EXPLORING AMBER WITH THE MICROSCOPE

Small fly in amber, 40x, stack of 15 pictures.

Amber has been called the *golden time machine*. It's the hardened, polymerized resin of prehistoric trees. The resin that oozed from the tree first became copal. It is not as hard as real amber and still contains volatile components, like oils, acids and aromatic compounds that give it its resinous smell. With time and depending on the soil it is buried in, copal eventually becomes totally polymerized, turns inert, and thus becomes amber.

Over the years, I have gathered a fair collection of amber and copal pieces containing various insects, spiders, and other inclusions. Most of these potential subjects are very small and require a lot of magnification to fill an image. While many shots can be made with a lot of extension (with a bellows or extension tubes between a macro lens and camera body), lighting can be difficult. With other specimens, the needed magnification makes it easier to use a microscope; on top of it lighting with the built in illumination and the microscope condenser becomes somewhat easier.

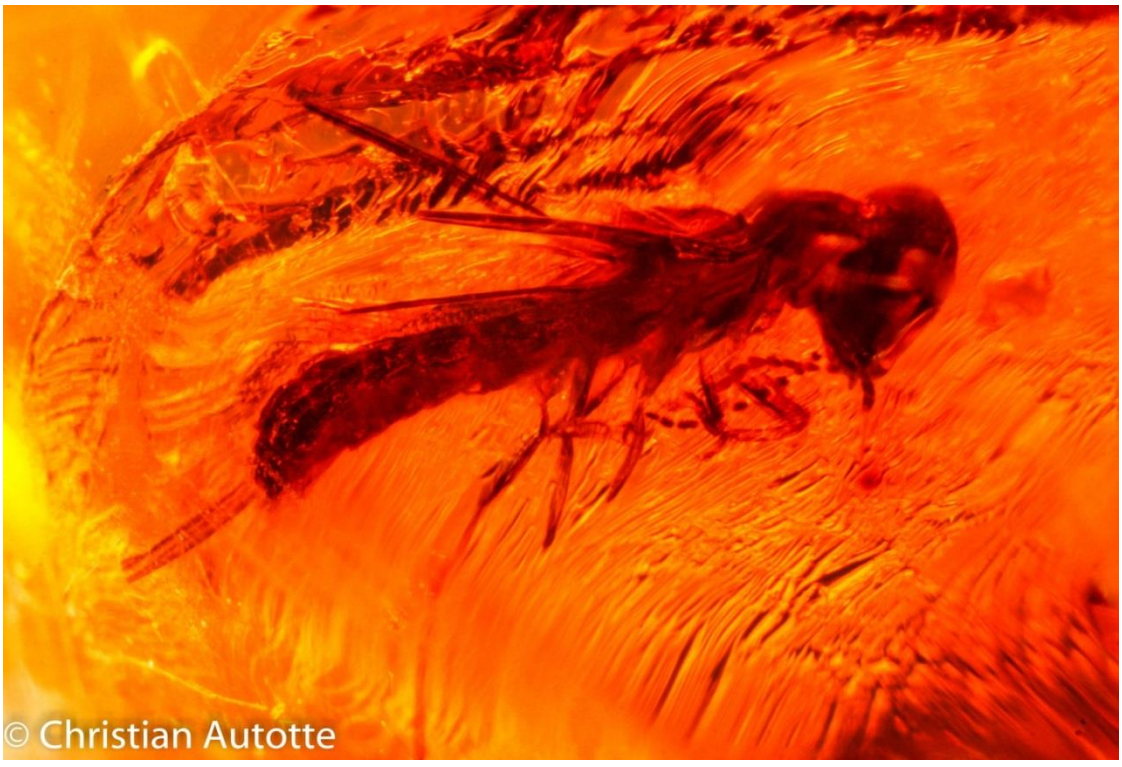
Thoroughly exploring any piece of amber with a standard microscope is not easy. The normal way of doing it is by hand-holding a piece under a binocular with a magnification between 10 and 30x. It is then possible to move it to better view a specimen embedded at an odd angle. It's also easy to raise the piece of amber up and down to explore its depth. So I always start my exploration with a binocular at about 10x.

Unidentified Insect, 40x, stack of 6 images.

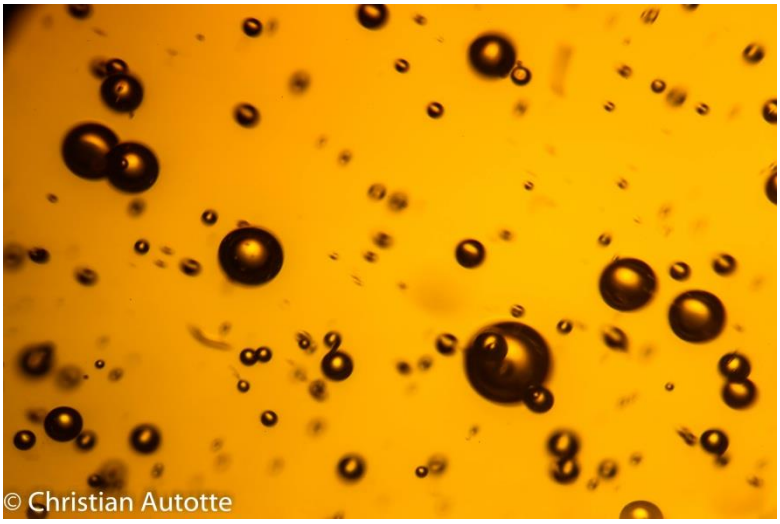
Once an interesting subject has been located, I move to the standard microscope. The piece of amber, which normally measure no more than 2 or 3 centimeters, is set on a microscope slide with a piece of modeling clay to keep the amber in the proper angle and to prevent it from rolling about on the slide. This is done under the binocular, so that the angle can be set before moving to the compound microscope.

I may have to move back and forth for a while to find what I spotted under the binocular, but the problem doesn't stop there. Not only does amber reduces the visibility of the subject being observed, but at times it makes may be impossible to use certain magnifications. As anyone who use compound microscopes should know, more powerful lenses will be ever closer to the preparation. If the insect is too deep in the piece of amber focusing on it becomes impossible. At times, I may flip the specimen over to try to reach it from the other side. In other situations I will resort to various photographic tricks to get the desired image size. For instance, I may switch from a full frame camera to one with a micro 4/3 sensor, which gives me an image with twice the apparent magnification. Going one step further, my micro 4/3 also offers the possibility of using a digital converter, which gives an extra 2x magnification of the image. As a last resort, it is always possible to crop an image to obtain a better composition.

The other problem is that my amber pieces are rounded, which can introduce distortions or limit the angle at which the subject can be observed. Consequently, I often do some focus stacking to increase depth of field and sharpness. Amber that is prepared specifically for scientific purpose is usually cut and polished differently: they are cut with square angles and polished with a flat surface, which makes study and photography much easier. I remember seeing a documentary about amber featuring the collection of the Natural History Museum; they have drawers upon drawers full of square amber pieces, each with one or more inclusion.



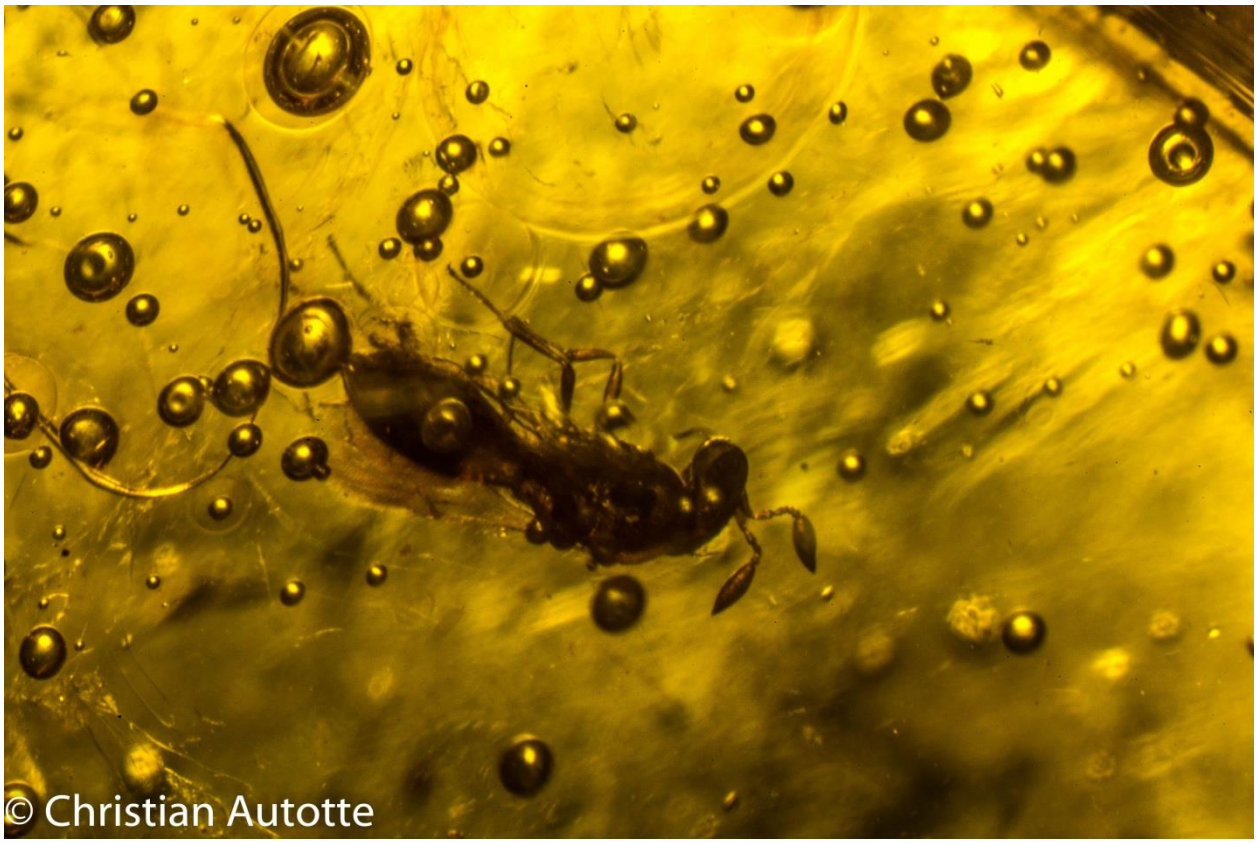
Hymenoptera, photographed with a 100 macro on bellows, about 5x.



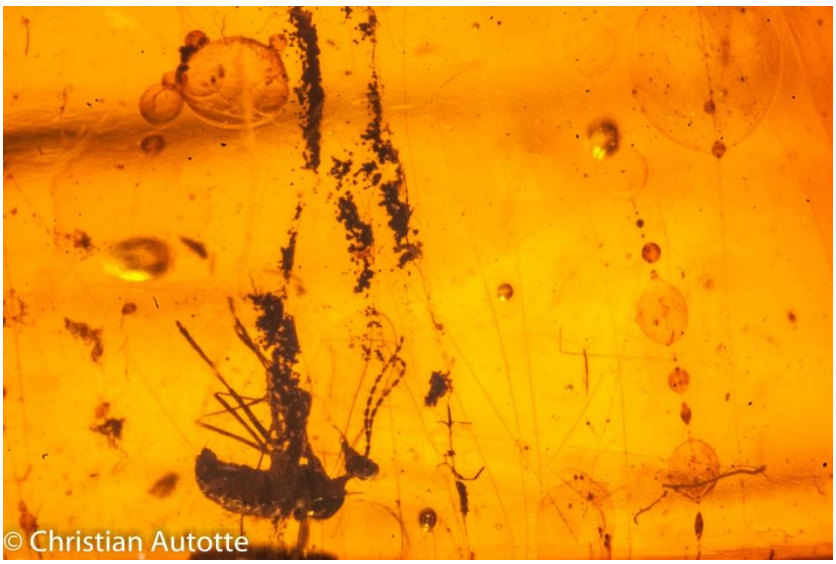
Air bubbles in amber, 40x.

Some inclusions are very common, air bubbles being one of them. In some pieces, they fill up the space, at times masking more interesting subjects. Nevertheless they can make interesting pictures. Air bubbles may have been trapped while the resin was flowing from the tree, but others were the result of gas produced by the decomposing organisms trapped in.

Air bubbles in amber, 40x



Hymenoptera and air bubbles, full frame camera and 65MPE lens, 5x.



Unidentified insect in spider web, 100 macro on bellows, magnification unknown.

Spider web, 40x

Look carefully at this insect. See its legs position. Look at what is above it. It looks like it was trapped in a spider web which got caught in the resin flow. To the right of it we see what looks like more web strands with water or glue bubbles.

While not the most abundant organisms found in amber, at least in my collection, spiders regularly got caught because they walked on the trees and could not fly away to escape incoming flow of resin. The spider seen below is just under the surface of copal; parts of its abdomen and cephalothorax have been eroded away. At right, a daddy-long-legs (Opiliones).

Spider in copal, 30x, stack of 22 pictures.

Daddy-long-legs, 100 macro on bellows.

Termite and air bubbles, 100 macro on bellows, about 4x.

The termite above is surrounded by air bubbles probably caused by its decomposition. I tried to look at it with higher magnification in an attempt to see some of its internal protozoan used in digesting wood; some have been found in the past. Unfortunately, my specimen seems to be too degraded to have kept any internal organs, let alone protozoans.

Other “exotic” subjects of my collection include a pill bug and a springtail. That last one was just discovered recently, even though this copal piece has been in my collection for years…

Pillbug at 30x, group of 4 pictures assembled as a panoramic

Springtail at 40x, slightly cropped, stack of 6 images.

Winged ant, 50mm macro on bellows, about 5x, stack of 7 images.

Ants are common subjects found in amber, but this one is special: it's a winged adult. There are many ants in my amber collection, but so far I have found no other interesting enough to photograph properly. Most of the time, the small insect is placed in such a way that the image is distorted by curves in the round piece of amber or hidden behind air bubbles.

Fairyfly, 40x.

Unidentified, 100 macro on bellows, about 5x.

Small flying insects are very common. Many of them may have been attracted by the sweet smell or got stuck simply by accident. Other insects came to the flowing resin deliberately. Like their modern counterparts, species of stingless bees used resin in their nest building and some of them were a little careless in their gathering.

Other species, like aphids and fungus gnats, were simply living on the resin producing tree, so it makes sense that many of them ended up stuck in the sticky flow.

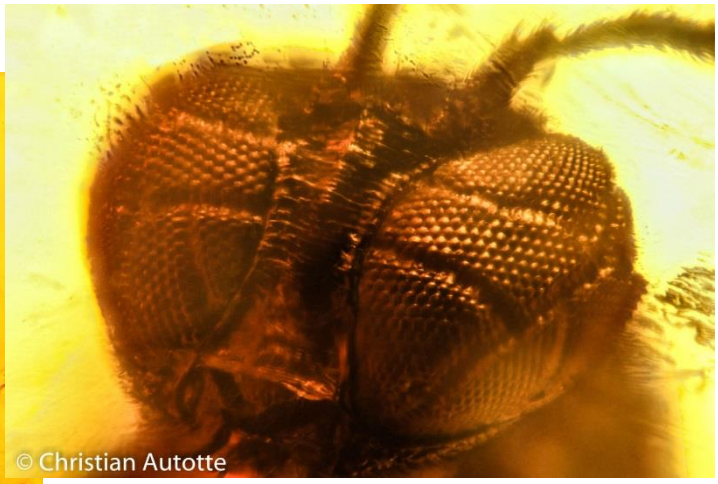
Unidentified, 40x, stack of 11 pictures.

Unidentified. 40x, stack of 11 pictures.

Sometimes, the amount of details visible is nothing short of astonishing. From small hairs on wings and legs to individual ommatidia on an insect's compound eye, a lot of anatomical details can be studied and recorded on the best specimens.

Details of wing, 100x, stack of 9 pictures.

Details of insect legs, 40x, stack of 9 pictures.

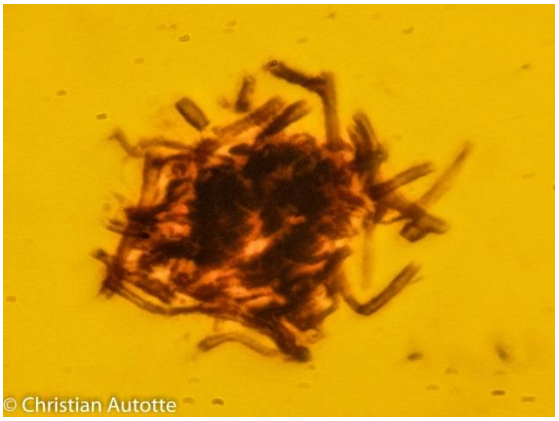


Close-up of the head at 40x, stack of 10 images.

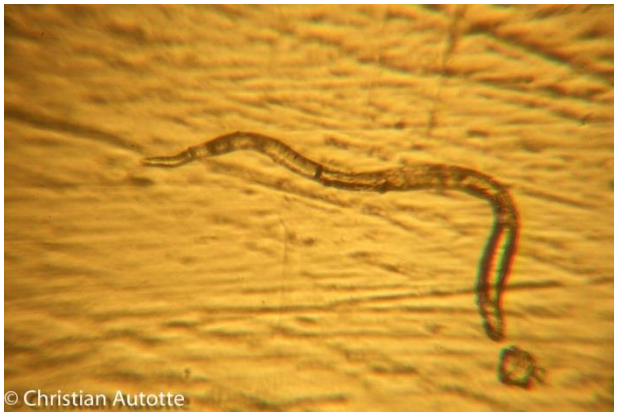
Insect head, 100 macro on bellows, about 5x.

Some things found in amber are very puzzling. Some masses I can't identify; they might be nothing more exotic than dust mote or some other debris that got caught in the resin while it was flowing off the tree. However, I am pretty sure that some others must be frass, insect dropping.

While exploring a piece at 40x I noticed something peculiar. At 100x it looks like a nematode. It is not the first mention of nematodes being found in amber, but it's the only one I saw in my collection. Now if I could find it again…



Frass or debris? 200x, stack of 11 pictures

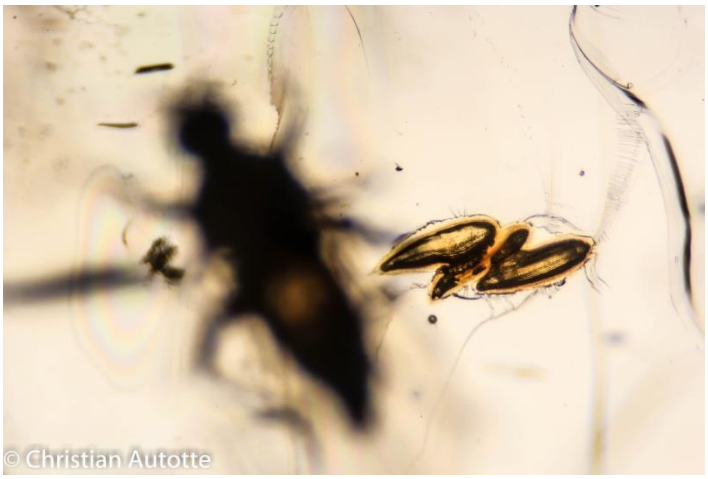


Nematode in amber, 100x, stack of 5 images.

Small piece of moss leaf, 40x.

Another piece of copal contains a fly that seems to have laid a few eggs before dying. It's a common occurrence for insects to lay a final clutch of eggs when the feel their end coming as many amber pieces have shown.

Fly in copal, 40x, stack of 8 shots.



Fly eggs, 40x.

Fungus gnat? 100 macro on bellows, about 5 x.

Chalcid Wasp, 100 macro on bellows, about 5x, stack of 5 images.

Unidentified, 100 on bellows, about 4x.

Fungus gnat? 40x, stack of 17 images.

Even if no more pieces of amber is added to my collection in the near future, I am convinced that there are many more surprises to be found in what is already at my disposal. Who knows, you may get to read about it in a future issue of Micscape…

Comments to the author Christian Autotte welcomed, email:
cautotte.9001 AT videotron DOT ca
Published in the April 2020 issue of Micscape magazine.
www.micscape.org