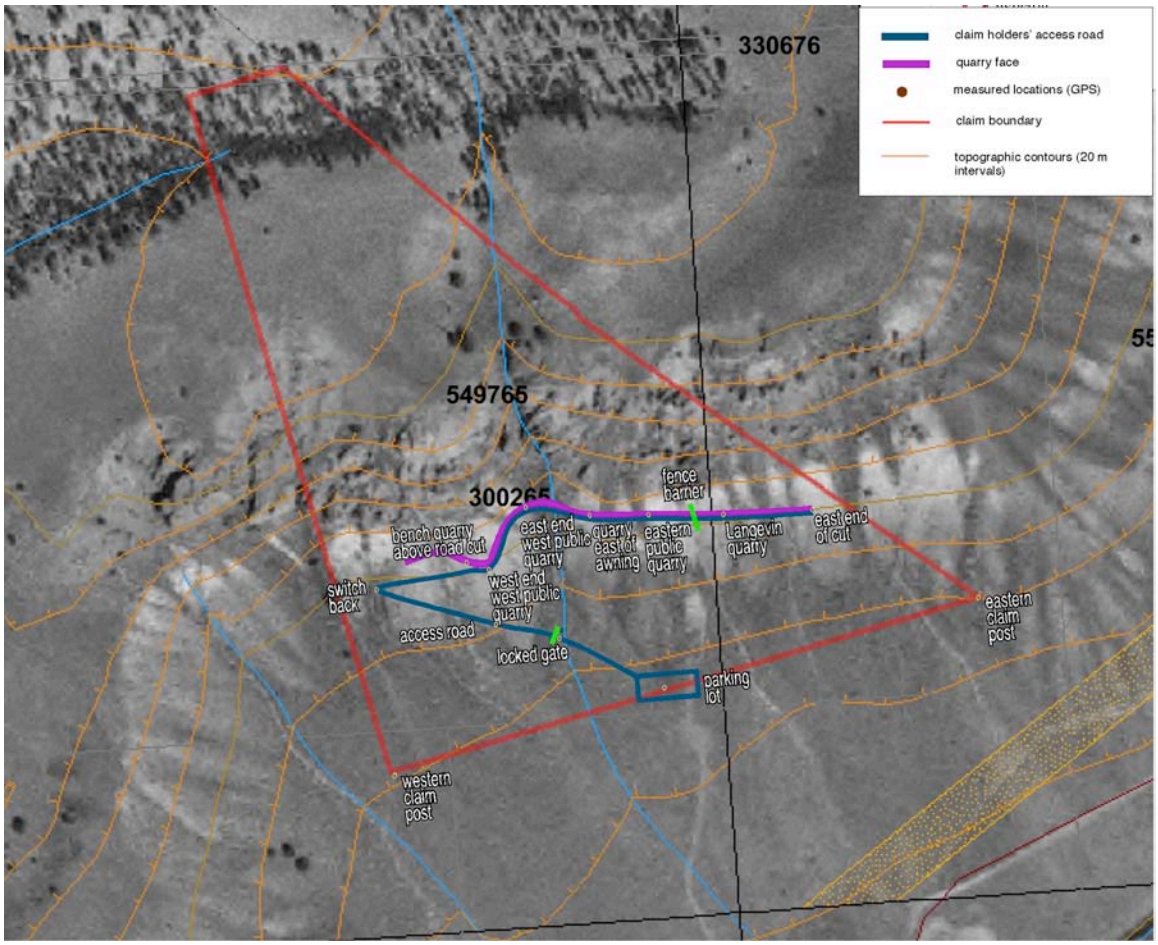

Fig. 3. Aerial view of the McAbee site showing access road (blue) and locations where GPS coordinates readings were taken by the author. The boundary of the Zugg 1 claim is shown in red, and the quarry face, on the uphill side of the road cut, is shown in purple. The access road is closed by a locked gate above the parking lot (green). For GPS coordinates, see Appendix 1.

Geological Context

The McAbee beds are an informally named unit of lake-bottom sedimentary rocks contained within the Kamloops Group, which consists primarily of volcanic rocks. One researcher (George Mustoe) has suggested that the McAbee shales are composed largely of modified diatom frustules. If so, the diatoms are so highly modified that their original features cannot be seen in microscopic examination of the rocks.

At the McAbee claim site, the fossil beds sit beneath a cliff that is formed from the volcanic rocks of the Kamloops Group (Figs. 4, 5). Similar cliffs of volcanic rocks are common in the region, and lake sediments are often found at the bases of such cliffs.

Farther east, near Kamloops, the Kamloops Group contains lacustrine sedimentary rocks of much the same age that are formally named as the Tranquille Formation; however, the McAbee beds are not known to be continuous with that formation and thus have not been included within the Tranquille Formation by most authorities.

Figure 4. View of McAbee site from highway showing access road, parking lot, and excavation through fossil beds.

Fig. 5. Panoramic photo of McAbee claim showing access road and quarry face. There is a single car in the parking lot near the bottom centre of the photo.

West of the McAbee claim site, similar lake-bed sedimentary rocks can be seen from the highway. One example is about 4 km west of the claim (Figs. 2, 6, 7). In the 1970s, the author obtained from that outcrop a small collection of fishes, insects, and plants that are now in the University of Alberta collections.

Fig. 6. Exposure of McAbee beds visible from the highway about 4 km west of the claim.

Fig. 7. Closeup (telephoto) view of the exposure 4 km west of the claim site.

Fig. 8. Detail of layers of McAbee beds immediately east of awning, showing lacustrine shales (brown) separated by layers of whitish volcanic ash.

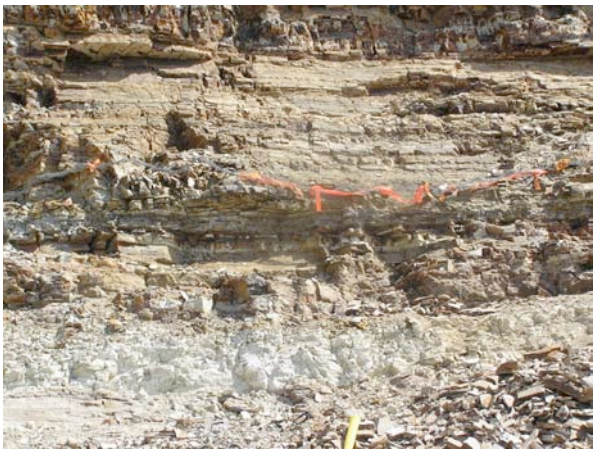

Fig. 9. Detail of layers of McAbee beds showing flagging used to keep public away from higher parts of the quarry face.

The McAbee beds at the claim quarry consist of layers of siliceous shale generally of a brown colour, with gypsum crystals common in cracks and separating weathered layers. Interbedded with the shales are white to pale grey ash layers (Figs. 8, 9). The outcrop areas of the McAbee beds can be seen from some distance away because of the pale-weathering shales and the whitish ash layers, giving an overall pale colour to the slopes where the beds are exposed (Figs. 4–7).

Several hundred meters to the northeast (Figs. 10, 11), the fossiliferous lake beds are mined by a different operator in an open-pit operation reputedly for use as livestock feed supplement and/or kitty litter (in the past) or as cattle bedding on feedlots, according to local residents. The strata in the mine are also fossiliferous, yielding large fish and other fossil specimens to local amateur collectors.

Immediately adjacent to the claim on its east and west sides (Fig. 2, outlined in blue) there are small areas where the McAbee beds, probably containing fossils very similar to those within the claim, crop out on the hillside. These areas represent a small reserve of potential future importance provided that they are not exposed to commercial mining activity.

Fig. 10. View of the open-pit 'kitty-litter' mine from the valley bottom.

Fig. 11. View to the west from near the center of the main pit of the open-pit mine.

Farther northeast, similar rocks occur in the valley of the Deadman River at a site called Split Rock (the author in the 1970s and some local collectors in recent years have had success collecting fossils there).

The age of the McAbee beds is most likely late early Eocene, about 51 million years old. They were formerly considered to be early middle Eocene, but revised dating studies have suggested the slightly greater age.

In addition to the Tranquille Formation, other lake-bed deposits of similar age in British Columbia include those near Smithers (Driftwood Canyon), Horsefly (e.g., Horsefly Mine), Falkland, Quilchena, Princeton (e.g., One-mile Creek, Whipsaw Creek, Princeton Chert, Vermilion Bluffs, Tulameen Road, Blakeburn Mine), and similar deposits in and near Republic in Washington State (Fig. 1).

Claim Use and Impact

The claim holders have constructed a rough road connecting the highway with the fossil beds. Recently an area near the bottom of the hill was cleared as a parking lot and turn-around for vehicles including school buses (Figs. 2, 3, 4, 5, 14). The road is blocked by a locked gate, and extends up to the fossil layer near the western boundary of the claim. From there, it was excavated by bulldozer along the trend of the fossil beds. This access road was cut through the fossil beds, destroying some fossils in the process, and the quarry face is periodically cleaned by a 'bobcat' excavator, destroying more fossils. The excavated cuts are the places where collecting takes place on the uphill side of the road, and the downhill side of the road is where rock fragments are pushed over the edge. A locked gate prevents easy access by vehicle to the excavation, and at the present time, a relative of Mr. Langevin lives on site in a trailer, making vandalism or theft of material from the site relatively unlikely under current conditions.

In several places along this road, intensive digging for fossils has occurred, using hand tools. As yet there is no indication that the productive layers have been exhausted in any location. There is a small area of un-excavated fossil bed to the east of the claim (Figs. 2–4), judging by the color of the slope. To the west, there appears to be another modest area of fossil bed exposure, though these areas are outside the claim and were not investigated closely.

The two claim stakes marking the southwest and southeast boundaries of the claim were located and photographed (Figs. 12, 13). GPS locations of these stakes were recorded, and this allowed the author to superimpose approximately the GPS locations of the parking lot, quarry face, and access road onto the detailed site map provided (Fig. 3), using the assumption that the claim boundaries supplied on that map were accurate. This procedure should be considered an approximate one. GPS locations as measured in the field are listed in Appendix 1.

Fig. 12. Western claim stake.


Fig. 13. Eastern claim stake with GPS unit atop post.

Quality, Abundance, and Importance of the Fossils from McAbee

The fossil record of British Columbia for the Cenozoic Period (65 to 3 million years ago) is dominated by deposits of Eocene age yielding fossils that are preserved in ancient lake sediments. The vast majority of these deposits have been discovered over the past 100 years. It is not likely that many more will be discovered in the future, and it is even less likely that other important fossil-bearing deposits of Cenozoic age, either older or younger, will be found in the future, as the geology of the province has been relatively well documented. Thus the McAbee site and perhaps two or three other notable sites are the most important fossil sites within the province for understanding ancient life and environments of the Cenozoic Period. The McAbee site occupies a special place among these Cenozoic sites for reasons detailed below.

The McAbee site yields extremely well-preserved compression fossils, mostly of plants and insects. Compression fossils are the most common category of fossil plants and insects, as distinct from some special categories such as three-dimensional plant fossils in chert, and insects preserved in amber.

Within the compression-fossil category, the McAbee site has several important advantages:

1. The layers of sedimentary rock are extremely fine grained and pale in colour. This produces a detailed impression of the external features of the fossil, with the fossil standing out against the paler background. They are thus relatively easy to find in the field and they generally make visually attractive exhibit or instructional specimens. It is also relatively easy to make high-quality, informative photographic images of them, which the layperson can appreciate because they look like the living insects or plants.
2. The rock layers are extremely thin and flat, resulting in a high probability that the fossil (leaf, flower, branch with leaves, seeds, or cones) will be preserved in its entirety. The overlying thin layers, if there are any covering parts of the fossil, can often be prepared away carefully using precision mechanical tools, to reveal the entire fossil.
3. The fossils are often preserved intact, having not been attacked by scavengers or deteriorated by decay before their burial. The larger leaves and insects are often spread out, the leaves perfectly flat and the insects with legs and wings spread.
4. The fossils are extremely abundant, so that even a casual visitor such as an elementary school student is likely to find a few recognizable fossils.
5. The taxonomic diversity of the plants and insects at the site is extremely high. Although some kinds of insects (e.g., March flies or Bibionidae) and some kinds

of plants (e.g., leaves of birch-like trees) are very common, they do not so dominate the assemblage that the other, rarer taxa are seldom found. At some other sites, the common and ultimately less interesting fossils are relatively more abundant.

6. The site is readily accessible and visible from a major highway (Highway 1/97) and close to a major regional population centre (Kamloops).
7. The layers can in principle be traced laterally and distinguished vertically in the rock section, allowing future studies of changing fauna and flora during the time represented by the ancient lake.

The McAbee site has a combination of advantages (see above list) that is extremely rare, but it is not perfect from the point of view of preservation and scientific information. The following are a couple of its limitations:

1. The fossils are extremely compressed (flattened), thus lacking three-dimensional details. This can cause difficulties for the scientist or hinder their appreciation as once-living organisms.
2. The fossils often lack microscopic detail on very close examination. Importantly, there is little to no preservation of cuticle of the plants. Intact cuticle can be an important source of scientific information when it is preserved, as it is at some other Eocene fossil sites (e.g., Republic, Washington; Horsefly Mine, B.C.).

Even taking into account the site's few limitations, its long list of advantages constitutes a rather rare combination. For example, at the Driftwood Creek fossil beds near Smithers (more details below), the abundance of the fossils and the apparent diversity of the species are not nearly as high as at McAbee, and the site is not as accessible. As discussed in more detail below, there are perhaps two other sites in B.C. that exceed McAbee in some respects: Horsefly Mine (better preservation, more colourful fossils, more informative record of the passage of time) and Princeton Chert (three-dimensional preservation with cellular detail). However, no single site in B.C. is able to match McAbee in terms of the abundance, diversity, intact preservation, and accessibility. There is no fossil site in Canada, certainly not one of Eocene or even early Cenozoic age, that offers all of these advantages in one package.

The closest comparison to the quality and abundance at McAbee is probably with the Florissant Fossil Beds National Monument in Colorado, USA, where an extraordinary diversity of plants and insects has been studied by many specialists over more than 150 years. The McAbee beds could approach Florissant in abundance and diversity if a comparable long-term scientific effort were undertaken at McAbee.

Such a source of information about the diversity of plant and insect life in British Columbia during the Eocene is important for public understanding of the province's ancient past and its possible future. The early Eocene was one of the warmest periods in the history of the earth, yet the fauna and flora of central B.C. during the early Eocene were not identical to those of more southerly parts of North America at the same time. What caused the regional variation in fauna and flora even during extremely warm climatic periods is worthy of scientific study. Uncovering this story of past climate change and changes in diversity could also help the students and citizens of the province appreciate the fragility and uniqueness of the province's present environment.

Sale and Private Use of Fossils from McAbee

Fossils at McAbee are collected by professional and amateur collectors including the claim holders, primarily Mr. Langevin who manages the claim on site, and by Mr. John Leahy of Kamloops, who has collected extensively in recent years. These collectors make a preliminary sorting of the discovered fossils, retaining items they consider of likely scientific interest, and some of them make the remainder available for sale, e.g., on web sites or via dealers in the U.S.A.

such as “www.fossilmall.com”. These collectors generally also maintain and add to their own private collections in their homes, which contain some of the most spectacular fossils found at McAbee. There is at least one example, a large fossil stonefly, for which one half of the split fossil has been donated to science and has been designated a holotype, while the other half, the counterpart, has been retained by the collector. Technically, the entire individual is the holotype and thus it is highly questionable to have it divided in this way, but this was a condition of the donation.

Part of the fossil site is also open to amateur collectors including tourists, who may see the signs on the highway or learn about the site through brochures in area motels or tourist bureaus. These people pay a fee to collect for several hours, and are allowed to keep fossils that the claim holders do not decide to retain. Because some casual visitors are collecting during hours when the more knowledgeable claim holders are not present, and even the claim holder is not an expert on all fossils, it is probable that exceptional or scientifically important fossils are removed into private collections or private sales.

Images of typical and exceptional fossils found by amateurs and semi-professional collectors are shown in Appendix 3.

Educational Use of Fossils from McAbee

About 12 to 20 times per year, school groups from area schools (from as far away as Chilliwack and Williams Lake, but most from Kamloops, Ashcroft, and other nearby areas) visit the site with teachers and parent helpers (the whole group usually supervised by the claim holder, Mr. Langevin). The students collect specimens under teacher or parent guidance, which they take back to their schools for use in science teaching units. Mr. Langevin generally can review the collected material to retain anything of significance when he is present, although it rarely happens that the public and students find significant fossils. Most of their finds are of fragments of common species because they are not trained collectors.

Fig. 14. Arrival of the grade 5-6 class from Ashcroft Elementary School on June 26, accompanied by teacher, support worker, and parent volunteer.

Fig. 15. Ashcroft Elementary students searching for fossils in the eastern public area of the quarry, guided by David Langevin, claim holder, in red hat.

Fig. 16. Ashcroft Elementary boy with part of a fossil fish, *Eohiodon rosei*, the most common fish at the site.

Fig. 17. Ashcroft Elementary school group in western public area of the quarry.

The author was on site during a typical school field trip, this one by the Grade 5/6 class of Ashcroft Elementary School (Figs. 14-17). The class spent more than four hours on site, searching for fossils and reviewing their finds under the awning/tent structure near the center of the excavation. Several partial fish fossils, numerous leaves, and occasional insects were found by the group. Each student is usually able to find several recognizable fossils during a few hours of effort. The parents and teacher indicated that the experience was a very valuable one for the students, the teacher indicating that she brings a class each year if possible.

A web site maintained by the Dillhoff brothers in Seattle, USA (www.evolvingearth.org) has educational pages about the McAbee fossil beds.

Collections of Thompson Rivers University and other institutions, including the author's institution University of Alberta, are used in undergraduate teaching and occasionally in museum exhibition programs. McAbee fossils are also in some international institutions such as the Field Museum of Natural History, Chicago, and the Burke Memorial Museum, University of Washington, where they are available for public educational and exhibit purposes.

Scientific Use of Fossils from McAbee

Donations by Amateur and Semi-Professional Collectors

Most of the fossils considered worth retaining by the professional collectors are either sold for profit or destined ultimately for the collections of Thompson Rivers University. More fossils could probably be donated to TRU but how many fossils that institution can manage is open to question, since it has few dedicated facilities (one very small room) to house and catalog them. Meanwhile Mr. Langevin over the years has occasionally sent pictures of potentially interesting fossils to scientists, including the author, and has donated a few fossils to institutions as a result, including a few to the University of Alberta (Fig. 18).

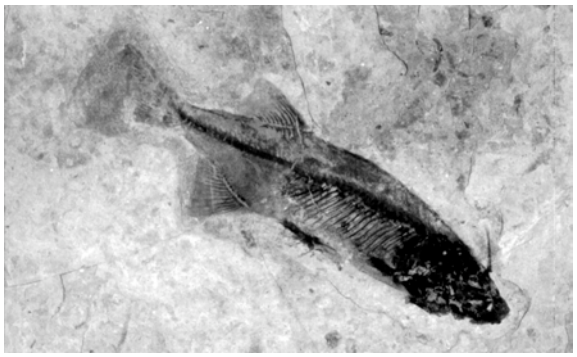

Fig. 18. Specimen of *Eohiodon rosei* donated to the University of Alberta by Mr. Langevin.

Fig. 19. Specimen of *Eohiodon rosei* in part and counterpart, collected at McAbee by the author during the B. C. Palaeontology Meeting at TRU in 2002.

More recently Mr. Leahy has made available to researchers collections on CD of digital images of each year's collected fossils; researchers are invited to contact him to arrange for study loans of the relevant specimens, to be followed by deposition in an institutional collection, usually TRU. Some of these specimens are currently on loan to scientists, and the remaining ones are still in his personal collection, which he says he intends to donate to an institution such as TRU.

Mr. Ken Pugh of Chilliwack has a large number of often excellent McAbee fossils accessioned into his private collection, which is called "The Fraser Centre for Non-marine Eocene Research' and abbreviated 'FCER' when cited in this report. These fossils are relatively well curated, and Mr. Pugh has self-published lists of the collections holdings. According to Mr. Pugh, this collection is ultimately destined for donation to a museum collection. It is said to be affiliated with the Fraser Valley Community College, but whether any formal agreement has been reached is unknown to the author of this report.

Another similar situation is that of Mr. Rick Dillhoff of the Seattle area. He has collected more than once at McAbee; at least some of the resulting specimens are in the collections of the Burke Museum, University of Washington, Seattle. Mr. Dillhoff has also co-authored a number of scientific papers on Eocene plants, including some studies of the McAbee fossil flora.

It is sometimes difficult to tell whether a particular collector is involved for private acquisition, or is interested in selling specimens, or is actually collecting for scientific study, since some collectors are involved in several kinds of activities.

Scientific Collecting

More rarely, scientists have collected at the site in person, including Dr. George Mustoe and Dr. Bruce Archibald, the latter having collected for several weeks. Overall, though, the scientific excavations at the site have been few and of short duration. More often, scientists will collect only briefly during a short visit. For example, during the 2002 B.C. Palaeontology Meeting held in Kamloops, a collecting opportunity was offered at the claim site. Small collections were obtained by investigators from various institutions (Fig. 19), including University of Alberta (fishes and insects: Dr. Mark V. H. Wilson; plants: Dr. Ruth A. Stockey and graduate students).

Several scientists have complained about restrictions or obstacles placed in their path, including restrictions on where (which part of the quarry) and when (scheduling obstacles) they are allowed to collect, but others have reported good cooperation.

It is noteworthy that several scientists who have published on McAbee fossils have only briefly worked at McAbee or have never personally collected or had their supervised students collect at McAbee. Examples include Dr. Jim Basinger (University of Saskatchewan), Dr. Rolf

Mathewes (Simon Fraser University), Dr. David Greenwood (Brandon University), and Dr. Steve Manchester (University of Florida). In at least two of these cases the scientists have active collecting programs at other fossil sites in the region, Dr. Basinger currently at Falkland (a site very similar to McAbee in geology and possibly flora), and Dr. Mathewes at Quilchena near Merritt. Therefore, any publications made by such scientists on McAbee fossils (notably Drs. Greenwood and Manchester) must necessarily have relied mainly on fossils collected or donated by others.

Loss of Scientifically Valuable Fossil Specimens

There are some documented cases of fossils of scientific importance not making their way into scientifically accessible collections. Examples include counterpart specimens (the obverse half) of unique or holotype insects (Mr. Langevin) or bird remains (Mr. Leahy) undoubtedly from the McAbee site, or excellent second specimens of rare species of fishes, plants or insects for which there is one good example under scientific study. There is also an example, well known locally, of a fossil bird specimen that was not donated to a Canadian institution despite attempts to offer a tax receipt (by TRU) for its donation. However, in this case, the so-called 'Cassini bird', it is not certain where the fossil was found—the collector has not given this information. The present whereabouts of that specimen are unknown, with some people believing it to have probably been sold in the USA and others believing it to be still in the collector's hands.

Both scientists and lay collectors expressed very strong opinions that the nearby commercial mine in the McAbee beds represents a significant loss of valuable scientific and educational resources, even more serious than the operation of the McAbee fossil claim itself. The mine operators allow casual collectors to visit during times when the mine is not actively being excavated; resulting finds show that this mine is the source of many of the fish fossils, including most of the larger specimens of *Eosalmo*, the fossil trout. Therefore, large numbers of fossils must be destroyed routinely by mining operations.

Scientific Publications

The McAbee fauna and flora are among the most diverse known for any Tertiary fossil site in North America; this is particularly true for the plants and insects. Preservation is excellent for a site of this type (compression fossils; see earlier discussion of quality and importance). The fossils are extremely abundant, and the diversity is very high.

The Bibliography lists the scientific publications to date for McAbee fossils; the number of publications is summarized here:

- Refereed scientific papers and book chapters on paleontology: 24
- Refereed papers and book chapters on geology/sedimentology: 3
- Non-refereed papers, chapters, and conference abstracts: 10
- Theses based largely on McAbee fossils: 2 M.Sc., 1 Ph.D.

Also listed is a synopsis of taxa recorded from McAbee (Appendix 2) and a detailed list of taxa in scientific publications from McAbee (Appendix 5).

Comparisons with other Eocene Fossil Sites

The following comparisons give summary statements about the diversity, management, and significance of fossils from selected Eocene freshwater fossil sites in British Columbia and Washington. Many other fossil sites are known but those listed are the most important and relevant comparisons.

Driftwood Canyon (Driftwood Creek), Smithers, B.C.

The first record of the Driftwood Creek fossil deposit was a specimen collected in the 1930s that was sent to the National Museum of Canada, where it attracted the attention of the present author. The fossil beds at Driftwood Creek (Driftwood Canyon Provincial Park) were on privately owned land until the owner donated them to the Province for the purpose of establishing a

paleontological park, where members of the public could collect and learn about fossils. Management and restrictions on collecting have changed during the years since. Currently, collecting by the public is discouraged.

Field work by the author of this report in the early 1970s resulted in basic collections of plants, insects, and fishes from this site. The most significant discovery was a species of fish, *Eosalmo driftwoodensis* Wilson, 1977, that to this day is the oldest known fossil of the salmon and trout family, Salmonidae. That species is also known now from other sites in the province including McAbee itself, although most McAbee specimens of *Eosalmo* have come from the 'Kitty Litter' mine near the McAbee claim. *Eosalmo* also occurs in the Princeton area and at Republic, Washington.

The plants and insects of Driftwood Creek have not been studied to the same degree as those of McAbee. Overall, the Driftwood Creek beds have significant potential for scientific advancement, but would require more thorough investigation to realize their full potential.

Horsefly Mine, Horsefly, B.C.

The Horsefly Mine deposit of Eocene age on the banks of the Horsefly River is arguably as significant as that at McAbee but for very different reasons. Discovered by the manager of a placer gold mine in the late 1800s, investigated by Canada's first vertebrate paleontologist Lawrence Lambe in 1906, investigated further by geologists and biologists in the 1950s and 1960s, the site was studied in detail by the author of this report over the decades since 1969.

At Horsefly, the most abundant fossils are fishes belonging to an extinct species of the sucker family (Catostomidae) called *Amyzon aggregatum* Wilson, 1977. Several other species of fishes are known, including two species of *Eohiodon*, *E. rosei* (Hussakof, 1916) (the same species as at McAbee), along with *E. woodruffi* Wilson, 1978 (a species first discovered near Republic, Washington). Also from Horsefly is *Priscacara aquilonia* Wilson, 1977, the only spiny-rayed teleost known from the interior Eocene of British Columbia.

Horsefly Mine also yields significant numbers of fossil insects and plants, many of them extremely well preserved (often better preserved than those at McAbee) but not found as abundantly as those at McAbee. Fossil flowers and mosses from Horsefly have been the subject of scientific publications. However, the insects and plants from Horsefly have not been studied intensively.

The Horsefly beds are also important because the fossil-bearing layers are composed mostly of diatom frustules. It has been proposed by Dr. George Mustoe that the beds at McAbee and elsewhere were originally composed largely of diatoms, but only at Horsefly have those diatoms been preserved. Dr. Alex Wolfe of the University of Alberta has begun the scientific study of the diatoms, which are among the oldest freshwater diatoms known in the world.

The main importance of the Horsefly deposit lies in the fact that the fossils occur in annual layers (varves) that can be counted; each fossil can be assigned to a particular year (varve) when it died and was preserved, and thus its relative year of death can be estimated very precisely. Thus the Horsefly beds represent a natural laboratory of the changes that occurred in the ancient Eocene lake, recording differences in fossil preservation, species composition, and even differences in the morphology of the fish species that inhabited the lake over hundreds or thousands of years, during one of the warmest periods in Earth's history. This story of ancient climate change and the responses of the species to them has enormous potential for educational use and scientific inquiry in the future. Indeed, the stories to be told by the Horsefly and McAbee sites are often complementary, each one offering a different but important aspect of of ancient environments and changing climates.

The Horsefly beds are partly on private land and partly in the bed of the Horsefly River where they are effectively under government control. To date the site has not received an official designation for protection. The Horsefly site is thus vulnerable to unprincipled destruction by collectors or restrictions on scientific access by landowners. Occurring as it does in the bed and on the banks of the modern Horsefly River, the site has importance for upstream migration of salmon and as an educational/natural example of that phenomenon.

Princeton Chert, Princeton, B.C.

Among the many fossil sites near Princeton, B.C., the most significant is the Princeton Chert on the banks of the Similkameen River. The site was studied in the past by Dr. Wilson Stewart and his then graduate student Dr. Jim Basinger when at the University of Alberta, and in recent decades by Dr. Ruth Stockey and her many graduate students at the University of Alberta. There are thus many scientific publications detailing the plants found. The Princeton Chert site has not yielded much in the way of other fossils, the only exception being a single partial skeleton of a soft-shelled turtle (*Aspideretes*) and a large fish in the bowfin family (Amiidae), called *Amia hesperia* Wilson, 1980, both at the University of Alberta.

The fossils of the Princeton Chert are preserved as 3-dimensional, silica-replaced, anatomically accurate plant organs, including stems, cones, fruits, and flowers. The study of these amazing fossils requires painstaking laboratory procedures that result in highly detailed, cellular-level anatomical reconstructions of the plant organs, important for scientific understanding of the evolution and relationships of the plants. The microscopic images of the fossils are often beautiful, like stained glass, but the lay person is not usually able to visualize the living plant based on these images.

Republic, Washington

Fossils from the Republic area were discovered as early as 1910 by geologists. The area was the site of significant mining activity. The author of this report made collections of fishes, insects, and plants in the Republic area in the 1970s, and a local resident was helpful in pointing the author to productive fossil sites: some of the most important fish specimens had been found by a high-school student and saved.

Since then, the community of Republic and scientists from the Burke Museum in Washington have enthusiastically embraced the fossil potential of the Republic area. An interpretive center called the Stonerose Interpetive Center (http://www.stonerosefossil.org/) was established. It maintains a small collection for demonstration purposes, sponsors community events, encourages educational and public participation including closely supervised, for-fee public collecting of fossils, and makes significant finds available to the scientific community.

The Republic fossils have in the years since the 1970s become extremely important scientifically as a result of extensive work mainly by paleobotanists and paleoentomologists.

Although the legal framework and history are different between Republic and McAbee, there is much to be learned from the Stonerose experience about fossil sites as educational, scientific, and tourism destinations.

Fossil Butte, Florissant Fossil Beds, and John Day Fossil Beds National Monuments, U.S.A.

The United States has a system of national monuments administered by the U.S. National Park Service. Several of these have a long history of educational and scientific accomplishment, including

- Fossil Butte National Monument (http://www.nps.gov/fobu/) near Kemmerer, Wyoming (the same age as the McAbee beds, approximately). The author was involved as an advisor to the U.S. Park Service during the planning of the visitor center and site development at Fossil Butte.
- Florissant Fossil Beds National Monument (http://www.nps.gov/flfo) at Florissant, Colorado (late Eocene age). This site has yielded an enormous taxonomic diversity based

on tens of thousands of scientific specimens of plants and insects over more than 150 years of study.

- John Day Fossil Beds National Monument (http://www.nps.gov/joda), Dayville, Oregon (Oligocene). This national monument comprises several different fossiliferous deposits originally discovered by a traveling preacher about 150 years ago.

These sites include visitor centers with small museum and preparation facilities, public educational programs, volunteer organizations, and trained on-site staff.

The site that is most comparable to McAbee in terms of the kinds of fossils and their preservation is the Florissant Fossil Beds National Monument.

Museum or Visitor Centre Proposals for McAbee

Several scientists and collectors advocated verbally or in writing for establishment of a visitor centre/museum/gift shop facility (details of their ideas are in Appendix 4). Details differ depending on whether the individual is approaching this primarily from an educational, scientific, or profit-making perspective. Nevertheless, there are some common threads involving promoting educational uses, on-site exhibits for tourists and schools, and trained staff who can recognize significant fossils that should be retained for study.

Should the Government choose to pursue some such alternative, there are many models to investigate, each one a little bit different in emphasis. These models include:

Canada

- Tumbler Ridge Museum & Dinosaur Centre, Tumbler Ridge, B.C. (http://www.tumblerridgemuseum.com/)
- *T. rex* Discovery Centre, Eastend, Saskatchewan (http://www.dinocountry.com/t-rex_center.html)
- Field Visitor Centre (Burgess Shale), Field, Yoho National Park, B.C. (http://www.burgess-shale.bc.ca/field.php)
- Courtenay and District Museum, Courtenay, B.C. (http://www.courtenaymuseum.ca/)
- Driftwood Canyon Provincial Park, Smithers, B.C. (http://www.env.gov.bc.ca/bcparks/explore/parkpgs/driftwood.html)
- Parc Miguasha, Miguasha, Gaspé, Québec (http://www.sepaq.com/pq/mig/en/)

Elsewhere

- Stonerose Interpretive Center, Republic, Washington (see above details)
- John Day Fossil Beds National Monument, Dayville, Oregon (see above)
- Fossil Butte National Monument, Kemmerer, Wyoming (see above)
- Florissant Fossil Beds National Monument, Florissant, Colorado (see above)

Conclusions

McAbee fossils are collected regularly by professional collectors, amateurs, and school groups, and occasionally by scientists. Fossils from the site are retained by collectors for their private collections, sold on the internet and by other means, or donated or sold to institutional collections such as that of Thompson Rivers University in Kamloops. Institutions holding fossils from the site include museums and universities in British Columbia, Alberta, Saskatchewan, Ontario, New York, Illinois, and Washington State. Some of those museum holdings result from purchases from dealers or claim holders.

The fossil site is the most diverse known in Canada for species of plants and insects of Eocene age. There are also abundant but not diverse fishes, and occasional finds of birds, spiders, and crayfish. Compared to other sites in British Columbia, it has a much greater diversity of known fossil species of plants and insects (and probably a greater potential for future discoveries of new species). Its advantages include its accessibility, the abundance, diversity, and intact

preservation of its fossils, their ready recognition in the field and by the public, and the potential for future studies of its horizontal and vertical variation.

There are more scientific papers about McAbee fossils than about any other Eocene site in B.C., although the Princeton Chert and the Horsefly Mine localities have also engendered much publication and scientific interest, albeit for different reasons in each case. Some aspects of the preservation of the fossils at McAbee are exceeded by the Horsefly beds (because of the annual diatom layers of that deposit) and by the Princeton Chert (because of the cellular-level plant anatomy). Nevertheless the McAbee deposit has the greatest known taxonomic diversity by far in the region, offering a unique window into the animals and plants living in B.C. during one of the warmest periods in the history of the earth.

The high diversity of the site as known to date is owing to a combination of scientific collecting efforts and the donations to scientific institutions by the professional and amateur collectors. The fossil beds themselves are not being rapidly depleted, though the steady progress of the excavations will make collecting progressively more difficult as the quarry walls become higher and more hazardous, as has happened at Driftwood Canyon Provincial Park. The steady collecting, often by persons who are not experts, means that rare and exceptional specimens are often destroyed by careless or unskilled collectors.

Some scientists are concerned about the barriers to scientific research caused by the activities of the claim holders, restricting where and when scientists can collect, and about the loss of scientifically valuable fossil specimens through accidental destruction, excavation activities, private collecting, and sale for profit. On the other hand, the claim holders and certain serious amateur collectors believe that the activities of the claim holders bring important specimens to light for scientific study. Members of the latter group believe that most scientists have made too little effort themselves at careful, systematic collecting, relying instead on specimens donated to them by the collectors.

Individuals on both sides of the debate desire to see a museum or interpretive centre on site for public education and tourism, with trained staff who can recognize rare and exceptional specimens. The details of this vision differ between the scientists and the collectors, the former being more concerned with educational use and discovery of important specimens, and the latter with selling common fossils and charging fees for collecting experience by school groups and tourists.

The author of this report is a recognized expert in the study of similar fossil deposits, with more than 30 years of experience in the field. The author believes that the McAbee fossil site is already one of the two or three most significant sites in British Columbia for scientific study of Cenozoic (early Eocene) fossils. Given its key advantages of high taxonomic diversity, fossil abundance, site accessibility, excellent preservation, and recognizable fossils, the McAbee site has the potential to become as useful for scientific, educational, museum exhibition, and tourism purposes as the Florissant Fossil Beds National Monument and similar sites in the USA.

Signature Page

This report was prepared by the undersigned in fulfillment of Contract CCLAL08009 of the Ministry of Agriculture and Lands for the Strategic Land Policy and Legislation section. Initial contacts and negotiations were with Mr. Tom Cockburn.

The author wishes to thank the Ministry for the opportunity to undertake this assessment, all the interested parties who were very generous with facts and opinions concerning the site, and the individuals in Kamloops (Mr. David Langevin, Mr. John Leahy, Dr. Ken Klein) who made the site visit and viewing of collections possible. Mr. John Bruner, subcontractor, generated bibliographic information and taxonomic database tables used in the preparation of this report.

The contents of this report are accurate to the best of the author's knowledge but inevitably some errors will have crept in. These are of course the responsibility of the author only, and not of any person who provided assistance.

Submitted on July 30, 2007, and revised on August 5, 2007 by

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Museum Collections: **CDM** Courtenay and District Museum, Courtenay, British Columbia, Canada; **RTM** Royal Tyrrell Museum, Drumheller, Alberta, Canada; **BMNH** Burke Museum of Natural History and Culture, Seattle, Washington; **ROM** Royal Ontario Museum, Toronto, Ontario, Canada; **UA** University of Alberta, Edmonton, Alberta, Canada; **UCC** University College of the Cariboo, Kamloops, British Columbia, Canada; **UW** University of Washington, Seattle, Washington, USA

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Museum Collections: **UWBM** Thomas Burke Museum of Natural History and Culture, University of Washington, Seattle, Washington; **UCCIPR** University College of the Cariboo Institute for Paleontological Research; Other museums: the Geological Survey of Canada; The Canadian Museum of Nature in Ottawa, Ontario; the Royal Tyrrell Museum in Drumheller, Alberta; The University of Saskatchewan in Saskatoon, Saskatchewan.

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Museum Collections: **UWBM** Thomas Burke Museum of Natural History and Culture, University of Washington, Seattle, Washington; **UCCIPR** University College of the Cariboo Institute for Paleontological Research; University College of the Cariboo, Kamloops, British Columbia, Canada; **UF** University of Florida, Gainesville, Florida, 32611 USA.

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Appendix 1

Email requests for information

Professional Scientists

Sent email inquiries to 14 researchers; replies received from 13:

Dr. Bruce Archibald (Harvard University / Simon Fraser University) (**replied**)
Archibald, S. Bruce, Museum of Comparative Zoology, Harvard University, 28 Oxford Ítreet, Cambridge, Ma 02138 USA Telephone: (617) 496-4098 *Email:* barchibald@oeb.harvard.edu

Dr. James F. Basinger, University of Saskatchewan (**replied**)
Basinger, James F., Department of Geological Science, University of Saskatchewan CANADA (306) 966-5684, basinger@usask.ca, Ph.D., 1979, Alberta, Research: Paleobotany; fossil plants of western and arctic Canada.

Dr. Thomas Denk, Sweden (**not contacted**)
Denk, Thomas, Sweden {Plants}; *Email:* thomas.denk@nrm.se

Dr. Melanie Devore, Georgia (**not contacted**)
DeVore, Melanie L., Department of Biological and Environmental Science, 135 Herty Hall, Georgia College and State University, Milledgeville, GA 31062-0001, USA.

Mr. Rick Dillhoff, University of Washington (**replied**)
Dillhoff, (Rick) Richard M., 1307 212th Street NE, Redmond, Washington, 98074-6715 U.S.A. [Evolving Earth Foundation, P. O. Box 2090, Issaquah, Washington 98027 USA (425) 868-0468] *Email:* rdillhoff@evolvingearth.org {Plants}; paleobot@u.washington.edu

Dr. David Greenwood, Brandon University (**replied**)
Greenwood, David R., Environmental Science, Brandon University, 270 18th Street, Brandon, MB R7A 6A9, Canada.

Dr. Jim Haggart, Geological Survey of Canada, Vancouver (**replied**)
JHaggart@nrcan.gc.ca

Dr. Richard Hebda, Royal British Columbia Museum (**replied**)
Hebda, Richard J., Curator of Botany & Earth History, Royal British Columbia Museum, 675 Belleville Street ,Victoria, British Columbia, V8W 9W2 CANADA Tel: 250-387-5493, Fax: 250-356-8197. *Email:* rhebda@royalbcmuseum.bc.ca

Dr. Len Hills, University of Calgary (**replied**)
hills@geo.ucalgary.ca

Dr. Ken Klein, Thompson Rivers University (**replied, interviewed in person**)
Klein, Kenneth, S217 Chairman, Dept. of Physical Sciences & Engineering, Thompson Rivers University Kamloops, B.C., CANADA Office: S217
Phone: 250-828-5414 Email: keklein@tru.ca

Dr. Estella B. Leopold, University of Washington (**no reply**)
Leopold, Estella B., Professor Emeritus, Biology; Adjunct Professor, Forest Resources, Geological Sci, Box 351800 University of Washington, Department of Biology, Quaternary Research Ctr., Seattle, Washington 98195-1800 USA +1 206 685-1151, +1 206 685-1960; FAX: +1 206 543-3262 *Email:* eleopold@u.washington.edu {plants}

Dr. Steve Manchester, University of Florida (**replied**)
Manchester, Dr. Steven R., Curator of Paleobotany, 214 Dickinson Hall, Florida Museum of Natural History, Department of Botany, University of Florida, Gainesville, Florida, 32611-7800 USA Telephone: h. 352 392-1721 ex 495 *Email* steven@flmnh.ufl.edu {Plants}

Dr. Rolf Mathewes, Biology Dept., Simon Fraser University (**replied**)
mathewes@sfu.ca

Dr. Patrick T. Moss, Australia (**not contacted**)
Moss, Patrick T., School of Geography, Planning and Architecture, The University of Queensland, Brisbane QLD 4072, Australia.

Dr. George Mustoe, Western Washington University (**replied**)
Mustoe, George E., 2002. Geology Department, Mail Stop 9080, Western Washington University, Bellingham, Washington 98225 USA *Email:* mustoeg@cc.wwu.edu

Dr. Kathleen Pigg, Arizona State University (**replied**)
Pigg, Kathleen B., School of Life Science Faculty and Administration, Arizona State University, Box 874501, Tempe, AZ 85287-4501, USA.

Dr. Ruth A. Stockey, University of Alberta (**replied**)
Stockey, Ruth A., Department of Biological Sciences, University of Alberta, Edmonton, Alberta T6G 2E9 Canada; rastockey@ualberta.ca

Dr. Mark V. H. Wilson (**author of this report**)
Wilson, Mark V. H., Department of Biological Sciences, University of Alberta, Edmonton, Alberta T6G 2E9 Canada; mark.wilson@ualberta.ca

Amateur and semi-professional collectors

Sent inquiries to 7 people known to the author as having collected fossils at McAbee; replies received from 5; interviewed 4.

Robert Drachuk, Utah (**claim holder; no reply**)

David Langevin, Kamloops (**claim holder; replied; hosted site visit; interviewed in person**)
Langevin, Dave, The McAbee Fossil Beds, Cache Creek, BC (250) 374-7164 *Email:* DaveL@sageserve.com

John Leahy, Kamloops (**replied; interviewed in person**)
Leahy, John, 2518 Thompson Drive, Kamloops, B.C. V2C 4L3 (250) 374-6540 *Email:* jbswake@shaw.ca jleahy@sd73.bc.ca {amateur collector}

John Fraser, Ashcroft (**replied; unable to arrange meeting**)

Mr. Chambers, Kamloops (**interviewed in person at TRU**)

John Ratcliffe, Kamloops (**no reply**)

John Maccagno, Kamloops (**not contacted**)

Kenneth Pugh, Chilliwack (**replied; telephone interview**)
Pugh, Kenneth W., 45964 Ivy Ave., Chilliwack, B. C. V2R 2C5 Canada Telephone: (604) 858-0544; (604) 858-7140; *Email:* kpugh@shaw.ca (replied; interviewed on telephone)

Site Visit Agenda

June 26, 2007, 8 AM – 1 PM

- visited fossil site (Zugg 1 claim) accompanied by co-claim holder David Langevin
    - recorded locations of claim stakes by GPS and locations of main digging sites
    - examined quarry face and spill piles for fossil contents
    - observed field trip of the Grade 5-6 class at Ashcroft Elementary School
    - briefly visited adjacent mine property for comparison

June 26, 2007, 2 PM – 7 PM

- local interviews and specimen examination: Dave Langevin (co-claim holder) and, separately, John Leahy, both of Kamloops.
    - photographed examples of specimens in both private collections
    - interviewed both for history of activity and views on future

June 26, 8:30 AM – 1 PM

- Visited Thompson Rivers University geology laboratory with Dr. Ken Klein, curator of the collection and chair of the department
    - Met also with a Mr. Chambers, local amateur collector
    - observed and photographed examples of specimens of insects, plants, and fishes in the TRU collection

GPS Coordinates Recorded On Site

The following coordinates were taken with a Garmin GPS 12 hand-held GPS unit on June 26, 2007.

Parking lot (centre):	N 50.79607º, W 121.14154º
Western claim stake:	N 50.7956º, W 121.14436º
Eastern claim stake:	N 50.79650º, W 121.13827º
Eastern end of access road and quarry face:	N 50.79718º W 121.13987º
Eastern end of private Langevin quarry face:	N 50.79720º W 121.14078º
Eastern public/school group quarry face:	N 50.79724º W 121.14154º
Quarry face immediately east of awning:	N 50.79727º W 121.14214º
Eastern end of western public quarry face:	N 50.79736º W 121.14321º
Western end of western public quarry face:	N 50.79696º W 121.14321º
Bench quarry face above road cut:	N 50.79702º W 121.14343º
Switch-back in access road:	N 50.79689º W 121.14437º
Mid-point of access road first leg:	N 50.79659º W 121.14256º
Gate to access road above parking lot:	N 50.79646º W 121.14256º
Nearby:	
Approx. centre of ‘Kitty Litter Mine’ open pit:	N 50.80142º W 121.13354º

Web Sites Seen

- The McAbee Fossil Beds (web site operated by claim holders):
    - http://www.dll-fossils.com/
- Fossil digging tours offered by Kamloops Rockworx:
    - http://kamloopsrockworx.com/page2.htm
- McAbee Paleobotany Project at the Evolving Earth Project (operated by Rick and Tad Dillhoff, Seattle, Washington):
    - http://www.evolvingearth.org/paleocollaborator/index.php

- Images of 'McAbee Fossil Fields':
    - http://www.thompson-nicolafilmcommission.com/locations_search.php?resultpage=3&pid=154
- Fossils from McAbee are often sold on web sites such as
    - www.fossilmall.com
    - www.ebay.com

Museum Collections with Significant McAbee Fossil Holdings

- RBCM: Royal British Columbia Museum (thousands of specimens, most not identified)
- UALVP: University of Alberta Laboratory for Vertebrate Paleontology
- UAPC: University of Alberta Paleobotany Collection
- UASM: University of Alberta Strickland (Entomology) Museum
- UC: University of Calgary Department of Geology
- USASK: University of Saskatchewan
- FCER (private collection intended for University College of the Fraser Valley eventually(?)): Fraser Centre for Non-Marine Eocene Research, Chilliwack, Mr. Ken Pugh
- UWBM: Burke Museum, University of Washington, Seattle
- TRU: Thompson Rivers University, Kamloops
- RTMP: Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta (thousands of specimens, most not identified)
- VIPS (society): Vancouver Island Palaeontological Society
- FMNH: Field Museum of Natural History, Chicago (purchased from or donated by Mr. Drachuk, co-claim holder, I'm told by the curator, though records were not consulted)

Contractor and Subcontractor for this Report

Contractor

Dr. Mark V. H. Wilson, B.Sc., M.Sc., Ph.D.
Professor, Department of Biological Sciences
University of Alberta
Edmonton, Alberta, T6G 2E9

Phone: 780 492 5408 work; 780 435 6501 home
Fax: 780 492 9234
Email: mark.wilson@ualberta.ca (work); mvhw@telusplanet.net (home)

More than 35 years' experience with the paleontology of the Eocene lake beds of British Columbia (beginning in 1969). More than 100 scientific publications. Editor, Senior Editor, and now Chair of the Publications Committee for Journal of Vertebrate Paleontology. 32 years as university professor.

Subcontractor

Mr. John C. Bruner, B.Sc., M.Sc.
More than 20 years' experience with paleontology collections management and databasing.
Author of paleontological publications including two type catalogs and several bibliographies.

Appendix 2

Synopsis of McAbee Fossil Taxa Recorded in Publications and Theses

This list of fossil taxa is compiled from publications and theses listed in the Bibliography. It has been assumed that the identifications made by the expert authors of those works are correct. Please see the more detailed list in Appendix 5 for the details and publication sources of each item.

"Algae"

diatoms, chrysophytes

Fungi

fungal spores

Arthropoda

Arachnida
- Araneae (true spiders)

Crustacea
- Decapoda (crayfish)
  - Palaemonidae: *Bechleja*
  - Astacidae: *Pacifasticus*
  - Cambaridae: *Procambrus*

Insecta
- Blattodea (roaches)
  - Blaberidae: Diplopterinae
- Coleoptera (beetles)
  - Cantharidae
  - Carabidae
  - Cerambycidae
  - cf. Cleridae
  - Chrysomelidae: Pachymerinae
  - Cupedidae
  - Curculionidae
  - Elateroidea
  - Mordellidae
  - Passalidae
- Dermaptera (earwigs)
  - Forficulidae?
- Diptera (true flies)
  - Bibionidae: *Plecia*, *Penthetria*
  - Brachycera *incertae sedis*
  - Cylindrotomidae
  - Limoniidae
  - Mycetophilidae
  - Nematocera *incertae sedis*
  - Syrphidae
  - Tipulidae
  - Trichoseridae
- Ephemeroptera (mayflies)
  - Heptaginiidae

Hemiptera (bugs)
- cf. Coreidae
- Gerridae: *Gerris*
- Aphididae
- Cercopidae
- Cercopidae or Aphrophoridae
- Cicadidae
- Cicadellidae
- Cixiidae?
- Ricaniidae

Hymenoptera (ants, wasps, bees)
- Apidae
- Braconidae
- Chrysididae or Bethylidae
- Cimbicidae: Cimbicinae
- Cimbicidae: Coryninae or Pachylostictinae
- Diapriidae
- Figitidae
- Formicidae: Myrmeciinae: *Ypresiomyrma, Avitomyrmex, Macabeemyrma, Myrmeciites*
  - Dolichoderinae
  - Formicinae
- Ichneumonidae
- Megachilidae (leaves damaged by leaf-cutter bees)
- Peradeniidae?
- Pompilidae
- Proctotrupidae
- Scelionidae?
- Scoliidae?
- Siricidae: Tremecinae?
- Sphecidae *s.l.*
- Tenthredinidae
  - Tenthredininae
  - Allantinae
  - Blennocampinae
  - Nematinae
  - Nematinae or Susaninae
- Tiphiidae?
- Vespidae

Isoptera (termites)
- Mastotermitidae
- Hodotermitidae

Lepidoptera (moths and butterflies)
- Gracillariidae

Mecoptera (scorpionflies)
- Bittacidae
- Cimbrophlebiidae: *Cimbrophlebia*
- Dipanorpidae: *Dinokanaga*, *Eomerope*
- Holcorpidae
- New unnamed family
- Panorpidae

Neuroptera (net-winged insects)
- Polystoechotidae
- New unnamed family
- Osmylidae

Chrysopidae
Hemerobiidae
Odonata (dragonflies and damselflies)
Aeshnidae
Megapodagrionidae
Orthoptera (grasshoppers and crickets)
Acrididae
Gryllacrididae?
Prophalangopsidae
Tettigoniidae
Plecoptera (stoneflies)
Raphidioptera (snakeflies)
Trichoptera (caddisflies)

Chordata

Actinopterygii
Ostariophysi
Catostomidae (suckers): *Amyzon* sp.
Osteoglossomorpha
Hiodontidae (mooneyes): *Eohiodon rosei*
Salmoniformes
Salmonidae (trout and salmon): *Eosalmo driftwoodensis*
Unnamed taxon under study at U of Alberta
Aves
Sandcoleiformes (extinct bird group)

Plantae

Equisetopsidae (horsetails)
Equisetaceae: *Equisetum*
Lycopodiophyta (clubmosses)
Lycopodiaceae: *Lycopodium*
Pteridophyta (ferns)
Filicales
Pteridophyta (spores): *Magnastriatites*
Polypodiaceae (spores): *Polypodiaceasporites*
Gymnospermae (cone-bearing plants usually)
Araucariaceae: *Araucaria?*
Cupressaceae: *Calocedrus, Chamaecyparis, Cunninghamia, Juniperus, Metasequoia, Sequoia, Taxodium, Thuja, Thujopsis*
Ginkgoaceae: *Gingko*
Pinaceae: *Abies, Cryptomeria, Larix?, Picea, Pinus, Pseudolarix, Tsuga*
Podocarpaceae
Taxaceae: *Amentotaxus?, Taxus? Torreya*
Taxodiaceae: *Calocedrus?, Metasequoia*
Unknown (pollen): *Inaperturopollenites*
Angiospermae (flowering plants)
Anacardiaceae: *Rhus*
Araliaceae: *Aralia, Paleopanax*
Areaceae
Asterales?: *Calycites*
Betulaceae: *Alnus, Betula, Carpinus, Corylites, Corylus*, *Palaeocarpinus*
Cercidiphyllaceae: *Joffrea, Nyssydium, Trochodendroides*
Cornaceae: *Cornus*
Ericaceae: *Rhododendron*

Fagaceae: *Fagus, Quercus*
Grossulariaceae: *Itea, Ribes*
Hamamelidaceae: *Langeria*
Juglandaceae: *Carya, Juglans, Pterocarya*
Lauraceae: *Lindera, Phoebe, Sassafras*
Malvaceae: *Tilia*
Myricaceae: *Comptonia*
Oleaceae: *Fraxinus*
Platanaceae: *Macginicarpa*, *Macginitiea, Platanus*
Rosaceae: *Amelanchier, Crataegus, Prunus, Sorbus*
Rutaceae?
Salicaceae: *Salix, Populus,*
Sapindaceae: *Acer, Aesculus, Bohlemia, Dipteronia, Koelreuteria*
Theaceae: *Gordonia*
Trochodendraceae: *Nordenskioldia, Trochodendron, Zizyphoides*
Ulmaceae: *Ulmus, Zelkova,* pollen: *Ulmoideipites*
Unknown family: *Averrhoites, Chaneya*
Vitaceae: *Ampelocissus, Cissus, Vitus*

Appendix 3

Images of McAbee Fossils

The following images are selected examples of fossil specimens from the McAbee fossil beds seen by the author of this report in the collection at Thompson Rivers University and in the private collections of Mr. David Langevin (co-claim holder) and Mr. John Leahy (Kamloops).

Typical Fossils Found by School Groups and Tourists

These fossils are typical of those collected by tourists and school groups; normally they are the kinds of fossils that are relatively abundant at the McAbee site and also relatively large. Tiny fossils such as some of groups of insects are very unlikely to be noticed. Larger fossils, such as certain plants and insects, are unlikely to be found intact because the amateurs and children do not use expert methods of collecting and do not keep track of the source of the fossils in the quarry face.

Gingko leaf

Angiosperm deciduous leaf

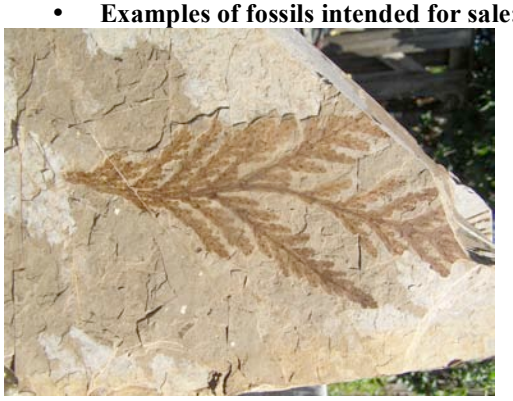
Elementary student with part of a fossil fish

Fossil ‘maple key’ seed

David Langevin Private Collection

Mr. Langevin, one of the claim holders, has a large collection in his home that includes fossils destined for sale for profit, fossils destined for donation or sale to a museum, and exceptional fossils that he retains for his private collection. Examples of all of these are shown here. In this and subsequent examples, I have assumed that the identifications provided by the collector/custodian are approximately accurate.

- **Examples of fossils intended for sale:**



Branching system of ?cedar.

Assorted leaves, angiosperms and *Metasequoia*.

Metasequoia (dawn redwood) leafy shoots.

Gingko leaves, two different species.

- **Examples of fossils intended for loan to a researcher and ultimately for donation or perhaps sale to an institution (usually TRU):**

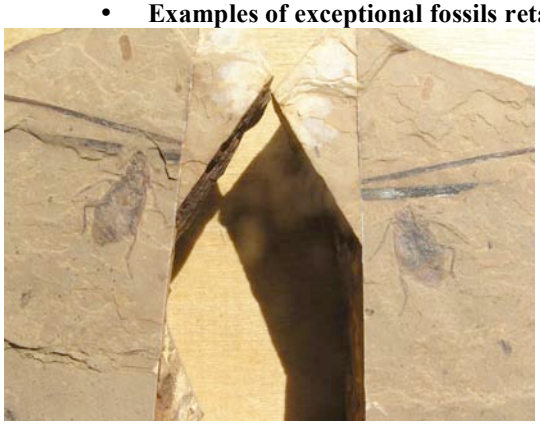
Crane fly (Tipulidae) or related insect.

Large-bodied ant.

Smaller fly, possibly also a tipulid (crane fly).

Unidentified large insect.

- **Examples of exceptional fossils retained in Mr. Langevin's private collection:**



Carrion beetle (?)

Fish (*Eohiodon rosei*) and leaf

Fish (*Eohiodon rosei*). This species of fish is the most common one at McAbee.

Feather. Feathers are fairly rare, but good examples such as this one are not common.

Lacewing insect; preservation is exceptional.

Sassafras leaf.

Counterpart of the holotype specimen of a stonefly. Technically this is also part of the holotype because it is part of the same individual organism, but it is in a private collection and thus subject to loss.

Spider. Spiders are extremely rare.

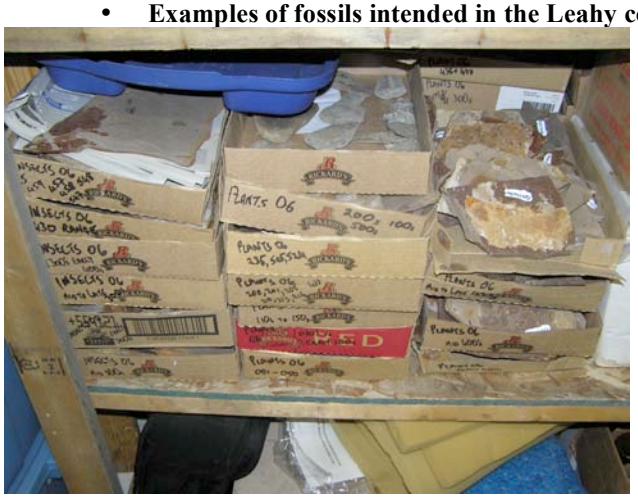
John Leahy Private Collection

Mr. Leahy has a private collection that he intends to retain or donate. He has accumulated specimens over several summers of extensive collecting with permission from the claim holders that are intended for his private collection or for donation to an institution, usually TRU.

Mr. Leahy has sent or intends to send fossils for study to the following scientists: Dr. Steve Manchester – 15 specimens; Dr. Bruce Archibald - ~12 including scorpionfly, 8 in box that are potential type specimens; Dr. David Greenwood – several boxes of cones; Rick Dillhoff – several items. He prepares a set of CDs or DVDs with images of the interesting fossils and sends them to selected scientists, who request the items for study.

Mr. Leahy has also donated items to Thompson Rivers University c/o Dr. Ken Klein, including a crayfish, a partial bird, parts of a bird, pieces of a large fish (*Eosalmo driftwoodensis*), and others.

- **Examples of fossils intended in the Leahy collection:**



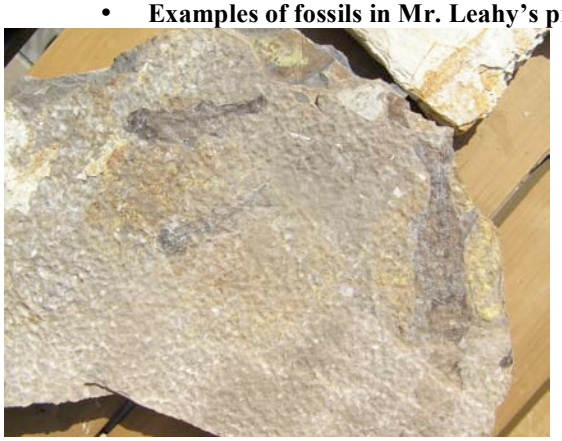
Insects and plants in flats from 2006 field work.

Flat of insects.

Flat of feathers.

Flat of seeds and cones.

- **Examples of fossils in Mr. Leahy's private retained collection:**



Three fish from 'Kitty Litter' mine.

Largest of 3 fish from 'Kitty Litter' mine.

Fagus and *McGinitia* from the 'Kitty Litter' mine.

Partially disarticulated large fish skeleton, *Eohiodon rosei*, from the 'Kitty Litter' mine.

Bird feathers and bones. This is counterpart of a specimen being donated to TRU.

Small fish, *Eohiodon rosei*, from McAbee site.

- **Examples of fossils intended for donation and scientific study:**

Letter detailing items for loan to Dr. Archibald.

Packaged specimens to be sent to Dr. Archibald.

Thompson Rivers University Collection

The TRU collection is under the care/direction of Dr. Ken Klein. Some of the more important donated specimens have been the subject of publications by various researchers. These are housed in cabinets in a small room in the Science area; some but not all of them have been accessioned and have catalog numbers. A few are still in process of being donated and thus are not officially part of the TRU collection yet.

- **Examples of specimens in the TRU collection (L18 = McAbee claim locality):**

Cone L18 F050.

Leaf L18 F644.

Leaf and flower L18 F633.

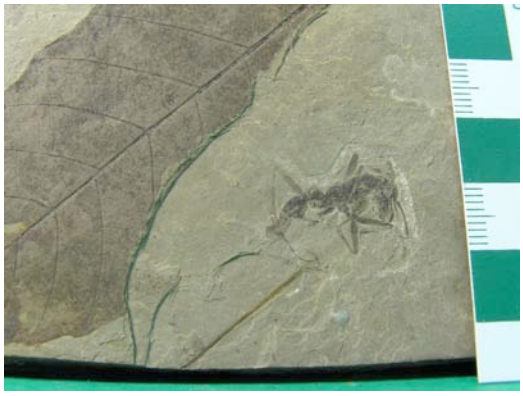
Branching twigs bearing cones L18 F477.

Leaf L18 F499.

Leaves L18 F555.

Prophalangopsidae (Orthoptera) insect L18 F1002.

Cone and ant (*Myrmeciites goliath*) L18 F999.



Ant *Myrmeciites herculeanus* L18 F974

Large insect wing.

Branches L18 F668.

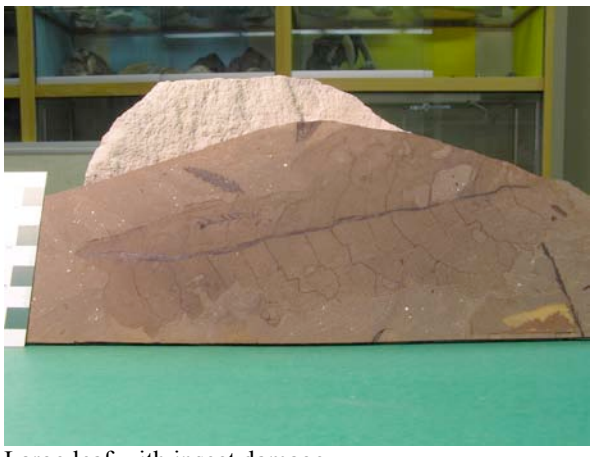
Large insect *Dinokanaga hillsi* L18 F1034.

Prophalangopsidae L18 F1001.

Ant *Ypresomyrma orbiculata* L18-749.

Bird; donation by David Langevin not yet final.

Scattered bird bones and feathers donated by John Leahy, who retained part of this specimen for personal use.



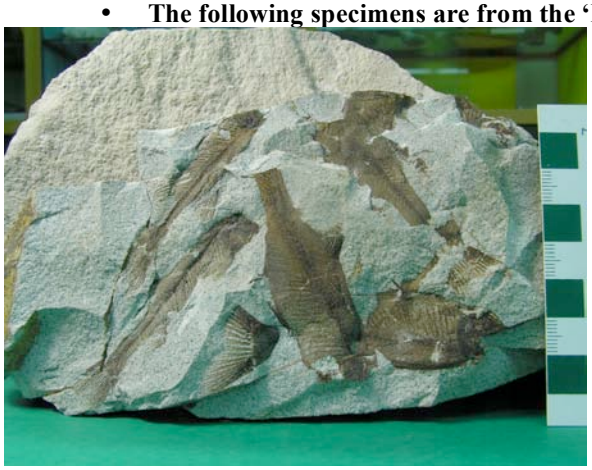
Large leaf with insect damage.

Grasshopper, *Conocephalus* sp., found by Jack Youd.

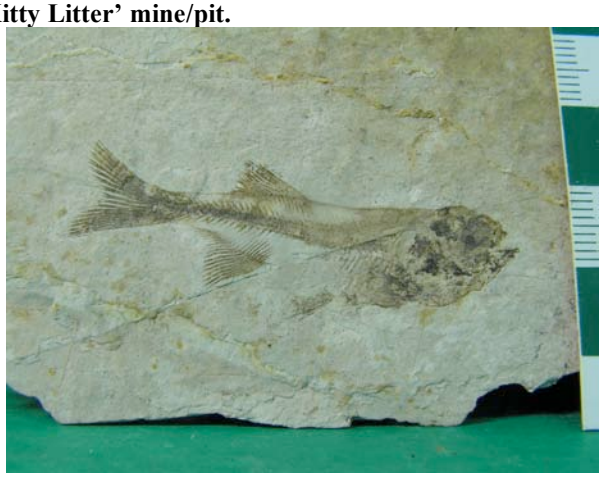
Crayfish found by Ian Cochrane; donation not final.

Crayfish found by John Leahy in 2004.

- **The following specimens are from the 'Kitty Litter' mine/pit.**



Fish mass mortality grouping, *Eohiodon rosei*..



Fish *Eohiodon rosei.*

Large fish, *Eosalmo driftwoodensis*

Large fish, *Eosalmo,* donation not final.

Appendix 4

Proposals for Museum or Interpretive Centre

Several people, both scientists and collectors, have suggested to the author that some kind of interpretive centre be established on site. The text or paraphrase of representative proposals is reproduced here.

Dr. Bruce Archibald, Harvard University / Simon Fraser University

Dr. Archibald is extremely impressed by the operation of the Stonerose Interpretive Center in Republic, Washington. They operate public digs but closely monitor the specimens found, retaining the most important ones. They are also very active in the community with public education and tourism programs. The following images from a festival event participated in by Dr. Archibald illustrate their community involvement:

Public participation event at Stonerose Interpretive Center, Republic, Washington

Images courtesy Dr. Bruce Archibald

Dr. David Greenwood, Brandon University

Dr. Greenwood believes that the site should be protected as a heritage site, with a management plan similar to that at Driftwood Canyon near Smithers. He cites examples of interpretive centres and museums such as the *T. rex* Discovery Centre in Eastend, Saskatchewan, the Field Visitor Centre near the Burgess Shale, and the Courtenay & District Museum on Vancouver Island as possible models.

Dr. Ken Klein, Thompson Rivers University

Dr. Klein takes his role as the regional paleontologist seriously. He proposed in the past a museum facility on the campus of Thompson Rivers University, but the university did not fund the project. The donated specimens are well cared for but in a tiny, cramped facility, and many are not yet accessioned/cataloged.

Mr. David Langevin, co-claim holder

Mr. Langevin's vision of the future for the McAbee fossil beds (written by him):

1.) To continue, personally, to collect at the site, always looking for that elusive "first time found" specimen.
2.) To offer guided fossil digging tours to the general public, including school classes, for a fee (and possibly a profit in the future!).
3.) To support the scientific community, as I always have, by donating significant finds which I have found, or which have come to my attention, to appropriate curated collections. This would most likely be the T.R.U. collection. As a footnote to the support, the scientific community may come and collect at the site (which they have always been able to do), by merely calling me and arranging it.
4.) In a very optimistic view of the future, I would really like to have a small interpretive center/museum/store in the field below the beds, where people can view excellent fossil specimens, and perhaps purchase some of the many commonly found fossils at the site.

D. Langevin June 20, 2007

P.S. If the British Columbia government, or the scientific community wished to be involved in any way with the fossil beds, if I am allowed to carry on, positive ideas would be welcome by myself and Mr. Drachuk. One idea may be funded students as guides, who would in the not busy times amass collections for their university, college or whoever. Thanks for your interest in my views.

D. Langevin
961 Columbia St.
Kamloops. British Columbia
V2C 2V8 CANADA
TELEPHONE: 250-374-7164

Mr. John Leahy, Kamloops

The following is paraphrased from an interview with Mr. Leahy, who is currently President of the Thomson-Nicola Paleontology Society. Mr. Leahy collects regularly at McAbee and in recent years has acted as a tour guide for the claim holders. He said:

I would like a museum and gift shop to be established. One possibility is to find a corporate sponsor or investor for such a venture. I might be willing to invest in such a project.

Appendix 5

Detailed List of McAbee Taxa in Publications, with References

This list is arranged approximately in taxonomic sequence, beginning with algae, then arthropods, then vertebrates, and finally macroscopic plants. The year of publication is shown on the left, and the reference at far right.

Year:	KINGDOM:	PHYLUM:	CLASS:	HIGHER TAXA:	FAMILY:	GENUS:	SPECIES:	COLLECTION:	HOLOTYPE:	Reference:
2006	ALGAE	diatoms								Archibald, & Makarkin 2006. 119-155
2005	ALGAE	diatoms								Mustoe 2005:231-241
2005	ALGAE			chrysophytes						Mustoe 2005:231-241
2005	ALGAE					Algae (granules)				Dilhoff et al. 2005 42:151-166.
2005	ALGAE					Algae (smooth)				Dilhoff et al. 2005 42:151-166.
2005	FUNGI					Fungal spores				Dilhoff et al. 2005 42:151-166.
1995	ANIMAL	ARTHROPODA	Arachnida	Araneae				FCER		Archibald 1995 1-8pp.;
1997	ANIMAL	ARTHROPODA	Arachnida	Araneae				FCER; MacKenzie		Pugh. 1997, ms p. 1
1997	ANIMAL	ARTHROPODA	Arachnida	Araneae	Araneidae?/Tetragnathidae?			FCER; Naumann		Pugh & Haggart 1997
1995	ANIMAL	ARTHROPODA	Arachnida	Araneae	Undetermined					Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Arachnida							Archibald 1995 1-8pp.;
1999	ANIMAL	ARTHROPODA	CRUSTACEA	DECAPODA	Palaemonidae	*Bechleja*		FCER		Pugh 1999, Arthropoda: Crustacea. P. 4
1995	ANIMAL	ARTHROPODA	CRUSTACEA	DECAPODA	Astacidae	*Pacifasticus*				Archibald 1995 1-8pp.; Wehr & Barksdale 1995;
1995	ANIMAL	ARTHROPODA	CRUSTACEA	DECAPODA	Cambaridae	*Procambrus*	*P. ortmann*			Archibald 1995 1-8pp.;
1997	ANIMAL	ARTHROPODA	CRUSTACEA	DECAPODA	Cambaridae	*Procambrus*		FCER		Pugh. 1997, ms
1995	ANIMAL	ARTHROPODA	CRUSTACEA	DECAPODA						Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Blattodea	Blaberidae	Diplopterinae				Archibald (personal communication, June 2007)
2005	ANIMAL	ARTHROPODA	Insecta	Blattodea	Blaberidae	Diploterinae				Greenwood et al. 2005:167-185
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Polyphaga	Cantharidae?					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Adephaga	Carabidae					Archibald (personal communication, June

Year:	KINGDOM:	PHYLUM:	CLASS:	HIGHER TAXA:	FAMILY:	GENUS:	SPECIES:	COLLECTION:	HOLOTYPE:	Reference:
										2007)
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Polyphaga	Cerambycidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Coleoptera	cf. Cleridae					Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Coleoptera	cf. Cleridae					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Polyphaga	Chrysomelidae	Pachymerinae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Polyphaga	Chrysomelidae	unknown				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Archostemata	Cupedidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Polyphaga	Curculionidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Coleoptera	eggs on leaf					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Polyphaga	Elateroidea					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Polyphaga	Mordellidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Coleoptera:Polyphaga	Passalidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Coleoptera	Undetermined			FCER; Langevin		Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Coleoptera	Undetermined					Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Coleoptera						Archibald 1995 1-8pp.;
1997	ANIMAL	ARTHROPODA	Insecta	Dermaptera	Forficulidae?					Archibald 1995 1-8pp.;
1997	ANIMAL	ARTHROPODA	Insecta	Dermaptera	Undetermined			FCER		Pugh & Haggart 1997, ms p. 7
1995	ANIMAL	ARTHROPODA	Insecta	Dermaptera	Forficulidae?					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Dermaptera						Archibald (personal communication, June 2007)
1996	ANIMAL	ARTHROPODA	Insecta	Diptera	Bibionidae	Undetermined		CMN; FCER; Langevin		Douglas & Stockey 1996
1996	ANIMAL	ARTHROPODA	Insecta	Diptera	Bibionidae			CMN		Douglas & Stockey 1996, 1140-1157
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Bibionidae	*Plecia*		RBCM		Royal British Columbia Museum Catalogue

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2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Bibionidae	*Penthetria*		RBCM		Royal British Columbia Museum Catalogue
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Bibionidae					Archibald (personal communication, June 2007)
1991	ANIMAL	ARTHROPODA	Insecta	Diptera	Bibionidae			CMN		Douglas 1991, p. 165; p. 201, Figure V-26 E,F; p. 311
1996	ANIMAL	ARTHROPODA	Insecta	Diptera	Bibionidae			CMN		Douglas & Stockey 1996, p. 1149, fig. 26,E,F 1150
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Brachycera in. sedis					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Cylindrotomidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Limoniidae					Archibald (personal communication, June 2007)
1996	ANIMAL	ARTHROPODA	Insecta	Diptera	Mycetophilidae	Undetermined		FCER		Weht 1995
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Mycetophilidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Nematocera in. sedis					Archibald (personal communication, June 2007)
1997	ANIMAL	ARTHROPODA	Insecta	Diptera	Suborder Nematocera			Langevin		Pugh & Haggart 1997, ms p. 18
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Syrphidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Diptera	Tipulidae	Undetermined		FCER		Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Diptera	Tipulidae					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Tipulidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Diptera	Trichoseridae					Archibald (personal communication, June 2007)
1997	ANIMAL	ARTHROPODA	Insecta	Diptera	Undetermined			FCER		Pugh & Haggart 1997, ms p. 31
2007	ANIMAL	ARTHROPODA	Insecta	Ephemeroptera	Heptaginiidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Hemiptera	Undetermined			Langevin		Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Hemiptera	cf. Coreidae					Archibald 1995 1-8pp.;

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1996	ANIMAL	ARTHROPODA	Insecta	Hemiptera	Gerridae	*Gerris*				Beard 1996
1995	ANIMAL	ARTHROPODA	Insecta	Hemiptera	Undetermined			CMN		Douglas 1991
1995	ANIMAL	ARTHROPODA	Insecta	Hemiptera	Aphididae					Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Hemiptera	Undetermined					Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Hemiptera	cf. Coreidae					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Hemiptera:Sternorrhyncha	Aphididae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Homoptera	Aphididae					Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Homoptera	Cercopidae					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Hemiptera:Auchenorrhyncha	Cercopidae/Aphrophoridae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Homoptera	cf. Cicadidae					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Hemiptera:Auchenorrhyncha	Cicadellidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hemiptera:Auchenorrhyncha	Cicadidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Homoptera	Cicadidae					Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Homoptera	Cixiidae?/Cercopidae?					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Hemiptera:Auchenorrhyncha	Ricaniidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hemiptera:Heteroptera						Archibald (personal communication, June 2007)
1991	ANIMAL	ARTHROPODA	Insecta	Hemiptera:				CMN		Douglas 1991, p. 311, Appendix 4
1995	ANIMAL	ARTHROPODA	Insecta	Homoptera						Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Apidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Braconidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	cf. Ichneumonidae					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Chrysididae or Bethylidae?					Archibald (personal communication, June 2007)

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2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Cimbicidae	Cimbicinae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Cimbicidae	Coryninae or Pachylostictinae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Cimbicidae	*in. sedis*				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Diapriidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Figitidae					Archibald (personal communication, June 2007)
2006	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Formicidae	*Avitomyrmex*	*elongatus*	CDM	2003.2.8CDM032	Archibald, Cover, & Moreau 2006, 487-523
2006	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Formicidae	*Avitomyrmex*	*mastax*	UCCIPRL	UCCIPRL-18 F-850	Archibald, Cover, & Moreau 2006, 487-523
2006	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Formicidae	*Avitomyrmex*	*systenus*	CDM	2003.2.11 CDM 035	Archibald, Cover, & Moreau 2006, 487-523
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae=Myrmeciinae	*Avitomyrmex elongatus*				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae=Myrmeciinae	*Avitomyrmex mastax*				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae=Myrmeciinae	*Avitomyrmex systenus*				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae	Dolichoderinae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae	Formicinae				Archibald (personal communication, June 2007)
2006	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Formicidae	*Macabeemyrma*	*ovata*	UCCIPR	UCCIPRL-18F-856	Archibald, Cover, & Moreau 2006, 487-523
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae=Myrmeciinae	*Macabeemyrma ovocephalus*				Archibald (personal communication, June 2007)
2006	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Formicidae	*Myrmeciites*	*herculeanus*	UCCIPR	UCCIPRL-18F-974	Archibald, Cover, & Moreau 2006, 487-523
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae=Myrmeciinae	*Myrmeciites herculeanus*				Archibald (personal communication, June 2007)
2006	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Formicidae	*Myrmeciites?*	*goliath*	UCCIPR	UCCIPRL-18F-999,F-1000	Archibald, Cover, & Moreau 2006, 487-523
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae=Myrmeciinae	*Myrmeciites? goliath*				Archibald (personal communication, June

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										2007)
2006	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Formicidae	*Ypresiomyrma*	*orbiculata*	UCCIPR	UCCIPR L-18 F-749	Archibald, Cover, & Moreau 2006, 487-523
2006	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Formicidae	*Ypresiomyrma*	*bartletti*	GSC	GSC 127632a,b	Archibald, Cover, & Moreau 2006, 487-523
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae=Myrmeciinae	*Ypresoimyrma bartletti*				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Formicidae=Myrmeciinae	*Ypresoimyrma orbiculata*				Archibald (personal communication, June 2007)
1991/96	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Ichneumonidae	Undetermined		CMN		Douglas 1991; Douglas & Stockey 1996
1996	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Ichneumonidae			CMN		Douglas & Stockey 1996, p. 1145, Fig.21,D, p. 1147
1996	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Ichneumonidae			CMN		Douglas & Stockey 1996, 1140-1157
1991	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Ichneumonidae			CMN		Douglas 1991, p. 197, Figure V-21
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Ichneumonidae					Archibald (personal communication, June 2007)
1997	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Ichneumonoidea	Undetermined		FCER		Pugh & Haggart 1997, ms p. 35
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Megachilidae	(leaf damage)				Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Megachilidae	cut leaves		Langevin		Pugh & Haggart 1997, ms p. 37
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Peradeniidae?					Archibald (personal communication, June 2007)
1991/1996	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Pompilidae			CMN		Douglas 1991; Douglas & Stockey 1996
1996	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Pompilidae			CMN		Douglas & Stockey 1996, p. 1149, fig. 23, 1148
1996	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Pompilidae			CMN		Douglas & Stockey 1996, 1140-1157
1991	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Pompilidae			CMN		Douglas 1991, p. 163; p. 199, Figure V-23, p. 311
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Pompilidae?					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Proctotrupidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Proctotrupoidea	*in. sedis*				Archibald (personal communication, June 2007)

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2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Scelionidae?					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Scoliidae?					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Siricidae	Tremecinae?				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Sphecidae s.l.					Archibald (personal communication, June 2007)
1997	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Tenthredinidae	Undetermined				Pugh & Haggart 1997, ms p. 37
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Tenthredinidae	Tenthredininae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Tenthredinidae	Allantinae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Tenthredinidae	Blennocampinae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Tenthredinidae	Nematinae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Tenthredinidae	Nematinae or Susaninae				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Symphyta	Tenthredinidae	*in. sedis*				Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Tiphiidae?					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Undetermined					Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Undetermined			FCER		Archibald 1995 1-8pp.;
1995	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Undetermined					Archibald 1995 1-8pp.;
1997	ANIMAL	ARTHROPODA	Insecta	Hymenoptera	Vespidae			FCER		Pugh & Haggart 1997, ms p. 37
2007	ANIMAL	ARTHROPODA	Insecta	Hymenoptera:Apocrita	Vespidae					Archibald (personal communication, June 2007)
1997	ANIMAL	ARTHROPODA	Insecta	Isoptera	Mastotermitidae			FCER		Pugh & Haggart 1997
1995	ANIMAL	ARTHROPODA	Insecta	Isoptera	Undetermined					Weht 1995
2007	ANIMAL	ARTHROPODA	Insecta	Isoptera	Mastotermitidae					Archibald (personal

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										communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Isoptera	Hodotermitidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Lepidoptera	Gracillariidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Bittacidae					Archibald (personal communication, June 2007)
2005	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Cimbrophlebiidae	*Cimbrophlebia*				Archibald, & Makarkin 2006. 119-155
2007	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Cimbrophlebiidae					Archibald (personal communication, June 2007)
2005	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Dinopanorpidae	*Dinokanaga*	*hillsi*	UCCIPRL, RTM, UWBM	TMP8339.1132	Archibald 2005 119-136;
2005	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Dinopanorpidae	*Dinokanaga*	*dowsonae*	CDM	2003.2.5 CDM 030	Archibald 2005 119-136
2005	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Dinopanorpidae	*Dinokanaga*	*wilsoni*	UAFIC, UA	UAFIC5004a,b	Archibald 2005 119-136
2007	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Dinopanorpidae	*Dinokanaga*	*D. hillsi*			Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Dinopanorpidae	*Dinokanaga*	*D. dowsonae*			Archibald (personal communication, June 2007)
2005	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Eomeropidae	*Eomerope*	*E. macabeensis*	UCCIPRL	UCCIPRL-18F-826	Archibald, Basnitsyn, & Akhmetiev 2005:503-524
2007	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Eomeropidae	*Eomerope*	*E. macabeensis*			Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Holcorpidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Mecoptera	New unnamed family					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Mecoptera	Panorpidae					Archibald (personal communication, June 2007)
1997	ANIMAL	ARTHROPODA	Insecta	Neuroptera	Undetermined			FCER		Pugh & Haggart 1997, ms p. 14
2006	ANIMAL	ARTHROPODA	Insecta	Neuroptera	Polystoechotidae					Archibald, & Makarkin 2006. 119-155
2006	ANIMAL	ARTHROPODA	Insecta	Neuroptera						Archibald, & Makarkin 2006. 119-155
2007	ANIMAL	ARTHROPODA	Insecta	Neuroptera	New unnamed family					Archibald (personal communication, June

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										2007)
2007	ANIMAL	ARTHROPODA	Insecta	Neuroptera	Osmylidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Neuroptera	Chrysopidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Neuroptera	Hemerobiidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Odonata	Undetermined					Archibald 1995 1-8pp.;
2007	ANIMAL	ARTHROPODA	Insecta	Odonata:Zygoptera	Megapodagrionidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Odonata:Anisoptera	Aeshnidae					Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Odonata?/Ephemeroptera?						Archibald 1995 1-8pp.;
1997	ANIMAL	ARTHROPODA	Insecta	Orthoptera	Acrididae			Langevin		Pugh & Haggart 1997, ms p. 8
1991	ANIMAL	ARTHROPODA	Insecta	Orthoptera	Undetermined			CMN		Douglas 1991
2007	ANIMAL	ARTHROPODA	Insecta	Orthoptera:Ensifera						Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Orthoptera:Ensifera	Gryllacrididae?					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Orthoptera:Ensifera	Prophalangopsidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Orthoptera:Ensifera	Tettigoniidae					Archibald (personal communication, June 2007)
2007	ANIMAL	ARTHROPODA	Insecta	Orthoptera:Caelifera	Acrididae	Catanopinae s.l.				Archibald (personal communication, June 2007)
1991	ANIMAL	ARTHROPODA	Insecta	Orthoptera:				CMN		Douglas 1991, p. 311, Appendix 4
1995	ANIMAL	ARTHROPODA	Insecta	Orthoptera?						Archibald 1995 1-8pp.;
1997	ANIMAL	ARTHROPODA	Insecta	Plecoptera				Langevin		Pugh & Haggart 1997, ms p. 8
2007	ANIMAL	ARTHROPODA	Insecta	Raphidioptera	Raphidiidae					Archibald (personal communication, June 2007)
1997	ANIMAL	ARTHROPODA	Insecta	Trichoptera	Undetermined			FCER		Pugh & Haggart 1997, ms p. 31

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2007	ANIMAL	ARTHROPODA	Insecta	Trichoptera						Archibald (personal communication, June 2007)
1995	ANIMAL	ARTHROPODA	Insecta	Undetermined						Archibald 1995 1-8pp.;
2000	ANIMAL	ARTHROPODA	Insecta							Archibald, & Mathewes 2000, 1441-1462
2007	ANIMAL	Chordata	Actinopterygii	Cypriniformes	Catostomidae	*Amyzon*				Wilson 2007 (personal communication)
2007	ANIMAL	Chordata	Actinopterygii	Hiodontiformes	Hiodontidae	*Eohiodon*		RBCM.EH2004.001.1927.ARS469		Royal British Columbia Museum Catalogue
1977	ANIMAL	Chordata	Actinopterygii	Osteoglossiformes	Hiodontidae	*Eohiodon*	*E. rosei*	ROM		Wilson 1977 1-61; Wilson 1996, 212-224
1999	ANIMAL	Chordata	Actinopterygii	Osteoglossiformes	Hiodontidae	*Eohiodon*		FCER		Pugh. 1999, Part IV, 2ms pp.
1999	ANIMAL	Chordata	Actinopterygii	Perciformes	Undetermined			FCER		Pugh. 1999, Part IV, 2ms pp.
2007	ANIMAL	Chordata	Actinopterygii	Salmoniformes	Salmonidae	*Eosalmo*				Wilson 2007 (personal communication)
1995	ANIMAL	Chordata	Aves	Sandcoleiformes						Wehr & Barksdale 1995;
2005	PLANT			Angiospermae	Anacardiaceae	*Rhus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Araliaceae	*Aralia*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Araliaceae	*Paleopanax*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Areacaceae					Moss et al. 2005:187-204
2007	PLANT			Angiospermae	Asterales?	*Calycites*		RBCM		Royal British Columbia Museum Catalogue
2005	PLANT			Angiospermae	Betulaceae	*Alnus*	*A. parvifolia*	UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Betulaceae	*Alnus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Betulaceae	*Alnus*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Betulaceae	*Alnus*				Moss et al. 2005:187-204
1991	PLANT			Angiospermae	Betulaceae	*Alnus*				Douglas 1991, p. 41
2005	PLANT			Angiospermae	Betulaceae	*Alnus sp. 1*		UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Betulaceae	*Alnus sp. 2*		UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Betulaceae	*Betula*	*B. leopoldae*	UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Betulaceae	*Betula*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Betulaceae	*Betula*				Moss et al. 2005:187-204

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2005	PLANT			Angiospermae	Betulaceae	*Carpinus*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Betulaceae	*Corylites*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Betulaceae	*Corylus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Betulaceae	*Corylus*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Betulaceae	*Palaeocarpinus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Cercidiphyllaceae	*Joffrea*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Cercidiphyllaceae	*Joffrea*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Cercidiphyllaceae	*Nyssydium*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Cercidiphyllaceae	*Trochodendroides*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Cornaceae	*Cornus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Cornaceae	*Cornus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Ericaceae	*Rhododendron*				Dilhoff et al. 2005 42:151-166.
2007	PLANT			Angiospermae	Fagaceae	*Castanea*		RBCM.EH1997.004.0006		Royal British Columbia Museum Catalogue
2001	PLANT			Angiospermae	Fagaceae	*Fagus*				Dilhoff et al. 2001. P. 11
2005	PLANT			Angiospermae	Fagaceae	*Fagus*	*F. langevinii*	UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Fagaceae	*Fagus*				Dilhoff et al. 2005 42:151-166.
2004	PLANT			Angiospermae	Fagaceae	*Fagus*	*F. langevinii n.sp.*	UWBM; UCCF; UF	UWBM97583	Manchester & Dillhoff 2004. 1509-1517.
2005	PLANT			Angiospermae	Fagaceae	*Fagus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Fagaceae	*Quercus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Fagaceae	*Quercus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Fagaceae	*Quercus*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Grossulariaceae	*Itea*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Grossulariaceae	*Ribes*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Grossulariaceae	*Ribes*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Grossulariaceae	*Ribes*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Hamamelidaceae	*Langeria*	*L. magnifica*			Dilhoff et al. 2005 42:151-

Year:	KINGDOM:	PHYLUM:	CLASS:	HIGHER TAXA:	FAMILY:	GENUS:	SPECIES:	COLLECTION:	HOLOTYPE:	Reference:
										166.
2005	PLANT			Angiospermae	Juglandaceae	*Carya*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Juglandaceae	*Carya*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Juglandaceae	*Juglans*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Juglandaceae	*Pterocarya*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Juglandaceae	*Pterocarya*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Lauraceae	*Lindera*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Lauraceae	*Phoebe*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Lauraceae	*Sassafras*	*S. hesperia*			Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Lauraceae	*Sassafras*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Malvaceae	*Florissantia*	*F. quilchenensis*			Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Malvaceae	*Tilia*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Myricaceae	*Comptonia*	*C. columbiana*			Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Myricaceae	*Comptonia*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Oleaceae	*Fraxinus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Platanaceae	*Macginicarpa*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Platanaceae	*Macginitiea*	*M. gracilis*			Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Platanaceae	*Macginitiea*				Greenwood et al. 2005:167-185
2007	PLANT			Angiospermae	Platanaceae	*Platanus*		RBCM		Royal British Columbia Museum Catalogue
2005	PLANT			Angiospermae	Rosaceae	*Amelanchier*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Rosaceae	*Crataegus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Rosaceae	*Crataegus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Rosaceae	*Prunus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Rosaceae	*Prunus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Rosaceae	*Sorbus*				Greenwood et al. 2005:167-185

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2005	PLANT			Angiospermae	Rutaceae?					Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Salicaceae	*Salix?*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Salicaceae	*Populus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Salicaceae	*Populus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Salicaceae	*Populus*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Salicaceae	*Salix*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Sapindaceae	*Acer*	*A. rousei*	UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Sapindaceae	*Acer*	*A. stewarti*	UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Sapindaceae	*Acer*	*A. wehri*	UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Sapindaceae	*Acer*		UCCIPRL1		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Sapindaceae	*Acer*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Sapindaceae	*Acer*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Sapindaceae	*Aesculus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Sapindaceae	*Aesculus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Sapindaceae	*Bohlemia*				Greenwood et al. 2005:167-185
2007	PLANT			Angiospermae	Sapindaceae	*Bohlenia*		RBCM		Royal British Columbia Museum Catalogue
2005	PLANT			Angiospermae	Sapindaceae	*Dipteronia*	*D. brownii*	UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Sapindaceae	*Dipteronia*				Greenwood et al. 2005:167-185
2001	PLANT			Angiospermae	Sapindaceae	*Dipteronia*	*D. brownii n.sp.*	USASK; CMN		McClain & Manchester 2001:1316-1325
2005	PLANT			Angiospermae	Sapindaceae	*Dipteronia?*		UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Sapindaceae	*Koelreuteria*	*K. arnoldi*	UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Sapindaceae	*Koelreuteria*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Sapotaceae					Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Theaceae	*Gordonia*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Trochodendraceae	*Nordenskioldia*				Dilhoff et al. 2005 42:151-166.

Year:	KINGDOM:	PHYLUM:	CLASS:	HIGHER TAXA:	FAMILY:	GENUS:	SPECIES:	COLLECTION:	HOLOTYPE:	Reference:
2005	PLANT			Angiospermae	Trochodendraceae	*Trochodendron*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Trochodendraceae	*Trochodendron*				DeVore et al. 2005:205-214
2006	PLANT			Angiospermae	Trochodendraceae	*Trochodendron*				Pigg et al. 2006: in ABSTRACTS Amer. Bot. Soc.
2006	PLANT			Angiospermae	Trochodendraceae	*Trochodendron*		UWBM		Pigg et al. 2007:521-532.
2005	PLANT			Angiospermae	Trochodendraceae	*Zizyphoides*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Ulmaceae	*Ulmus*		UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Ulmaceae	*Ulmus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Ulmaceae	*Ulmus*				Moss et al. 2005:187-204
2005	PLANT			Angiospermae	Ulmaceae	*Ulmus*				Denk & Dillhoff 2005:1663-1681
2005	PLANT			Angiospermae	Ulmaceae	*Ulmus*	*U. okanaganensis n sp.*	Univ. Wash. Burke Mus.	UWBM 97766	Denk & Dillhoff 2005:1663-1681
2005	PLANT			Angiospermae	Ulmaceae	*Ulmus (3p)*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Ulmaceae	*Zelkova*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Ulmaceae	*Zelkova*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	UNKNOWN	*Averrhoites*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	UNKNOWN	*Chaneya*	*C. tenuis*			Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Vitaceae	*Ampelocissus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Vitaceae	*Cissus*				Greenwood et al. 2005:167-185
2005	PLANT			Angiospermae	Vitaceae	*Vitus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	Vitaceae	*Vitus*				Greenwood et al. 2005:167-185
1991	PLANT			Angiospermae				CMN		Douglas 1991, p. 77, Plate III-IV, Fig. 1
1991	PLANT			Angiospermae				CMN		Douglas 1991, p. 139, Plate IV, Fig. 21
2005	PLANT			Angiospermae		*Ulmoideipites*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	3-colpate					Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	3-colporate					Dilhoff et al. 2005 42:151-166.

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2005	PLANT			Angiospermae	3-porate					Dilhoff et al. 2005 42:151-166.
2005	PLANT			Angiospermae	4-6-porate					Dilhoff et al. 2005 42:151-166.
2005	PLANT			Equisetopsidae	Equisetaceae	*Equisetum*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Pteridophyta: Filicales						Moss et al. 2005:187-204
2005	PLANT			Pteridophyta	Osmundaceae	*Osmunda*				Moss et al. 2005:187-204
2005	PLANT			Pteridophyta	Polypodiaceasporites					Dilhoff et al. 2005 42:151-166.
2005	PLANT			Pteridophyta	Polypodiaceae-type					Dilhoff et al. 2005 42:151-166.
2005	PLANT			Pteridophyta	Triradiate-spore					Dilhoff et al. 2005 42:151-166.
2005	PLANT			Lycopodiophyta	Lycopodiaceae	*Lycopodium*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Pteridophyta		*Magnastriatites*				Dilhoff et al. 2005 42:151-166.
2007	PLANT			Gymnospermae	Araucariaceae	*Araucaria*		RBCM		Royal British Columbia Museum Catalogue
2005	PLANT			Gymnospermae	Cupressaceae	*Calocedrus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Cupressaceae	*Chamaecyparis*		UCCIPRL18F		Dilhoff et al. 2005 42:151-166.
1996	PLANT			Gymnospermae	Cupressaceae	*Chamaecyparis*		Univ. of Sask.	Fig. 20.4B p. 254	Basinger et al. 1996, 248-258
2005	PLANT			Gymnospermae	Cupressaceae	*Chamaecyparis*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Cupressaceae	*Cunninghamia*		UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Cupressaceae	*Cunninghamia*				Moss et al. 2005:187-204
2005	PLANT			Gymnospermae	Cupressaceae	*Juniperus*				Moss et al. 2005:187-204
2005	PLANT			Gymnospermae	Cupressaceae	*Metasequoia*	*M. occidentalis*			Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Cupressaceae	*Metasequoia*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Cupressaceae	*Metasequoia*				Moss et al. 2005:187-204
2005	PLANT			Gymnospermae	Cupressaceae	*Metasequoia*				Mustoe 2005:231-241
2005	PLANT			Gymnospermae	Cupressaceae	*Sequoia*				Dilhoff et al. 2005 42:151-166.
1996	PLANT			Gymnospermae	Cupressaceae	*Sequoia*		Univ. of Sask.	Fig. 20.3 p. 253	Basinger et al. 1996, 248-258
2005	PLANT			Gymnospermae	Cupressaceae	*Sequoia*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Cupressaceae	*Sequoia*				Moss et al. 2005:187-204

Year:	KINGDOM:	PHYLUM:	CLASS:	HIGHER TAXA:	FAMILY:	GENUS:	SPECIES:	COLLECTION:	HOLOTYPE:	Reference:
2005	PLANT			Gymnospermae	Cupressaceae	*Taxodium*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Cupressaceae	*Taxodium*				Moss et al. 2005:187-204
2005	PLANT			Gymnospermae	Cupressaceae	*Thuja*		UWBM		Dilhoff et al. 2005 42:151-166.
1996	PLANT			Gymnospermae	Cupressaceae	*Thuja*		Univ. of Sask.	Fig. 20.4C p. 254	Basinger et al. 1996, 248-258
2005	PLANT			Gymnospermae	Cupressaceae	*Thuja*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Cupressaceae	*Thujopsis*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Ginkgoaceae	*Ginkgo*	*G. biloba*			Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Ginkgoaceae	*Ginkgo*	*G. dissecta*		WWU-GK-020	Dilhoff et al. 2005 42:151-166.
2002	PLANT			Gymnospermae	Ginkgoaceae	*Ginkgo*	*G. dissecta n.sp.*	Western Wash. Univ.	WWU-GK-020	Mustoe 2002, 1078-1087
2005	PLANT			Gymnospermae	Ginkgoaceae	*Ginkgo*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Ginkgoaceae	*Ginkgo*				Moss et al. 2005:187-204
2005	PLANT			Gymnospermae	Pinaceae	*Abies*	*A. milleri*			Dilhoff et al. 2005 42:151-166.
1986	PLANT			Gymnospermae	Pinaceae	*Abies*	*A. milleri*			Schorn & Wehr 1986, 1-7
1996	PLANT			Gymnospermae	Pinaceae	*Abies*		Univ. of Sask.	Fig. 20.6 p. 256	Basinger et al. 1996, 248-258
2005	PLANT			Gymnospermae	Pinaceae	*Abies*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Pinaceae	*Abies*				Moss et al. 2005:187-204
2005	PLANT			Gymnospermae	Pinaceae	*Cryptomeria*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Pinaceae	*Cryptomeria*				Greenwood et al. 2005:167-185
2007	PLANT			Gymnospermae	Pinaceae	*Larix?*		RBCM		Royal British Columbia Museum Catalogue
2005	PLANT			Gymnospermae	Pinaceae	*Picea*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Pinaceae	*Picea*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Pinaceae	*Picea*				Moss et al. 2005:187-204
2005	PLANT			Gymnospermae	Pinaceae	*Pinus*				Dilhoff et al. 2005 42:151-166.
1996	PLANT			Gymnospermae	Pinaceae	*Pinus*	*P. latahensis*	Univ. of Sask.	Fig. 20.5 p. 255	Basinger et al. 1996, 248-258
2005	PLANT			Gymnospermae	Pinaceae	*Pinus*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Pinaceae	*Pinus*				Moss et al. 2005:187-204

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2005	PLANT			Gymnospermae	Pinaceae	*Pseudolarix*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Pinaceae	*Pseudolarix*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Pinaceae	*Pseudolarix*				Moss et al. 2005:187-204
2005	PLANT			Gymnospermae	Pinaceae	*Tsuga*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Pinaceae	*Tsuga*				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Pinaceae	*Tsuga*				Moss et al. 2005:187-204
2007	PLANT			Gymnospermae	Podocarpaceae	Podocarp		RBCM		Royal British Columbia Museum Catalogue
2005	PLANT			Gymnospermae	Taxaceae	? Amentotaxus				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Taxaceae	? Taxus				Greenwood et al. 2005:167-185
2005	PLANT			Gymnospermae	Taxaceae	*Amentotaxus*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Taxaceae	*Torreya*				Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Taxaceae			UWBM		Dilhoff et al. 2005 42:151-166.
2005	PLANT			Gymnospermae	Taxodiaceae	? Calocedrus				Greenwood et al. 2005:167-185
2007	PLANT			Gymnospermae	Taxodiaceae	*Metasequoia*	*M. glyptostroboides*	RBCM		Royal British Columbia Museum Catalogue
2005	PLANT			Gymnospermae		*Inaperturopollenites*				Dilhoff et al. 2005 42:151-166.