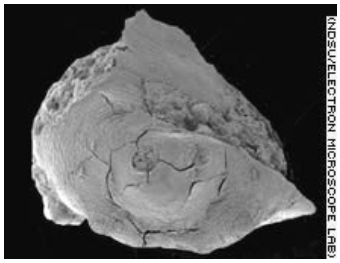
Scientists Surprised by Common House Fly Fossils in Antarctica



Electron microscope image of fossilized fly pupa (cocoon)
5 to 7.5 millimeters long, discovered on the Beardmore Glacier in Antarctica.
Photomicrograph 2003 courtesy University of North Dakota Electron Microscope Lab.

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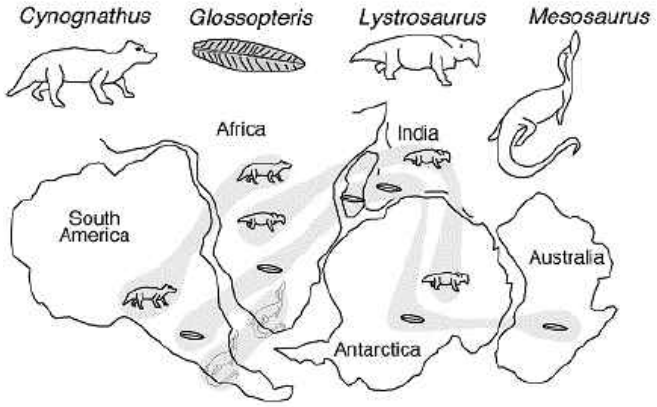
Earthfiles, news category.

May 30, 2003 Fargo, North Dakota - Earlier in May, the journal *Nature* published the discovery of common house fly fossils in Antarctica that surprised scientists and could re-write history about the now-ice continent, the evolution of flies, and cycles of global warming and cooling on Earth.

Geologist and paleontologist, Allan Ashworth, Professor and Chairman of the Dept. of Geosciences at North Dakota State University, lead a team into the Transantarctic Mountains only 300 miles from the South Pole. There, rocks are exposed from all the churning of glaciers over millions of years on the mountains. The scientists did not expect to find fossils of "higher flies," the *Cyclorrhapha* family, that include the modern day common house fly.

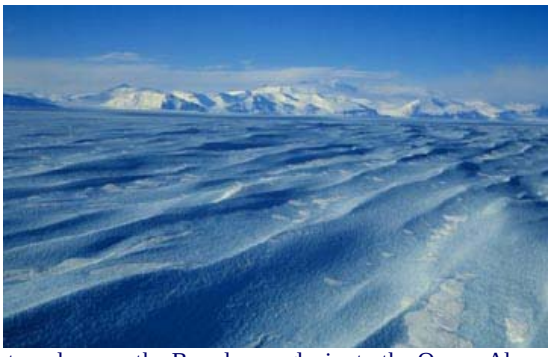
Beardmore glacier, Antarctica, looking south from the fossil site.
The mountains are part of the Dominion Range of the Transantarctic Mountains.
The polar plateau is on the horizon. Photograph © 2002 by Allan Ashworth.

At least 200 million years ago, continents were all one big land mass called Gonwanaland. Then big tectonic plate movements began and pushed the land masses apart into what we know today as continents. Were the flies, or their ancestors, on Gonwanaland when it split up? Or did the flies some how get to the Antarctic continent after the split?



Occurrences of unusual geological structures and of plant and animal fossils found on the matching coastlines of South America and Africa and their association with Antarctica and Australia, which are now widely separated by the Atlantic Ocean after the one large land mass, Gonwanaland, was split up at least 200 million years ago.

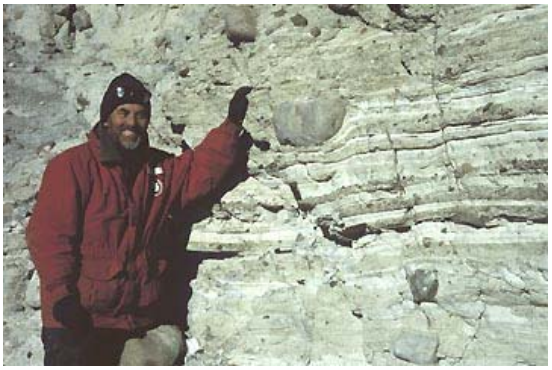
I asked Prof. Ashworth whether the fly fossils could be from a time when there was no ice at the South Pole or a time when there was a lot of ice?



Looking eastward across the Beardmore glacier to the Queen Alexandra Range. The rippled blue surface sculpted by wind looks like frozen waves. When the flies of the fossils inhabited this region millions of years ago, the Beardmore valley would have been a huge, ice-choked fjord. Photograph © 2002 by Allan Ashcroft.

Interview:

Allan Ashworth, Ph.D., Professor and Chairman, Dept. of Geosciences, North Dakota State University, Fargo, North Dakota: "Good question. We are working, it is the Trans-Antarctic Mountains which is an area of uplift. These mountains have been uplifted. As they uplift, the glaciers that flow from this great central area of Antarctica the polar plateau then are eroding down into those mountains. So along these great glaciers, the mountains and the rocks are all exposed in these polar deserts. As geologists, we can explore the edges of these glaciers and find the deposits of the ancient glaciers. That's basically what this sequence is, where we're getting these fossils out of. We can then collect the samples just as rocks. We're not actually drilling in ice. We're not doing that to collect the samples. We're like regular geologists, except we're on a very frozen landscape.



Prof. Ashworth in front of a section of Sirius Group deposits (similar type and age to those that the fossils came from) on Bennett Platform, Shackleton Glacier. Ashworth's hand is on a dropstone a boulder dropped from a melting iceberg. You can see how the boulder deformed the sediments when it landed on the lake or fjord floor. The layered nature of the deposits indicates that they were deposited in a glacial lake or a fjord.

We imagine the environment they lived in was tundra. There are things like shrub and form of a Southern Beech that only creeps along the ground a typical growth form of tundra environments. There are cushion plants which are another typical growth form of tundra environments. There are buttercups. They were like tundra meadows. This was the environment that this particular fly was living in. There had to be - the Beardmore Glacier today must have been a fiord at that time, a giant fiord that opened up from the Ross Sea all the way into the interior or Antarctica, more than 100 miles. It was a gigantic fiord and up this fiord then, these plants and animals including the fly, plus some beetles and some fresh water mollusks these animals or organisms had to be able to migrate up this fiord during this warm episode.

The question for us, for me as a paleontologist, is: Had these organisms then survived all the time from that very early time in Antarctica? Are these then the descendants from organisms that lived back at the time of the dinosaurs?

65 MILLION YEARS AGO.

Yes. And did they live in all that time around the edges of Antarctica? Or further inland?

HOW DO YOU THINK YOUR FLY FOSSIL WILL HELP YOU UNDERSTAND?

What it does do from the point of view of the evolution of organisms is that it tell us that this particular group of flies were present in Antarctica, whereas before it was believed that they weren't there. And so, it gives us an alternative ways of looking at fly evolution. We don't have enough evidence at the moment to say that these higher flies might even have evolved on Gonwanaland and then been taken to the Northern Hemisphere as the continents rafted apart in Gonwana. We don't have the evidence to do that, but it opens up the possibility that that could have happened.

COULD THE FLIES THAT YOU HAVE FOUND IN THE FOSSILS HAVE ACTUALLY BEEN BUZZING AROUND DINOSAURS AT SOME TIME?

Yeah. Yeah. Exactly.

IF SO, AND WE KNOW THERE WERE DINOSAUR FOSSILS IN ANTARCTICA, YOU ARE TRYING TO FILL IN THESE MISSING PIECES OF A PUZZLE THAT CAN GET UP TO ABOUT 30 MILLION YEARS AGO AND THEN BETWEEN 30 OR 33 MILLION AND 23 MILLION, THERE IS A KIND OF MYSTERY ABOUT WHAT HAPPENED IN THE EARTH'S CLIMATE. AND SINCE 23 MILLION YEARS AGO, IT IS SORT OF ACCEPTED THAT THERE HAS BEEN A GENERAL AND GRADUAL BUILD UP OF ICE THERE.

Yes, the picture of climate change over the last 65 million years there is a general cooling of the Earth's climate from the time of the dinosaurs at 65 million years ago. What happens then, is until about 34 million years ago, the climate oscillates in some pretty big swings going between warmer and cooler phases, but it was generally on the warmer side. And then right around 34 million years ago, there is this big decline in carbon dioxide. Then once again, after that, it goes into a more cooler phase of Earth's history leading up to the ice ages in there.

Did the fly, this organism, was it flying around? Or were its ancestors flying around at the time of the dinosaurs? And did they then as the climate oscillated, did they periodically move their distributions across Antarctica. Then as the

climate really started to cool down, were they forced to live just on the edges of Antarctica and have their habitats on the edges? Maybe in one of these late phases of warming in Antarctica was this fly able to migrate along with all these other organisms plants and animals up the fiords and reoccupy the interior of the continent again?

LEAVING THE GIGANTIC QUESTION: WHAT FORCED ALL THIS TO HAPPEN?

Yeah! What did? We just don't there are different hypotheses in there some involve tectonic changes on land and erosion of mountains, locking up then of carbon dioxide in rocks in the oceans so the oceans act as a sink for carbon dioxide, they then reduce the amount of carbon dioxide in the atmosphere which then leads to cooling. Once you get ice, you can have albido affects of the ice where you get reflection of heat back (into the atmosphere), so there is a feedback. There are all sorts of complicated events occurring that once you start the process going, you can imagine that you can get this type of cooling occurring.

IS IT FAIR TO SAY THAT PERHAPS THE EARTH NEVER HAD ICE CAPS PRIOR TO APPROXIMATELY 34 TO 23 MILLION YEARS AGO?

No. No. The Earth has undergone several glaciations and they go all the way back into what geologists call pre-Cambrian times, billions of years ago.

WILL YOU BE ABLE TO DATE THE FOSSIL OF YOUR FLY VERY PRECISELY?

Probably not. If we can get it within a million years, we would be extremely happy at this particular time.

WHY IS IT SO DIFFICULT TO GET A FINER AGE?

The type of deposits that these fossils occur in are the deposits associated with glaciers. We any organic material that's in there we think of ways to date more recent sediments, like we would use radio carbon dating. But radio carbon dating is only good back to about 40,000 years. These fossils are definitely in the order of millions of years old. So, we are beyond the capabilities of radio carbon dating.

Our best bet and we haven't been able to find it yet is to find volcanic ashes that would be included in these sediments, would be embedded in these sediments, so we might find a volcanic ash below the fossil-bearing beds or above it and then we could use the minerals that occur in the volcanic ash the feldspar we could use types of dating that are referred to as potassium-argon or argon-argon dating to give age estimates.

In that case, if we were able to do that, we probably could get within tens of thousands of years if we had access to the volcanic ashes. But so far, we haven't discovered any volcanic ashes at this particular locality.

HOW LONG WILL IT BE BEFORE YOU THINK YOU'VE GOT A PRETTY GOOD AGE?

I'd like to think that in a year's time, we would have a good age. But that's probably pretty optimistic. We're assuming at the moment that the age of this fly is going to come in somewhere between about 17 million and 3 million years ago. There's an outside chance it could be older.

Prof. Ashworth: "The fly fossil comes from siltstone containing other fossils and obvious pieces of *Nothofagus* wood . An age of 3 million years has been assigned to the deposits based on reworked marine diatoms. However, the age is controversial because some scientists feel that the diatoms could be windblown and a lot younger the deposits. The fossil fly and other fossils in the assemblage, including cushion plants that are 2 feet in diameter, are definitely not windblown. The organisms inhabited the head of a fjord and there fossils were brought together by meltwater stream processes of erosion and redeposition."

AND THAT THESE LITTLE FLIES THAT YOU NOW HAVE IN THE FOSSIL, THEY HAVE FLOWN AROUND IN ANTARCTICA AND NOBODY KNOWS FOR SURE EXACTLY HOW LONG. THEY AREN'T THERE NOW, THOUGH.

No. This type of fly is no longer present in Antarctica.

I'VE ALWAYS THOUGHT ONE OF THE HARDEST THINGS TO UNDERSTAND ABOUT THE EARTH IS IMAGINING A TIME WHEN THE POLES HAD NO ICE AND THEN THE CONDITION TODAY OF THREE MILES THICK ICE. HOW DOES THAT MACHINERY GET SET IN MOTION THAT SOMETHING CAN GO FROM TREES AND INSECTS AND OPEN LAND TO THREE MILES THICK OF ICE?

Yes, and I think you have to think in terms of you do! you have to think in terms of a very different Earth. We know then, for instance, in the Cretaceous period that sea floor spreading rates were a lot different than they are now. They seem to have been faster. You have to think more CO2 being in that atmosphere. But exactly what drives all those changes so we can understand the rhythms of climate change. We've got some clues. We know that the relationship of the Earth to the sun, the so-called Milankovitch cycles we know they are involved in the rhythm of ice ages. But what is changing these big values in CO2 is one of the great quests that climate scientists are trying to solve.

IT'S REALLY A MYSTERY.

It is a mystery.

THE FLY SORT OF SITS JUXTAPOSED AGAINST ALL THAT ICE AS A QUESTION WE HAVE ABOUT OURSELVES. HUMANS JUXTAPOSED AGAINST A POSSIBLE GLOBAL WARMING TREND, BUT AS YOU HAVE POINTED OUT, THERE HAVE BEEN SO MANY VARIABLE CYCLES OF WARMING AND COOLING THAT NOBODY UNDERSTANDS. COULD WE IN THE FUTURE BE FACED WITH ANOTHER GIGANTIC ICE AGE?

Oh, yeah. I think most scientists who work in my field, we work in this last part of geological time, we would argue that this last ice age we had was cyclical and that the ice ages, glaciation, seem to occur on cycles of about 100,000 years for at least the last million years. There's a change in frequency of them, but at any

rate, the bets would be from the majority of us that there is going to be another ice age."

Prof. Allan Ashworth in front of the Beardmore glacier just above the location that the fossils come from. The flat horizon on the right background is the edge of the Polar Plateau.
The mountain in the left background is Mt. Mills, Dominion Range. Transantarctic Mountains.

More Information:

Geologic Ages of Earth History

Cenozoic/ Holocene = Today

Cenozoic/Neogene/Miocene/Aquitanian = 23.3 million years ago

Antarctic Ice Sheet Seriously Began to Build Up = 34 million years ago

Cenozoic/Tertiary/Paleocene/Danian = 65 million years ago (End of dinosaurs)

Mesozoic/Cretaceous/Neocomian/Berriasian = 144.2 million years ago

Mesozoic/Cretaceous/Jurrasic/Lias = 205.7 million years ago

Mesozoic/Triassic/Scythian/Griesbachian = 248.2 million years ago

Paleozoic/Permian/Rotliegendes/Asselian = 290 million years ago (Dinosaurs emerge around 270)

Paleozoic/Carboniferous/Mississippian/Tournaisian/Hastarian = 362.5 million years ago

Paleozoic/Silurian/Llandovery/Rhuddanian = 439 million years ago

Paleozoic/Ordovician/Canadian/Tremadoc = 510 million years ago

Paleozoic/Cambrian/Caerfai/Tommotian = 570 million years ago

Sinian/Sturtian = 800 million years ago

Riphean/Burzyan = 1,650 million years ago

Hadean/Cryptic = 4,560 million years ago

Websites:

http://www.ndsu.nodak.edu/instruct/ashworth/antarcticimages/

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