THE NARG MISSION STATEMENT

The mission of NARG is to provide a forum for individuals who possess a passionate interest in fossils. In the Pacific NW, we are responsible for a wealth in fossil record.

We document our findings and strive to improve communication for scientific contribution and public benefit.

Our goal is to develop an affiliation of fossil enthusiasts working together, to continue research, perform site investigation, have fun, and contribute to the growth and development of an active, premier group of avocational paleontologists.

Our belief: The total can be greater than the sum of its parts: By working together, we can create an informative, educational experience for a dynamic group of people. Our individual pursuits and interests will contribute and enhance scientific knowledge and the public record.

If your interests are research and exploration, collection or preparation, we welcome your participation and invite your enthusiasm!

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NARG Newsletter

VOLUME I, ISSUE V   JANUARY 2006

A Story From NARG's Northern Chapter...

We Came From Above - Wide Bay, Alaska

By Don Brizzolara & Greg Keith

Greg Keith and I have told many tales about our experiences fossil hunting in Alaska. Normally we work as a team but on this particular adventure I was part of an oil industry geologic field party working the Alaska Peninsula in the summer of 2004. Greg was not part of the group but assisted me greatly by researching some excellent fossil localities that would assist our team in age dating the units we were interested in. Of particular interest to our group was the middle Jurassic Kialagvik Formation which outcrops along the south flank of the Alaska Peninsula between Puale Bay and Wide Bay. Both Greg and I have a keen interest in the ammonite fauna of Alaska and we knew that this rare opportunity to visit this poorly explored part of the state could be very useful to our understanding of Jurassic ammonite speciation. Many visits to our favorite coffee house were required to pour over maps and old literature some of which went back to the 19th century. We found the Kialagvik Formation in the vicinity of Wide Bay to have the greatest potential for finding a diverse assemblage of ammonite fauna. This short tale relates one exciting day when our little team was exposed to the closest I have ever come to ammonite "nirvana." In past articles I have discussed the hazards of field work in Alaska. Death or injury can come in many forms: (a) aviation crash (b) drowning (c) animal attack (d) rock fall (e) starvation (f) hypothermia….those are the big ones and I'm sure I may have missed some of the more minor or unusual causes. In the story I'm about to relate our biggest fears were in the form of aircraft disasters and bear attack. They are my biggest fears on the Alaska Peninsula.

Don on beach outcrop of Kialagvik sandstone at Wide Bay

We Came From Above - Wide Bay, Alaska

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"Don, another one!" and, unbelievably, "Don another one, again right at your feet!"

What not to do in a fixed wing: Fly into cumulus granitus!

Flying can be absolutely treacherous as the winds can be horrific…sustained, hurricane force winds that can only be described by pilots as vicious and squirrelly. Much of our flying is near sea cliffs (our best exposures) and usually requires over-the-water flying. If one is fortunate to survive a crash in the sea it is still very unlikely that death is not far away. Water temperatures are brutally cold and without proper survival gear death comes in but a few minutes. In past articles I have discussed the hazards of field work in Alaska. Death or injury can come in many forms: (a) aviation crash (b) drowning (c) animal attack (d) rock fall (e) starvation (f) hypothermia….those are the big ones and I'm sure I may have missed some of the more minor or unusual causes. In the story I'm about to relate our biggest fears were in the form of aircraft disasters and bear attack. They are my biggest fears on the Alaska Peninsula. Flying can be absolutely treacherous as the winds can be horrific… sustained, hurricane force winds that can only be described by pilots as vicious and squirrelly. Much of our flying is near sea cliffs (our best exposures) and usually requires over-the-water flying. If one is fortunate to survive a crash in the sea it is still very unlikely that death is not far away. Water temperatures are brutally cold and without proper survival gear death comes in but a few minutes. Bears…well bears are just so unpredictable and so incredibly powerful that they are always terrifying. I believe that there are some 7000 souls that live on the Alaska Peninsula but there are at least 10,000 brown bears. When ever a helicopter pilot approaches an LZ (landing zone) the standard operating procedure is to circle the LZ in an effort to identify bears that may be on the prowl. Another standard rule is to never wander off alone in bear country. Bears, due to their inquisitive nature, will frequently single out individuals but seem to be more intimidated by groups of three or more. On the Alaska Peninsula they are referred to as "the men in brown suits." We always carry bear protection in

We Came From Above - Wide Bay, Alaska

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the form of either a high powered revolver (.44 magnum or greater) or an 18-nch barrel 12 gauge shotgun. Never, I repeat, never leave home without one. With all these fears and concerns in mind we would face our daily task of performing field work.

Our camp was situated along the Kejulik River drainage and close to the massive Becharof Lake. Our field party consisted of 4 geologists and a helicopter pilot. We had the good fortune of being taken care of by a husband and wife guide service that treated us exceedingly well. Our bunk house and office space consisted of Quonset huts and our dining commons a simple wood framed cabin. The family that ran the operation was wonderful and each evening we returned from the field they welcomed us with a hearty meal (dominated by fish and game meats) and delightful conversation. Some field parties are much more Spartan and are referred to as "spike camps". A helicopter drops the team off with minimal gear and picks them up 2-4 weeks later. It is then the team's mission to map the geology and survive as best they can. Yes, this time we were very fortunate… especially to have solid walls around us to keep us dry and safe from "the men in brown suits!" For several days I had wanted to visit Wide Bay to examine the middle Jurassic section there. Each time we attempted a flight there was a problem, usually weather, but sometimes mechanical issues that left our helicopter grounded. On those weather days we would typically fly either by helicopter or by the lodge owner's Piper Super Cub to an accessible landing zone. In the case of the Super Cub it would mean a beach landing to view sea cliff or bluff geology. Some attempts by helicopter to get to Wide Bay were absolutely terrifying "white knuckle" flights. We couldn't fly through the mountain passes to Wide Bay due to low ceiling. These attempts were frightening in that the passes were very narrow and the ceiling was constantly shifting and dropping. It was very easy to get trapped or smack into what we called "". If we couldn't fly through the passes we would try the coastal route over the Shelikof Straits hugging close to the precipitous cliffs of the shoreline. This was often more terrifying than the mountain passes. On windy days the sea would be wildly churning with a helter skelter pattern of white caps. The helicopter would catch wild updrafts only to be seconds later smashed earthward by violent downdrafts. In short it was wild, near out of control, roller coaster ride. We also had to constantly be vigilant of sea birds.

Base camp on the Alaska Peninsula

Fixed Wing Aircraft, note large beach/tundra tires.

Helicopter: Background shows cloudy mountain passes!

Exotic Terranes of Western North America

Reprinted with permission from Susan Pachuta, Maps by James Sears©

"The Pacific Northwest is made up of some of the most exotic terranes found in North America."

The Pacific Northwest is made up of some of the most exotic terranes found in North America. The geologic history of the terranes and overlap assemblages is highly complex because terranes fragment and disperse after impact, and they react to the geologic processes they are helping to create. The western margins of British Columbia and Oregon, and most of Alaska, Washington and California are an amalgam of accreted crust. This project presents a time line for the discovery and understanding of exotic terranes, a description of these geologic structures, and a time line for the geologic history of the western boundary of the North American continent.

"Exotic terranes" - the very name conjures up a sense of mystery and foreign intrigue. Bounded by major faults, each terrane is a geologic province unto itself, with a unique geologic history and features that differ sharply from those of its neighbors. For years geologists puzzled over abrupt changes in geology and paleobiology, peculiar formations of ore deposits, and just how to explain rock assemblages from decidedly different backgrounds being found next to one another. How could these huge pieces of continental and oceanic crust be where they are if it was clear they did not originate in that location?

Remember "continental drift" and "the conveyor belt"? For the past 2 billion years, continents have rifted and drifted, and as many as twenty oceans have been created and destroyed. Since the break up of Pangaea, 200 million years ago (mya), that sea floor "conveyor belt" has brought fault-bounded volcanic island arcs, and bits of microcontinents, and fragments of ocean crust (more than 200 assorted pieces) all crashing into North America, building the continent. Geologists call this docking, or accretion. Each event effectively moved the now active plate boundary farther and farther west. Through microplate tectonics, the average accumulated continental build-up would be 500 kilometers inland.

The western margin of North America is a collage of exotic terranes with some commonality. But their differences outweigh their similarities. San Francisco, California, is made up of many small terranes - Alcatraz Island is a terrane! Some terranes, made of displaced continental crust from before the breakup of Pangea, can be quite large. The Brooks Range of Alaska is a good example. And let's include India with the large category - it had quite a trip before it began its crash into Eurasia.

We know exotic terranes are fault-bounded rock bodies that originated elsewhere - but how can we determine the "elsewhere"? The internal structure of the individual terrane, the fossil record, paleomagnetic signatures, and geochemical markers all contribute to the identification process.

Terrane Types- Four types of terranes have been identified: stratified, disrupted, composite, and metamorphic. Their geologic make up and structure can reveal their history, and, along with their velocity and angle of impact, it will determine how they will react to a collision. Some will fold up and over, some will shear along fault lines, some will rotate and migrate along a boundary, some will fracture, stretch, and disperse. And previous accretions will affect the scale and reaction of the impacts of "new-comers"!

Fossil Evidence- Most terranes with sedimentary layers hold evidence of their deep-water origins in the fossil record of the rock. By using microscopic skeletal remains of radiolarians and conodonts, workers have been able to successfully date portions of these terranes. Conodonts are often found with other fossil assemblages, and they develop different coloring in response to the different geomorphic events and conditions of the matrix rock. These facts have been used to successfully corroborate a time scale for dating rocks with conodonts alone. Tethyan fusulinids provide evidence for the global movements of some crustal terranes. Known to have originally lived in the ancient Tethys Sea, the fossils of these organisms are now found an ocean away in the terranes of western North America.

Exotic Terranes of Western North America

Paleomagnetic Signatures - Jones, Cox, Coney and Beck call paleomagnetic signatures the key to measuring the movement of terranes. The degree of inclination recorded by the magnetized fraction of the terranes' rocks establishes distance from the geographic North Pole at the time of origin; the declination indicates the angle between this vector and true north. By comparing terrane signatures with those of the craton's rocks of the same age, the global location of the terrane's origin can be calculated. These signatures can also help to determine terrane rotation before or after impact, direction of movement before docking and after impact, and the direction of ancient sea currents.

Geochemical Markers - Geologists use calculated ratios of strontium 87 and strontium 86 isotopes found in rocks to help delineate boundaries between ancient (Precambrian) continental crust and ocean crust rocks. Samples with high strontium 87 to strontium 86 ratios are identified as continental in origin; low ratios indicate exotic ocean crust. These results can be combined with other dating techniques for accurate identification.

Dating the rocks in a terrane is important to determining time of docking. Simply put, it is a matter of logic. The time of docking must be no later than the age of the rock which sutures the accretion nor earlier than the youngest rock in the accreted terrane. That makes sense!

Tracking Wrangellia

A popular and extensively studied exotic terrane identified in the Pacific Northwest is named Wrangellia. As you might expect, this in depth studying has resulted in a great deal of data, and some disagreements.

Stretching from the Wrangell Mountains east of Anchorage, Alaska, through Vancouver Island, to Hells Canyon, Idaho, Wrangellia is one of the most extensively displaced exotic terranes in North America. Studies have yielded distinctive fossils in this terrane. Particularly interesting is the fossilized presence of a species of clam, Daonella, also found in rocks native to Asia but nowhere else in North America!

Wrangellia is made of volcanic rocks, capped with shallow marine shales with interbedded limestones. The thick volcanic basalt found over these layers indicates possible formation in a rift zone, or an oceanic plateau. Subsequent volcanic layers built the terrane until the late Triassic. Initial sinking allowed the carbonate depositions of shallow water to accumulate; further sinking allowed deep-water sediments to collect. There is no indication of continental material in the depositional layers from this time, but some are found in layers from the Cretaceous. This indicates these layers were accumulated after the terrane began to collide with North America.

Some geologists believe paleomagnetic and paleobiogeographic information indicates that Wrangellia, which is part of the Insular superterrane, migrated from subtropical latitudes to northern temperate latitudes in the eastern Pacific between Late Triassic and Late Jurassic time (Dickinson, W. R., 1992). Others state it is not clear from the paleomagnetic data whether Wrangellia was derived from north or south of the equator (Moores, Eldridge and Robert J. Twiss, 1995). Jones, Cox, Coney and Beck (1982) have Wrangellia forming simply near the equator. Any theory would support that this terrane may have drifted for 4,000 kilometers or more before colliding with the continent.

Another area of uncertainty involves the site of the initial collision. One opinion bases its view on paleomagnetic data and proposes 25 degrees N latitude as the impact site (near present day Baja, California). After collision, the fractured terrane spread out and migrated north along a continental fault line. Rocks taken from two parts of Wrangellia which are now 2,500 kilometers apart, support the theory of post-docking strike-slip faulting. The opposing view points out that no one has found the mega-fault that would be responsible for the displacement. David G. Howell (1985) contends Wrangellia crashed into Oregon 70 million years ago - the subsequent faulting spreading fragments of the terrane northward through Vancouver and Queen Charlotte islands and on to the Wrangell Mountains of southern Alaska. The debate keeps researchers busy!

"Stretching from the Wrangell Mountains east of Anchorage, Alaska, through Vancouver Island, to Hells Canyon, Idaho, Wrangellia is one of the most extensively displaced exotic terranes in North America. "

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We Came From Above - Wide Bay, Alaska

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Kittiwakes, puffins, cormorants, murres and a variety of gulls and other species establish enormous rookeries along the sea cliffs. On occasion such rookeries would spontaneously erupt in flight. Helicopters and birds do not mix well. Since birds can wreak havoc with helicopters moving parts, all efforts were made to give rookeries a wide berth. On many windy days I would just close my eyes and hold onto whatever I could get my hands on for support. My pilot and fellow passengers would ride in silence. No words would be spoken over the intercom. An occasional glance to one of my compatriots would evoke a nervous smile that would soon collapse into a mouth agape, white-faced, bug-eyed stare. It was usually at this point that the pilot would calmly say "Enough of this sh # t! We're outa here!" Usually the geologist in charge would clear his parched throat and in a somewhat rattled voice say…."Gulp….Sounds good to me!" At moments like this I vividly remember my clothing stuck to my body by high volumes of sweat.

Finally, one early morning the day arrived when the ceiling lifted and we knew it was our golden opportunity…perhaps the only one we would have. I talked to the pilot and he gave me the thumbs up. Awesome! We were going in! On such missions I would typically be the navigator. As navigator it was mandatory that one have in mind a route and an LZ. As conditions were always in a state of flux and, if the proposed LZ was an impossibility, an alternate route or LZ must be immediately suggested. The navigator had a stressful job; the team would depend heavily on his direction and geologic wisdom. Ultimately, however, the pilot would always have the final decision. That morning we navigated through a maze of high mountain passes and deep valleys. Occasionally, some 2,000 feet below we would see the infamous "men in brown suits" or small bands of wandering caribou. The rugged volcanic terrane of the southern Alaska Peninsula was spectacular. In all my years as a geologist I have never seen anything to rival it. Flying was smooth but I knew that soon our course would take us from the high mountain domain to the coastline of the dreaded Shelikof Straits. Fortunately, this morning the sea was passive and we flew with relative ease along a course that paralleled the precipitous shoreline. Flying over the sea, even a calm sea, gave me the hebbie-jeebies. I was glad when we finally arrived over gently sloping land and well developed beaches...here; at least, one's chances of survival are greatly improved if the choppers propellers gave up the ghost. Now it was time to really concentrate. Where is that exposure? How will it look from the air as we race by at high speeds? Has it changed since last recorded on my now somewhat ancient maps?

It turned out to be much more difficult than I originally thought. The coastline had changed rather dramatically. We finally circled around a region that appeared close to where earlier workers had successfully collected. No bears were apparent. We picked a convenient LZ on the beach. It was gently raining but, much to our favor, the winds were calm. I opened the door of the helicopter and carefully picked a spot to start our investigation from (when leaving a helicopter never walk up hill…it's a very good way to lose your head!!!). I put on my pack and walked to the nearest bluff exposure. I guess I really didn't have high hopes. I felt that quite a bit of exploring would be necessary before we found any significant fossil material. What I saw floored me! Ammonites…big beautiful ammonites…everywhere I looked. Some were complete but many where broken. They were of good size (up to 8 inches) and mostly of the species Erycitoides howelli, a beautiful, prominently ribbed ammonite. My heart was pounding. I don't think I even was aware of the other geologists now scrambling over the outcrop. They too were scoring on some beautiful specimens.

Some of the haul at the outcrop, why the helicopter was cranky!

Every now and then the cry would go out,"Whoa!!...take a look at this little beauty!!" We continued to pluck ammonites from the Kialagvik sandstone. As the sandstone is well weathered the ammonites were released from there stony confines with great ease. I looked up higher on the cliffs and it even got better. Most were out of reach, but some, with a little careful climbing, could be reached. Careful now, Don, I thought…let's not break a leg this far from home. I remember one of my supervisors giving me his sage advice on doing field work…"Don... no field sample is worth your injury or life". Yeah, right, but dang if I could just reach another 12 inches!! By now I had picked up at least a dozen fine looking ammonites. My pack was full and getting very heavy. Still, until fully satiated, I continued to pack more in. Some ended up in my field jacket and baggy cargo pants. It had truly become an ammonite frenzy. Everyone was now getting in the act. We did, however, find time to gather other rock data that would be pertinent to our study of this unique stratigraphic unit. Normally, we field geologists are dedicated to producing accurate field maps and gathering as much stratigraphic, geochemical and structural data as we can. But...when fossils are abundant every other objective is dropped and a collecting "frenzy" ensues. It's just that much fun! It's one of the reasons why all geologists originally decided to major in the field…the thrill of discovering some of life's long lost members!! It brings out a basic animal instinct…the thrill of the hunt...be it animal or treasure. Time at the exposure went by in the flash. We knew we had other objectives this day and that the present site was really a treat for all the hard work our geologists had previously done. The word was given to saddle up. My pack was full…embarrassingly full! I tried to look cool by walking upright, with no visible strain on my face and neck muscles. Little did my cohorts know how much treasure my pack held. Few of my cohorts had my passion for these little beasts of long ago. With great effort I removed the pack from shoulders and placed it, gently, in the cargo hold of the helicopter. We all got aboard and the pilot start to crank up the chopper. As we lifted off the pilot said…"Hmmm…you boys picked up a lot of rocks back there?" I asked why…"Well, Don", he said, "this old girl either doesn't want to fly this morning or she is just too worn out!" I got his drift. Too much treasure aboard!! We flew to some other locations on the south side of Wide Bay and worked hard gathering data. Our little coiled friends, however, did not come out to play.

Nice Erycitoides howelli from the Kialagvik sandstone

We had a rare, calm flight back to camp just in time for our nightly feeding. There were other "guests" at our table that night. Each geologist (and even the pilot) brought a "friend" or two to pass around the table and to show the lodge owners. Little did our "friends" know some 150 million years ago that they would be the honored guests at such a fine repast.

After about another week in the field we completed our work and returned to Anchorage. There are always mixed emotions upon leaving a field project. A small team will typically become like a "band of brothers" after experiencing the exhilaration and often the terror of working the Alaskan outback. We will miss our daily contact and conversation. There is also the emotion of having survived another field season. It felt good not to have the daily worries of beach landings, turbulent helicopter flights, and bears. There was also sadness in leaving a pristine, virgin area that

displays such incredible natural beauty. Within all these mixed feelings contained within I reported the results of our trip to my good friend, Greg. If it weren't for his detailed research on fossil locations I doubt we would have scored so well on that one special day at Wide Bay. Greg looked over my haul and with much admiration took on the task of cleaning, repairing and identifying all of the pieces I'd brought back. Over the course of several weeks he completed the work including the detailing and preservation of a large cycad leaf that split perfectly leaving two identical impressions. Finally free from their tombs with many looking much finer than I remembered it was the day of reckoning.

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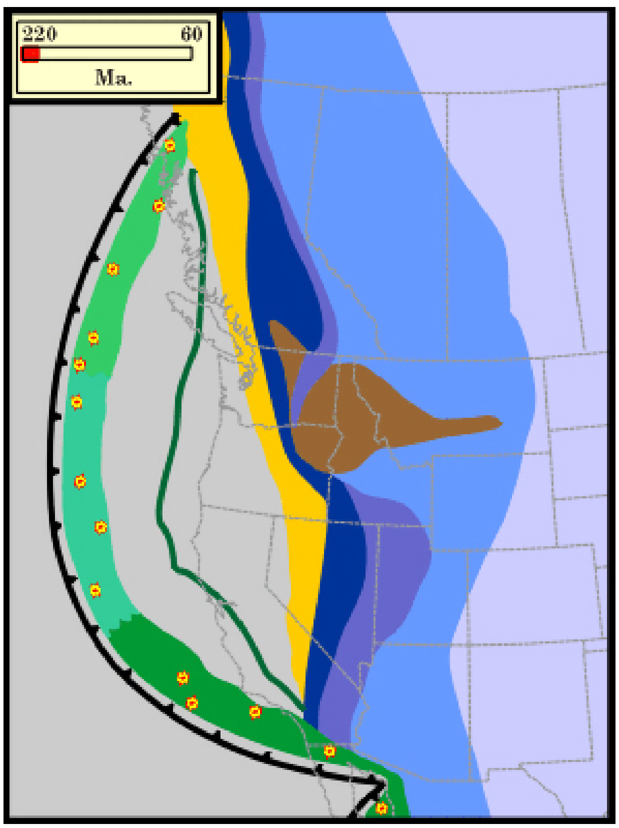
Exotic Terranes of Western North America...continued from Page 5

Geologic Time Line: Putting the Pieces Together - Literally!

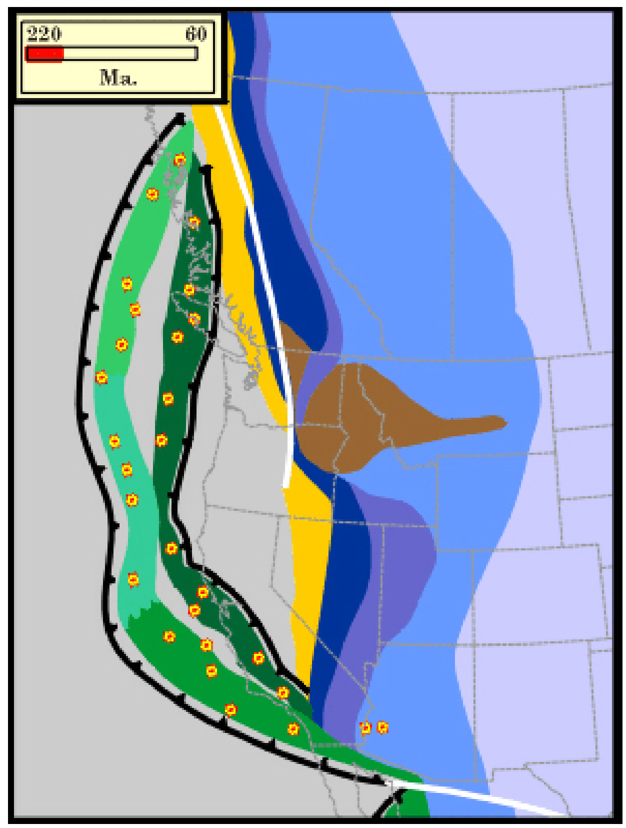
About 365 million years ago, during the Devonian Period, a westward dipping subduction zone began west of the continent, creating a volcanic island arc chain. As the ocean crust between the arc and the continent subducted, the two landmasses began to collide. The effects were felt across present day Montana. This marked the beginning of tectonic activity along this boundary, and it resulted in the Antler orogeny. The arc accreted, and it can be seen today in the Klamath Mountains and northern Sierra Nevada Mountains of California and southern Oregon (Chernicoff, Stanley, et al. 2002). The Cordillera would continue to accumulate additions from the west.

The Sonomian arc started docking in Central California about 260 mya. By about 235 mya, the thrust sheet produced by the collision reached central Nevada.

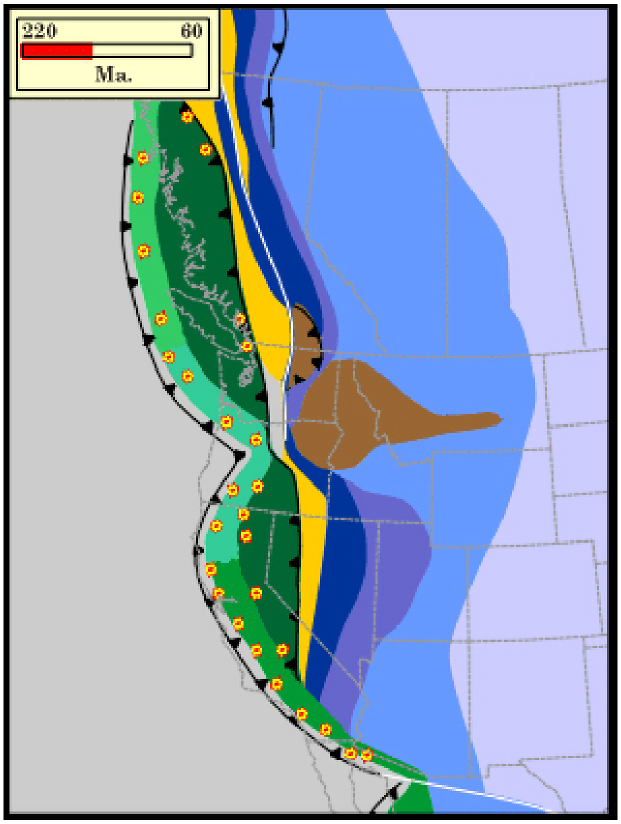
Using maps and descriptions created by Dr. James Sears from the University of Montana, and used with his permission, we can get a visual idea of the sequence of tectonic events of the past 220 million years.



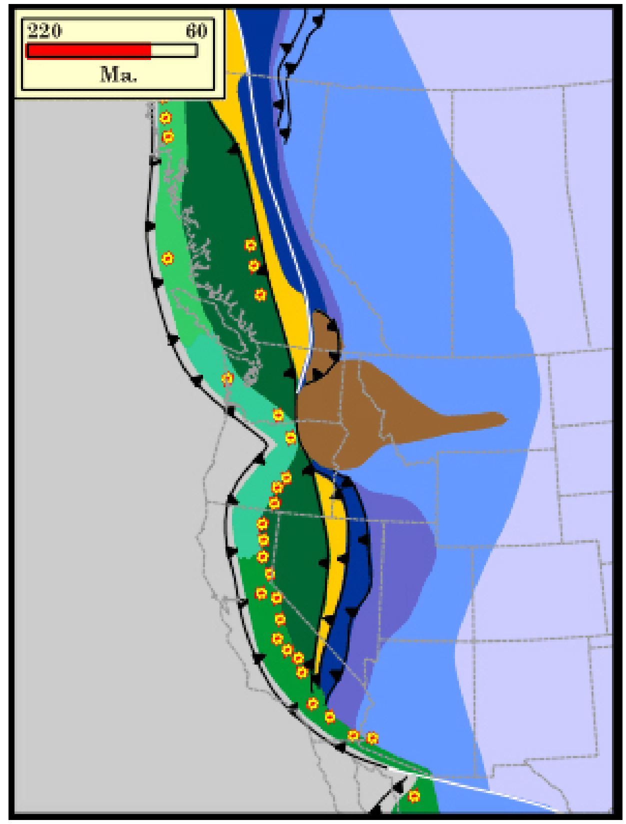
Late Triassic Hypothetical west-facing magmatic arc of same scale and curvature as modern Aleutian arc encloses a marginal sea floored by late Paleozoic-Triassic oceanic crust and marine sediments (Cache Creek, etc.). The arc collapses against North America beginning in late Triassic.



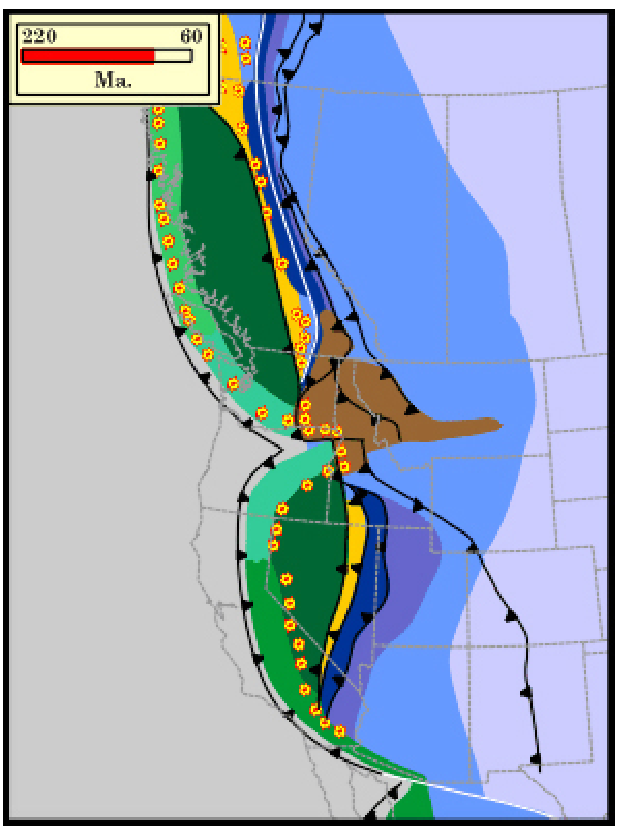
Early Jurassic Westward subduction along the axis of the marginal sea consumes the east half beneath the west half. Volcanic terranes now comprising Sonomia and Stikinia grow on the overriding west half of the marginal sea, and approach the miogeocline. Collapse of the arc into a chord drives part of the marginal sea and distal miogeocline northward on a transform fault (white line).



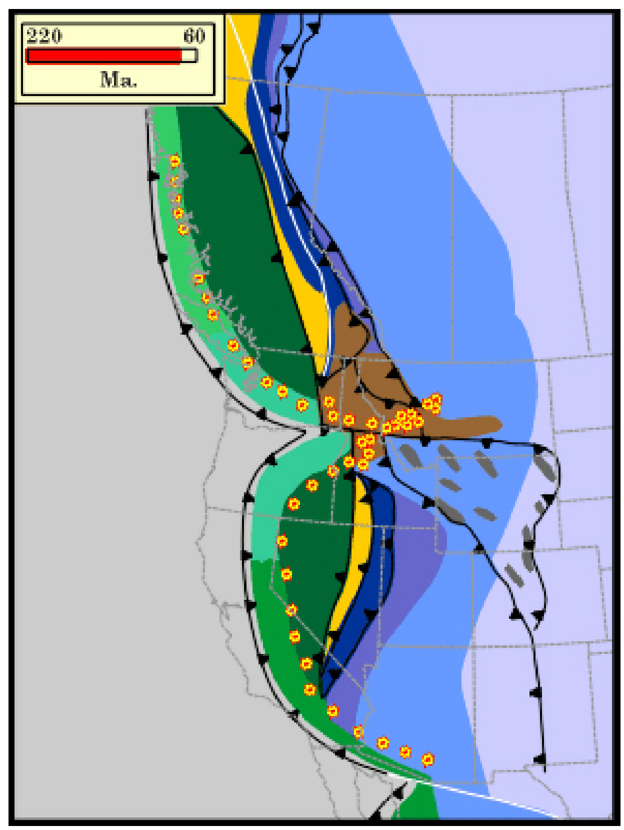
Middle Jurassic Complete closure of the marginal sea results in docking of the new volcanic terranes (Sonomia and Stikinia) against the miogeocline.



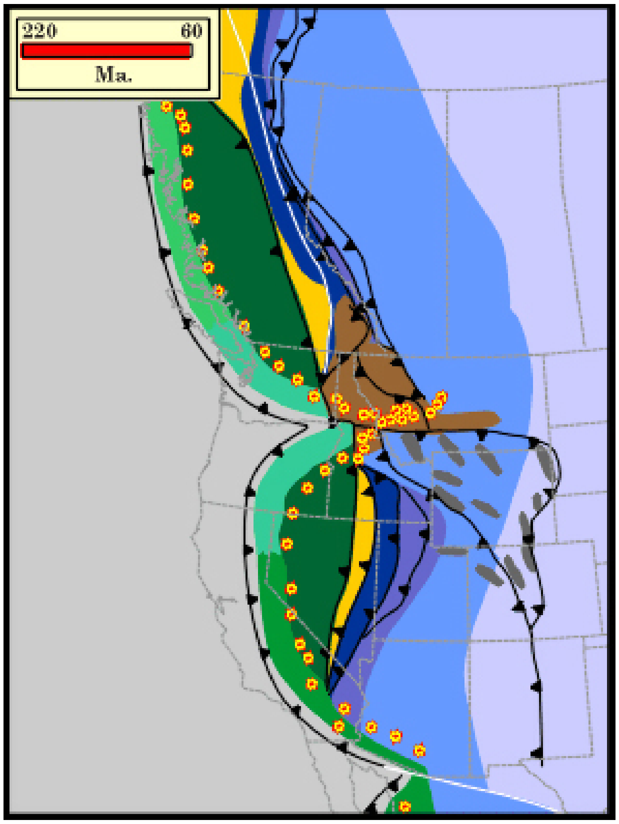
Early Cretaceous Complete closure of the marginal sea results in docking of the new volcanic terranes (Sonomia and Stikinia) against the miogeocline.



Middle Cretaceous Northward displacement of the distal miogeocline permits the main arc to dock directly against the Belt basin. The cusp in the main arc divides the Cordillera into two mechanical segments along the Lewis and Clark line sinistral shear boundary. The southern segment displaces the Sevier thrust belt, Colorado Plateau, and Wyoming province. The northern segment displaces the Canadian Rockies.



Late Cretaceous The magmatic arc crosses into central Montana as the cusp deepens and the northern and southern domains shorten.



Late Paleocene Climax of compressional orogeny.

NARG Membership

Membership Dues are due by June 1st. If you join between June and December, pay the full amount. If you join between January and May, pay half the amount.

Membership Dues Individual: $25
Family/Couple: $40
Junior: $10

Guests are welcome and encouraged to attend NARG Meetings!

Marginal Sea
- Dominantly pelagic
- Sonoman and Stikine arcs

Main magmatic arc
- Alexandria
- Wrangellia
- Sierra Nevada

Pacific Basin

Craton
- East of lower-middle Cambrian paleo-shoreline
- Between lower-middle and lower Cambrian paleo-shoreline
- Between lower Cambrian shoreline and east edge of Windermere
- Belt Basin

Miogeocline
- Between east edge of Windermere and east edge Mississipian foreland basin
- Between east edge Mississippian foreland basing and upper Paleozoic rift

Symbols
- Transform fault
- Trench or trust fault
- Active volcano

Q: What do you call a dinosaur that smashes everything in its path?
A: Tyrannosaurus wrecks!

Q: What kind of dinosaur can you ride in a rodeo?
A: A Bronco-saurus!

Q: What was T. rex's favorite number?
A: Eight! (ate)

Q: Why are there old dinosaur bones in the museum?
A: Because they can't afford new ones!

The Taxonomy Report #4 - Plants

Submitted by Aaron Currier

One of the important aspects of research is not only the labeling of specimens with accurate scientific binomial names, but understanding how a species fits into the hierarchal tree of life... otherwise known as the scientific system of classification, or taxonomy. In the "Taxonomy Report" we look at how species fit together, both in relation to other related species, as well as their ancestry.

Plant fossils are common in many formations throughout the State of Oregon. Whether specimens are in the form of petrified wood or leaf impressions, collecting is allowed on public lands (except within the boundaries of any state or federal park or monument, or where posted). Visiting fossil localities and finding nice specimens of petrified wood or leaves is fairly easy, but what about identification? That task is not so simple. In most cases it requires a loop or dissecting scope, reference books, and often the assistance of a trained paleobotanist.

The challenging part, however, is not necessarily identifying the Family or even Genus, but choosing the Division. More specific to the point, it's not the characteristics that are hard to identify, but which source to use and ultimately which form of classification to use. For those who want to categorize their collected specimens for filing or labeling purposes, a decision must be made regarding which references to use for validation.

"The challenging part, however, is not necessarily identifying the Family or even Genus, but choosing the Division."

Does one use the standard non-scientific references that divide vascular plants into coniferous and deciduous types? What about monocots and dicots? In common terms, there are about ten plant categories (Phyla according to University of Wisconsin, Green Bay1). The most important being: Flowering plants which include both monocots and dicots (common as fossils); Cone-bearing plants (common as fossils); Ferns and related plants (common as fossils); Horsetails and scouring rushes (common as fossils); Mosses (rare as fossils); Fungi (mushrooms, mold, etc.- very rare as fossils) -- a Kingdom Fungi in more modern schemes; Algae (some calcite secreting forms are common) - Kingdom Protista in more modern schemes; and Bacteria (Some preserved) - A Domain or Kingdom in more modern schemes.

To simplify this review, if that's possible, let's assume Fungi, Algae, and Bacteria have their own Kingdoms. That leaves the Kingdom Plantae and the classifications of common fossil plants that occur under that category.

Some researchers at universities around the globe are now using two subkingdoms under the Kingdom Plantae – Bryophyta and Tracheophyta (at UC Berkeley, it's Trachiobionta; and some use Superphylum Tracheata instead!2). Bryophyta groups the non-vascular plants while the Tracheophytans have vascular tissue. In Oregon, we typically find seed and cone-bearing plants with vascular tissues, so we'll focus our examination on the Tracheophytans/Trachiobiontans/Tracheatas… pick one already!

Instead of Phylum, plant classification typically uses the term Division. The standard suffix for the classification of Division is –phyta. However, here is where it gets complicated. Scientists do not agree which prefixes to use and often use entirely different names for the Divisions. One perfect example is the Division containing conifers (cone-bearing plants). Many scientists use what has practically become a common term, adding phyta to the end of conifer, for Coniferophyta. Sounds simple enough, but others believe the Division should be prefixed with the name of the type genus. In this case, the type genus is Pinus and therefore, all conifers could be classified as being in the Division Pinophyta, which is basically a replacement name for Coniferophyta, not in addition to it. Another example is Metasequoia, Oregon's designated state fossil. Metasequoia is in the family Taxodiaceae, which is in the Order Cupressales (Cypresses), the Class Pinopsida, and therefore, Division Pinophyta – or is it Coniferophyta? The latter is what UC Berkeley uses, as does William Tidwell in his book Common Fossil Plants of Western North America. Adding to the confusion, websites can be found using Spermatophyta for either a Division or SuperDivision to classify the conifers.

Some readers may now be wondering, "what about angiosperm and gymnosperm?; I thought you could divide plants into those two classifications." Scientists can and do, but those terms like conifer are used more often as common terms, not scientific ones. For the record, Gymnosperma was a Class name up until the 1950s3. Still, one can find references that list plants under the scientific names Angiospermae and Gymnospermae.

The Taxonomy Report #4 - Plants

Continued from previous page...

Meanwhile, how does cladistics fit into the classification method for plants? Does it change the divisions? Recall from The Taxonomy Report #1, cladistics is the systematic classification of groups of organisms on the basis of the order of their assumed divergence from ancestral species. (Also recall the former method was the Linnean classification process of grouping organisms by their visible similarities.) Therefore, scientists are more likely going to use the same divisional names as their resources, but change the groupings at the Family and Genus levels. On the internet, one can type in cladistics and conifer and find references with Divisions Coniferophyta, Pinophyta, Spermatophyta, and Gymnospermae!

Adding more confusion to the mix is a proposed formal set of rules governing phylogenetic nomenclature called The PhyloCode. It is designed to name the parts of the tree of life by explicit reference to phylogeny. The PhyloCode will go into operation in a few years, but the exact date has not yet been determined according to scientists at Ohio University4. How this relates to the existing nomenclature is also yet to be determined.

Why is there so much confusion and disagreement between scientists when it comes to classifying plants? The systems of classification of the plant kingdom vary because scientists are challenged with finding reliable fossil evidence, as there is in the case of animals, to establish the true evolutionary relationships of and distances between these groups. Furthermore, higher taxa and especially intermediate taxa are prone to revision as new information about relationships is discovered. It is imperative that extensive research is done to find accurate up-to-date information that supports the collector's choice for a Division and lower taxa to classify their plant specimen. That is, of course, unless the collector is satisfied with labeling their specimen a conifer or deciduous plant.

1 http://www.uwgb.edu/dutchs/EarthSC202Notes/FOSSILS.HTM
2 http://www.gpc.edu/~janderso/historic/labman/nclasslf.htm
3 http://www.absoluteastronomy.com/reference/gymnosperm
4 http://www.ohiou.edu/phylocode/

Tidwell, William D.; Common Fossil Plants of Western North America. Smithsonian Books, 1998, 2nd ed., 302 p.

Group suffixes

Taxa above the genus level are often given names derived from the Latin (or Latinized) stem of the type genus, plus a standard suffix. The suffixes used to form these names depend on the kingdom, and sometimes the phylum and class, as set out in the table below.

Rank	Plants	Algae	Fungi	Animals
Division/Phylum	-phyta		-mycota	
Subdivision/Subphylum	-phytina		-mycotina	
Class	-opsida	-phyceae	-mycetes	
Subclass	-idae	-phycidae	-mycetidae	
Superorder	-anae			
Order	-ales			
Suborder	-ineae			
Infraorder	-aria			
Superfamily	-acea			-oidea
Family	-aceae			-idae
Subfamily	-oideae			-inae
Tribe	-eae			-ini
Subtribe	-inae			-ina

NARG Paleo Kids

Heather's Amazing Discovery - A True Story of Paleontology

BY Deborah Griffiths
ILLUSTRATED BY Robert Lundquist AND Leah Pipe
WITH PHOTOGRAPHS BY Paul Bailey

This is the true story of an amazing discovery made by a girl named Heather. Heather lives on Vancouver Island on the coast of British Columbia.

When Heather awoke on the morning of her discovery, she had no idea that what she and her father would find that day would become known around the world.

Heather's discovery began like this…

One sunny morning, Heather and her father, Mike, decided to spend the day looking for fossils on the nearby Puntledge River. They packed up things they would need for their hike, and headed from home with their knapsacks full. They had hopes of finding something special that day.

Heather and Mike walked along the trail toward the site where they knew they might have luck finding fossils.

The winding trail followed the river. Tall fir, cedar and hemlock trees shaded them as they walked in the lush forest. Heather enjoyed fossil hunting with her dad.

On their first trip to the river, he had explained that fossils are the remains of plants and animals that lived many, many years ago.

Over the years the plants and animals had been covered by layers of sand and mud and had gradually turned to stone.

In the recent past, the force of the river had worn through these layers of stone to expose fossils from an 80 million year old ocean floor.

Each trip they made to the river was a journey back in time.

Some of the fossils they had found were ammonites, lobsters, sharks' teeth and shells.

They were the remains of animals that lived in the ocean at the same time dinosaurs had lived on land.

They finally reached the river, and Heather began to walk along the bank and search the ground for fossils. She began to daydream about how exciting it would be to discover…

Something larger and more mysterious than anything they had found yet...

Something ancient and extraordinary...

Something that lived in the ocean at the same time Tyrannosaurus rex, Triceratops and Pteranodon lived on land!

She wondered what it would be like to see these large animals living and breathing…

NARG Paleo Kids

Suddenly Heather's daydreaming was interrupted by something she noticed at her feet.

It was a rock as big as both her hands, standing out from the flat bed of shale. It looked different.

She kneeled down to take a closer look. It was the same grey color as the shale, but smooth and round.

"Dad! Dad!" she called to her father, who was downriver. "Come have a look at this!"

Mike called, "What did you find, Heather?"

"I don't know," she said. "This looks different from anything we've found before."

Mike knelt to have a closer look. He took a hammer and chisel out of his pack and carefully began removing the shale surrounding the stone.

Mike was very quiet as he worked. Heather had the feeling that this could be important. She wondered if they had found something that lived in the age of dinosaurs.

Finally, when she thought she couldn't wait any longer, Mike said, "Heather, I think we have a large bone. It could be a bone from a very large sea animal!"

There was more stone to be uncovered, and Heather waited impatiently as Mike worked. She listened to the hammer –clink, clink, clinking against the chisel – in tune with the sound of the river flowing over rocks and boulders.

As Mike finished with the stone he discovered another one next to it.

Heather watched in amazement as he uncovered another…and another…and another bone!

This was incredible!

They were all the same shape and size as the first one. For the next few hours Mike chiseled the rock surface while Heather helped clear the shale chips away.

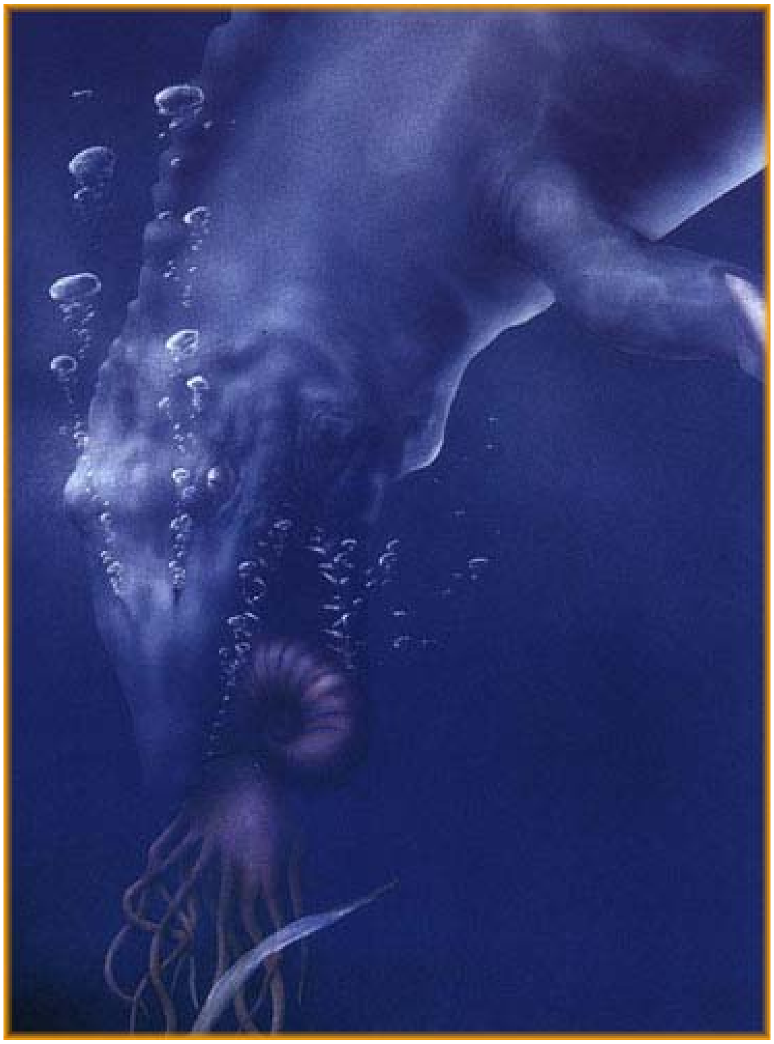
By the end of the afternoon they had uncovered twelve large bones lying next to each other in a row. It was certainly part of the spine of a large animal.

Tired from digging, Heather and Mike decided to return to the site in the morning to see if they could find more bones.

That night, Heather and Mike searched through books to delve further into the mystery of life 80 million years ago.

With each page that Heather turned she learned more about the fantastic creatures of long ago.

Tomorrow seemed like a year away as she tried to sleep that night. She couldn't wait to return to the river in the morning and see the bones again.



But, tired from the river hike, it wasn't long before she drifted off to sleep and began to dream…

What a dream! Heather was soaring through the air with animals from another time.

Swimming below her were mighty beasts of the ocean.

She dove beneath the water's surface and entered an ancient ocean world. There was a turtle, larger than Heather, that paddled through the water capturing fish in its sharp beak.

Even larger was the mosasaur. It looked like a giant sea crocodile, and whipped through the water searching for fish and ammonites to eat.

The elasmosaur was the largest of all. It used its long powerful neck and paddles to swim through the water, hunting for fish to swallow whole.

The next morning, Heather awoke and remembered her dream. Were the bones part of one of the sea creatures she had dreamed about? Could it be they had uncovered something so rare?

They packed up for another day at the river, and returned to the site of the discovery.

NARG Paleo Kids

Mike photographed the bones. In a notebook he wrote down the location and described what the bones looked like.

This would help scientists identify the animal.

Mike and Heather continued to dig for more bones, and by late that day they had uncovered eleven more. Now they had twenty-three in all. Heather was certain about one thing – this animal was incredibly long!

After studying the bones for several days, Mike decided to send some of them to a palaeontologist to have them identified.

He explained to Heather that a palaeontologist is a scientist who studies ancient life.

When the palaeontologist finished studying the bones, she returned them with a letter explaining

that they had found the remains of an 80 million year old elasmosaur, the long-necked swimmer of Heather's dream!

Heather would never forget her amazing discovery. The days she spent on the river with her father were always special – but the day they found the elasmosaur was the one to remember forever!

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Q: What do you get when you cross a dinosaur with fireworks?
A: DINOMITE!

Q: When can three giant dinosaurs get under an umbrella and not get wet?
A: When it's not raining!

Q: What's as big as a dinosaur but weighs nothing?
A: Her shadow!

Hungry? Make a batch of trilobite cookies

Stephen Greb - Kentucky Geological Survey

Trilobites (pronounced "TRY-low-bite") are extinct, hard-shelled marine animals that lived in the seas millions of years ago. They are called trilobites because they were divided into three parts.

Trilobites evolved at the beginning of the Paleozoic Era (over 500 million years ago) and went extinct during the late Permian period (248 million years ago). The Cambrian Period is known as "The Age of Trilobites." Trilobites were very common and very diverse; over 15,000 species of trilobites are known. Some trilobites crawled along the sea floor, some swam, and others drifted with ocean currents. The different trilobite species probably had different diets; some were herbivores (eating plants), some were detrivores (eating decayed material) and some were scavengers (eating carrion).

To make your tasty trilobite cookies, you will need:

1 bag of oval-shaped cookies. Cookies that do not already have icing work best. Several types of cookies can be used if you want to show variety.
1 bag (8 oz.) of semi-sweet chocolate pieces
1 cup of M ∓ M's ® (min-size works well) or other small, eye-shaped candies for eyes
Small microwave-safe bowl to melt chocolate in a microwave
Wax paper
Plates for cooling cookies
Preparation time:

About an hour and a half, but 40 minutes to an hour of that time is in the refrigerator so you can be doing other things

Recipe:

1. Lay out a sheet of wax paper on a plate.

2. Place chocolate pieces in a microwave-safe bowl and melt in the microwave, following package directions.

3. Take a cookie and place 1/3 to 1/6 of the long end of the cookie in the melted chocolate. This will be the back end or "pygidium" of your trilobite. It is not important that the front and back of the cookie be coated. If you want, you can just spread the melted chocolate on the top 1/3 to 1/6 of the cookie.

4. Carefully remove cookie and place on wax paper. Do this for as many cookies as you want to make, or until just less than half of the chocolate is gone, whichever comes first. Don't use up all the chocolate, you have another dipping to do.

5. Place cookies on wax paper, on plates, and put in the refrigerator. The chocolate should become solid in 15 to 25 minutes.

6. When the chocolate has cooled on one end of the cookies, you're ready for second dipping. Take the cookies out of the refrigerator.

7. Separate the cookies from the wax paper. You may want to trim cookies, with excess drippings.

Make a Batch of Trilobite Cookies....continued from previous page

8. Remelt the remaining chocolate.

9. Place a cookie that has already been dipped and cooled and place the other end in the chocolate. Be careful, because you'll be holding the chocolate end, and it may be slippery. Dip about 1/3 to 1/2 of the long end, so this end has a longer length of chocolate than the other end. This is the "cephalon" or head of your trilobite. Some trilobites had heads and tails of approximately equal proportions, whereas others had larger heads.

10. Place the cookie on second sheet of wax paper, on a second plate, for cooling.

11. Place two candies onto the "head part" of the chocolate-dipped cookie to make eyes.

12. Do the same for the rest of the cookies.

13. Place in the refrigerator and allow to cool, 15 to 20 minutes, and they're ready to be eaten.

"Trilobites evolved at the beginning of the Paleozoic Era (over 500 million years ago)"

Trilobite Facts

- Trilobites are a type of extinct arthropod.
- Tri-lob-ite means three-part-body in Latin.
- Trilobite bodies can be divided into three axial (long direction) lobes
- Trilobites can also be divided into three longitudinal parts (short direction); a head called the cephalon, an abdominal region called the thorax, and a tail region called the pygidium.
- Trilobites were covered with an exoskeleton.
- Trilobite's exoskeletons were segmented, and they could roll into balls for protection.
- Some trilobite exoskeletons were covered with spines and bumps for added protection.
- Like many modern arthropods, trilobites shed their exoskeleton and developed a new one as they grew. This process is called molting. Most fossil trilobites are actually fossil trilobite molts. This is why fragmentary fossils are so common.
- The largest trilobites were more than 70 cm long.

NARG's newest Advisor

Dr. Orr did undergraduate and graduate work at Univ of Okla. Univ of Calif. and at Mich. State Univ. and his PhD in 1966. In 1997 Dr. Orr retired from the U. of O. after 30 years they're teaching paleontology and oceanography and has been director of the state museum of paleontology (The Thomas Condon Collection) since 1982 and continue in that role in his retirement as a volunteer. Dr. Orr and his wife Elizabeth have written half dozen books on Oregon Paleontology, Oregon Geology, and Geology of the Pacific NW. The most recent book, which is an environmental history of Oregon's Water- use and abuse, came out Dec. 2005. From 1997 to 2005 Dr. Orr was on the Oregon State board of geologic examiners and is registered to practice geology as a professional in Oregon and Washington.

Dr. William Orr

Pacific NW Paleontology and Geology

About NARG

NARG is a non-profit organization, founded June, 2004. Our mission is to provide a forum for individuals who possess a passionate interest in fossils. In the Pacific NW, we are responsible for a wealth in fossil record. We document our findings and strive to improve communication for scientific contribution and public benefit.

Our goal is to develop an affiliation of fossil enthusiasts working together, to continue research, perform site investigation, have fun, and contribute to the growth and development of an active, premier group of vocational paleontologists.

Our belief: The total can be greater than the sum of its parts: By working together, we can create an informative, educational experience for a dynamic group of people. Our individual pursuits and interests will contribute and enhance scientific knowledge and the public record.

If your interests are research and exploration, collection or preparation, we welcome your participation and invite your enthusiasm!

NARG Membership

Membership dues are due by June 1. If you join between June and December, pay the full amount. If you join between January and May, pay half the amount.

Membership Dues: Individual: $25.00
Family/Couple: $40.00
Junior: $10.00

Guests are welcome and encouraged to attend NARG Meetings!

Current NARG Members:

Joe Pohl
Karen Letourneau
Gail Matthews
Michael Santino
Chuck Hunt
Larry Oblack
Gregory Keith
Joe Hendrix
Tiffany Jackson
Thomas Jackson
Rose Jackson
Tom Jackson
Robert Rose
Ted Silver
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Torrey Nyborg — Advisor
Dr. Jeff Myers — Advisor
Andrew Preinerberger
Dr. James Geodert — Advisor
James Martin — Advisor

NARG Meetings

Unless otherwise noted meetings are held on the first Wednesday of each month at the Rice Northwest Museum of Rocks and Minerals.
Board members meeting: 7:00PM - 7:30PM
Regular members meeting: 7:30PM - 9:00PM
Rice Northwest Museum of Rocks and Minerals

26385 NW Groveland Drive
Hillsboro, OR 97124
(503) 647-2418

NARG Meeting Topics

Meeting Speaker Topic
Feb 1, 06 Dr. William Orr
Mar 1, 06 Dr. Ellen Morris Bishop

Classifieds

Stonerose Interpretive Center:

Stonerose is the name of a fossil site, a place where impressions of plants, insects and fish that lived in and around a large lake nearly 50 million years ago can now be found in a large shale deposit. These fossils are the result of events that happened long before there were people to observe them.

Visitors to Republic can see examples of local fossils at the Stonerose Interpretive Center where if interested, they may purchase an admission sticker to hunt for fossils at the Stonerose Boot Hill fossil site. Visitors can bring their own tools (hammer and cold chisel) or they may rent them ($3.00 plus tax for the day) at the Center. All finds must be shown to the Curator or staff personnel. You may take home three fossil pieces per person per day. The Center's purpose is to further educational interests, to encourage scientific study and to preserve the fossils for public enjoyment. The Stonerose Interpretive Center reserves the right to retain any fossils that are of scientific value or significant to the Stonerose collection.

Classified Ad Rates
NARG Members: Free
Non-Members: $5.00 per issue

Size requirements
12 lines of type or a business card size (3.5" x 2")

Submissions
Please submit your ad verbiage and artwork to Jerry Rawdon at:

jrawdon@narg-online.com

Stonerose Interpretive Center is located at 15-1 N. Kean Street, on the corner of Kean Street and Highway 20 W., across from the city park in beautiful Republic, Washington. The fossil site is just a short walk from the Interpretive Center.

Hours of Operation
May 4-29 Wednesday-Sunday 10:00-5:00
Memorial Day to Labor Day Daily 10:00-5:00
Sept. 7 – Oct. 30 Wednesday-Sunday 10:00-5:00
Fossil Site Closes at 4:00

Fees to the Fossil Site
Per person admission fee: $5.00
Children under age of 6: free
6 - 18 years of age: $3.00
Senior Citizens (62+): $3.00.
Stonerose members: free

Q: What did dinosaurs have that no others animals ever had?
A: Baby dinosaurs!

Q: How many dinosaurs can fit in an empty box ?
A: One. After that, the box isn't empty anymore!

Q: What's the difference between dinosaurs and dragons?
A: Dinosaurs are still too young too smoke.

Q: What is a dinosaur that does rap?
A. A rap-tor.

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NARG Members: Free
Non-Members: $5.00 per issue
Size requirements
12 lines of type or a business card size (3.5" x 2")
Submissions
Please submit your ad verbiage and artwork to Jerry Rawdon at:
jrawdon@narg-online.com

With state-of-the-art tools and innovative techniques, the fossil technicians at RTBS Paleo Lab accomplish some of the most amazing fossil preparation seen in the world today. The lab's technicians are skillful and possess a high level of artistic ability, which is employed to exquisitely prepare fossil specimens.

For more information visit us as at: **www.rtbspaleolab.com**