

Professor finds new ice form

BY SHARON KOLBET

Heat it up and it becomes vapor, cool it down and you get ice.

But put water in a situation of extreme pressure and temperature and you get an unusual structure known as "Nebraska" ice.

In a paper published in the Nov. 30 edition of *Nature* journal, UNL Chemistry professor Xiao Cheng Zeng and Japanese chemists, Kenichiro Koga and Hideki Tanaka reported further developments with this new form of ice that is gaining international attention.

"I received an e-mail from Great Britain and Taiwan today. They were asking about 'Nebraska' ice," Zeng said.

The trio of chemists are receiving numerous inquiries about the frozen molecular structure because it is unlike any other ice previously known.

"We call it 'Nebraska' ice since the word Nebraska comes from the Otoe word for 'flat water,'" Zeng said. "This name is very appropriate since this ice is as flat as it can be."

Other types of crystalline ice have been found by other research facilities, but they all possess the expected three-dimensional structure. The ice discovered by Zeng and his colleagues differs significantly because it is two dimensional.

When the research team came

across the results in 1997 the findings were completely unexpected. Zeng said he was concerned he made a mistake, but after continuing the trials for nearly six months the researchers proved the results were correct.

Using a computer model, the researchers saw that the water was doing something unusual by forming crystals and shrinking instead of expanding. It is known that water, unlike most liquids, expands when it freezes. But Zeng and his colleagues found a situation where the molecules did the opposite.

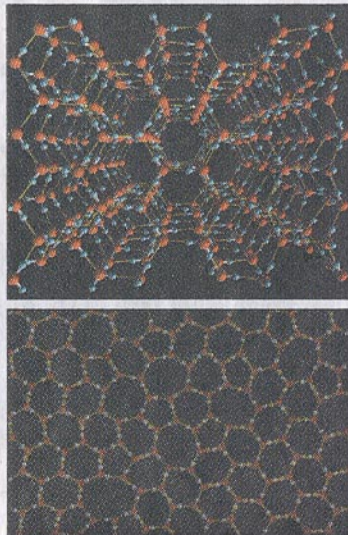
The discovery was made using extremes of temperature, pressure and confinement. There were 493 atmospheres of pressure at minus 40 degrees Celsius with the water molecules situated between two water repellent plates spaced one billionth of a meter apart.

Further work with this "Nebraska" ice has yielded even greater mysteries. The paper published in *Nature* details the latest twist in the "Nebraska" ice phenomenon.

After three years of work the research team produced a frozen water molecule that is not only two dimensional but also more closely resembles glass than ice.

"Normal ice is a crystal, it forms very ordered structures. "Nebraska" ice is amorphous like glass, it does not have a crystalline structure," Zeng said.

Kenichiro Koga of Fukuoka



Courtesy of X.C Zeng

Molecular models of "Nebraska" ice.

University in Japan was a postdoctoral researcher at UNL working with Zeng when they found "Nebraska" ice.

"We were very excited with our discovery," Koga said "No one had ever found ice like this before."

In regard to immediate applications, Koga said the finding could be useful for studying biological systems.

"The information is relevant in the study of cells. Within the human body there exists water between proteins and inside proteins. These findings may help scientists learn more about these biological systems."