

## The Air We Breathe Today:

*Is It the Same as 400,000 Years Ago?*

### Project Presentation<sup>1</sup> — Text for teacher

#### The “Ice Core Project”: Drilling for carrots... of ice!

The average temperature of the Earth is 15°C. Today there is much discussion about “**global warming**”. Scientists think this **rise in temperatures is due to the “greenhouse gas effect”**. Even in the past climate specialists believed that the atmosphere might be getting warmer due to **Man's activities**. As you probably know, the greenhouse effect is a **natural phenomenon**, which provides the heat necessary for life on the earth; but during the last 150 years, in other words since the beginning of the **industrial revolution**, there has been a significant emission of greenhouse gases due to changes in our civilization and our way of life.

These gases are mainly **CO<sub>2</sub> (carbon dioxide) produced by burning fossil fuels, CO (carbon monoxide) emitted by the exhaust pipes of our cars, methane**, which is produced in rice plantations and in the stomachs of for example cows, and **increased water vapor**.

Today numerous scientists all over the world claim that by the year 2050, the average global temperature will have climbed from **15 to 20 degrees Centigrade**. This conclusion suggests that by the middle of the next century we will have witnessed **a rise of 5 degrees Centigrade** (*cf. exercise from booklet: Review of Tenses*)

But how did scientists manage to prove that the Earth was getting warmer? Well, they tried to find a way to determine that the composition of the atmosphere (**especially CO<sub>2</sub> and methane**) had changed over the last **400,000 years** and that the ratio of deuterium was also increasing. They believed these factors coincided with the rise in temperature.

So scientists went “drilling” for carrots in Antarctica. I mean carrots of ice. Contrary to the Arctic, which is a frozen sea, Antarctica is a continent. It is twice the size of the United States and accounts for 90 % of the world's ice and 68 % of its fresh water. This continent is the driest in the world, even drier than the Sahara desert, and received very little snowfall. However, there is an ice flow movement from the center towards the coast. The snowflakes that form are, of course, made up of pure water and not salty seawater. **So a tiny snowflake that falls in the middle of Antarctica will after more than a million years reach the coast and thus become part of a floating “freshwater” iceberg!**

Antarctica is a **huge refrigerator**, which has kept traces of the ancient atmosphere within its ice. This is because the snowflakes don't suddenly become ice. They are gradually compressed, and when the snow turns into ice, the ice entraps air bubbles, thus conserving some of the

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<sup>1</sup> For slides see file Global\_Warming.ppt

atmosphere that existed at the exact moment when the ice was formed. **The aim of scientists was to study the ancient atmosphere and compare it with the air we breathe today.**

So what did they do? They sent French and Russian engineers to Vostok a base in the middle of Antarctica, which is the coldest place in the world, and these engineers (thanks to French and Russian technology) drilled down to a depth of about 4,000 meters. Then they brought this ice back to a Lab in Grenoble. **Bringing the ice samples back to Grenoble in the French Alps was the easy part...before that they had to drill...**

So what did they do? They sent French and Russian engineers to Vostok a base in the middle of Antarctica, which is the coldest place in the world and these engineers (thanks to French and Russian technology) drilled down to a depth of about 4,000 meters; and they were able to bring this ice back to Grenoble. **Bringing the ice samples back to Grenoble in the French Alps was the easy part...before that they had to drill...**

Of course, it is very difficult and expensive to drill a deep hole with a 20 cm diameter, not only because the ice is in constant movement but also because the drilling itself is so difficult. First of all, you have to drill "**straight**" **using heat to melt the edges of the hole**. Second, you have to recuperate the ice and identify each part of the core. But French engineers are very intelligent! As are the Russians! The ice samples were brought back to France **and provided the climate specialists with an entire profile or cross section of the Antarctic ice cap**. At the Institute of Glaciology in Grenoble scientists analyzed the air bubbles that they had extracted from the ice. These bubbles had been formed through this compression of snowfall, and they represented the air that existed as long ago as 400,000 years.

After dating the ice by means of Carbon 14, scientists analyzed different parameters such as greenhouse gases, isotopes and especially deuterium. These measurements made it possible for them to determine the composition and temperature of the ancient atmosphere. The ice, therefore, became a "thermometer" of the past. Scientists can now rightly say that the warmer temperatures we are experiencing are not just part of a normal cycle determined by natural phenomena but are caused but our industrial and agricultural activities.

In conclusion, climate specialists and glaciologists have now proved that Man has changed the composition of the Earth's atmosphere more drastically than Nature has ever done before. So steps must be taken before the planet becomes too hot!

We thank the "Laboratoire de Glaciologie" in Grenoble for providing this information, and we thank **you, the audience**, for your attention.

*Written by Marianne Raynaud for classes at Grenoble University of Technology (INP-Grenoble).*

*N.B.*

*Speaking time: roughly 5 to 6 minutes, which is longer than the time allotted to the students—a teacher's privilege once in a while!*