A Passenger Through the Ice Ages:
Milutin Milankovitch (1879 – 1958)

by Milos Rastovic

One of the most difficult riddles in the history of Earth science is: what has caused the changes to the Earth’s climate since the Ice Ages? Milutin Milankovitch—a Serbian geophysicist, climatologist, astrophysicist, and mathematician—is best known in the history of science for postulating the most significant theory ever made for the cause of the Ice Ages. His theory relates to the long-term climate changes to the Earth’s orbital motion.

NASA, the United States National Aeronautics and Space Administration, has ranked Milankovitch among the 15 best scientists in history, those who have shaped our civilization.1 Peter Huybers, a professor of Earth and Planetary Sciences at Harvard University, tested many hypotheses about climate changes, and he confirmed the one proposed by Milankovitch. The astronomical or orbital rotation theory, the Milankovitch Theory of Climate Changes, states that slow changes and variations in the Earth’s orbit throughout history coincide with the periods of glaciations, the gradual melting away of glaciers, over the past 2 million years. According to Huybers:

“These periods of glaciation saw massive climate changes…We ought to understand what caused these massive changes in past climates if we are to predict long-term changes in future climates with any confidence. And at least now we know with greater than 99 percent confidence that interaction between obliquity [the changing angle] and precession [motion in the direction of the earth’s axis of rotation] are among the factors that contribute to deglaciation.”2

Through experimentation, Huybers tested ed the connection between the Earth’s orbital cycles and deglaciations. He constructed glacial cycles and added similar distortions to geological data, such as noise and errors in timing. He explained the results:

“At the same time we’re seeing high obliquity, we also tend to get an alignment with precession whenever deglaciation occurs…When you get that alignment, the radiation that the Northern Hemisphere receives during summer increases by tens of watts per meter squared, and if large Northern ice sheets are present, they tend to disintegrate. These statistical findings agree exactly with what Milutin Milankovitch [a Serbian geophysicist, proposed in the first half of the 20th century…It could also be that orbital forcing causes a rise in atmospheric CO2, and that’s the increased CO2 that drives the loss of ice sheets.”3

Milankovitch’s hypothesis concerning the causes of the Ice Ages is based upon claims made in the 19th century by French scientist Joseph Adhemar and Scottish scientist James Croll. Adhemar suggested that glaciation occurs when long winters coincide with the Earth’s aphelion, the farthest point in the Earth’s orbit around the Sun. Croll, however, proposed that glaciation occurs whenever the Earth’s aphelion coincides with times during the winter when the intensity of insolation, or solar radiation, is weakest.

In the journal Nature, Huybers with Mau reen E. Raymo, a Professor of Earth Sciences at Boston University, further described Milankovitch’s suggestion about the influence of the Earth’s orbit on the glaciation, or the times when the Earth is covered by glaciers:

“He [Milutin Milankovitch] argued that glaciation occurs when insolation [solar radiation] intensity is weak at high northern latitudes during summer. This happens when both Earth’s spin axis is less tilted with respect to the orbital plane and aphelion coincides with summer (not winter) in the Northern Hemisphere. According to Milankovitch[14], when there is less insolation during the summer, snow and ice persist through the year, gradually accumulating into an ice sheet.”4

While Huybers was the first to test the connection between the Earth’s orbital cycles and deglaciations, Milutin Milankovitch was the first to launch and mathematically prove this hypothesis in the first half of the 20th century.

Milankovitch’s theory claims that a dominant factor in Earth’s orbital motion around the Sun is cyclical variations and interaction between the Earth and the Sun. According to Milankovitch, there are three basic elements of these cyclical variations:

1. Earth’s eccentricity (departure from circularity) in which the Earth changes its circular orbit to the elliptical (a period of 105,000 years).
2. Obliquity – changes in the angle (axial tilt) with respect to the plane of the Earth’s orbit (a period of 41,000 years).
3. Precession through time -- changes in the direction of the Earth’s axis rotation (a period of 22,000 years).5

Milankovitch posited that these three elements of cyclic variations have an effect on the long-term climate changes, including the waxing and the waning of glacial cycles and the loss of ice sheets.

In 1914, when World War I broke out, Milankovitch was in his native Dalj on his honeymoon with his wife Kristina Topuzovic, an opera singer. The Austro-Hungarian authorities arrested him because he was a Serbian citizen, and he was put in a prison camp in Nezider. Milankovitch described his life in prison in this way:

“The heavy iron door closed behind me… I sat on my bed, looked around the room and started to take in my new social circumstances…In my hand luggage which I brought with me were my already printed or only started works on my cosmic problem; there was even some blank paper. I looked over my works, took my faithful ink pen and started to write and calculate… When after midnight I looked around in the room, I needed some time

3. Precession through time -- changes in the direction of the Earth’s axis rotation (a period of 22,000 years).
4. As quoted in Milankovitch Cycles. 
8. See http://en.wikipedia.org/wiki/Milutin_Milankovic
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Milutin Milankovitch (1879–1958)

When Milankovitch’s Professor, Eman-uel Czuber, from the Vienna Institute of Tecnical Science, discovered that a student was in prison, he immediately intervened. As a result, Milankovitch was sent to Budapest where he spent a great deal of time in the library. After World War I (1914 – 1918), Milankovitch returned to Belgrade and continued to work as a Professor at the University of Belgrade until his retirement in 1955.

In addition to his theory of climate change, he also made a major con-tribution to revising two of the most widely used calendars in the Western World – the Julian and the Gregori-an. In 1923, at a congress of all of the Eastern Orthodox churches held in Constantinople, Milankovitch proposed a revision of the old Julian and Gregorian calendars.

According to Milankovitch, in the next 900 years, seven leap years should be removed from the Julian calendar. In stead of the 225 leap years, which were in the old Julian calendar, there should be only 218 leap years, because every 128 years the Julian calendar delays for one day. He also found that the Gregorian calendar was not exact because it lost one day every 3,300 years.

For Milankovitch, leap years have to be divisible by four without a remainder. Secular years can be leap years if the number of their centuries is divided by four, with a remainder of two or six. As a re- sult, Milan continued from page 13

Milankovitch’s year is 365.2422 days, which is very close to the tropical year (a complete cycle of seasons of 365.24219 days).

The difference between Milankovitch’s findings and the tropical year is only two seconds per year. Or rather, in the next 43,200 years the difference will be only 218 leap years, because every 128 years the Julian calendar delays for one day. He also found that a smaller angle of the Earth’s axis means less seasonal differences. By contrast, a greater angle of the Earth’s axis means a warmer summer and cooler winter.

Unfortunately, Milankovitch Theory was neglected for more than 50 years until J. D. Hay, John Imbrie, and N. J. Shack-leton published a paper in 1976 in the journal Science. They found that Milan-kovitch Theory corresponded to the peri-ods of climate changes. As a result, the National Research Council of the U.S. National Academy of Sciences confirmed Milankovitch Theory in 1982.

By the beginning of World War II in 1941, Milankovitch was 63 years old. During the war, he published another autobiogra-phy – Recollection, Experiences and Vision, and the popular science history books Through Space and Centuries and Through the Realm of Science. About his scientific work, Milankovitch said:

“In my scientific vocation I have found a pleasant shelter, by which I was protected from much turbulence that shook the world. Under that roof I have prepared and equipped my scientific workshop, segregated from the wider world but in constant spiritual connection with famous scientists, I have created my scientific area, my indisputable spiritual property. In this workshop I have spent forty years including short breaks writing and pub-lishing my papers.”

After the war, Yugoslavia was under Communist regime. While Milankovitch’s only child, Vasko, immigrated to Austra lia, Milankovitch and his wife Kristina de-cided to stay in Yugoslavia.

Milankovitch was a member of the Serb ian Academy of Sciences and Arts, the Yugoslav Academy of Sciences and Arts, and the German Academy of Naturalists “Leopoldina” in Halle. In the recognition of Milankovitch’s contribution to science, the International Astronomical Union (IAU) named after Milankovitch a crater on the moon in 1970, a crater on Mars in 1973, and a main belt of asteroids, dis-covered in 1936 (1605 Milankovitch). Since 1993, the Milutin Milankovitch Medal has been awarded for contribu-tions in the field of climate by the Europe-an Geophysical Society.

Milankovitch died on December 12, 1958 in Belgrade, and was buried in Dalj. To-day, his house in Dalj is the Milutin Mi-lankovitch Cultural and Scientific Center, which promotes the legacy of Milankovitch by organizing cultural and scientific events, and by popularizing science.

Two international symposiums, one in 2004 and another in 2009, were orga-nized under the patronage of the United Nations Educational Scientific and Cul-tural Organization (UNESCO) in honor of Milankovitch’s scientific achievements. In 2012, because of Milankovitch’s great contribu-tion to science, the Serbian Na-tional Bank issued a bill with his image.

In 2012, Andre Berger of the Universi te de Catholique Louvain in Belgium, Fedor Mesinger of the Serbian Academy of Sciences and Arts, and Djordje Sijacki of the University of Belgrade edited a volume entitled Climate Change, a compilation of the papers presented at the 2009 international symposium honoring Milutin Milankovitch. In it, they wrote the following dedication to Milan-kovitch’s legacy:

“Thus, understanding paleoclimate, fol-lowing in the footsteps of Milankovitch not only adds to our basic knowledge of the history of the world we live in, but it also adds to our abilities to anticipate future climate changes as the emission of greenhouse gases by the increasing world population continues with little abatement in sight.”

Milankovitch’s son, Vasko, wrote the book The Memory of My Father, and, in it, described the character of his father in a very interesting way through a child-hood memory:

“Father was barely 57” tall (1.70 m) and of fine frame. He had a prominent fore-head and bushy brows over brown eyes which are always alert and quietly smil-ing. …He was not the bespectacled-pro-fessor-type of scientist as he enjoyed nature and loved all things aesthetically harmonious and maintained a constant interest in history, literature, painting and sculpture. …His love for abstract pleas-ures did not preclude him from earthy enjoyment. He enjoyed a glass of fine wine with his meals and would later re-lax with a favorite cigar. He often shared a good joke, and not necessarily a clean one, either.

Mother was the master of our family. Fa-ther would call her the “Home Secretary,” and always showed her great respect. He was the well-looked-after guest with no household duties.

He was popular with the ladies due to his excellent manners and because he was a good raconteur. His widely read book of popular astronomy, written in the form of letters to a lady friend, added to his popu-larity with women. What those ladies nev-er knew was that he really did not have a very high opinion of the fair sex. …He thought that they are less objective than men and with a nervous system more fragile. The real thread of larger problems somehow escape them. …In other words, he was a real male chauvinist!

I often recall an event of my youth…. Father and I were vacationing in Austria [where Vasko fractured his collar bone and was treated at the local hospital].

Later that afternoon and throughout dinner, father was very absent-minded...
HAPPY BIRTHDAY, YOUR HIGHNESS

BELGRADE - His Royal Highness Crown Prince Alexander celebrated his 72nd birthday on July 17 in the company of his immediate family. “Thanks to everyone who sent birthday cards and messages,” he said warmly.

As is customary, the Palace has released the annual film of the Prince’s activities for the past year. It’s available on YouTube and runs approximately 17 minutes; as visits throughout the world to promote Serbia and help its people. Search on YouTube: 17 July 2016 - 17 July 2017 - HRH Crown Prince Alexander. While there, you will also be able to subscribe to the Royal Serbian Channel and see many other film clips of Royal activity.

GEORGE MIRICH

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It is with great sadness we report the passing of a lifelong member of Holy Trinity Serbian Orthodox Church in Youngstown, Ohio, George Mirich, Jr. who fell asleep in our Lord Jesus Christ on June 20, 2017.

George was born October 12, 1941 in Lowellville, Ohio, one of six sons and seven daughters, to Pete and Mary (Brinsko) Mirich. He graduated from Lowellville High School in 1959, then sold life insurance for nine years for Mutual of Omaha. George also was the owner of GMHR, Inc., a spray-painting contractor for 35 years and was retired from General Motors Lordstown Fabricating Plant after 19-1/2 years.

For 45 years, George served on the Church Board, more than 20 years of those as its president. Through his leadership as chairman, the parish enjoyed continuous success at their Friday Night Fish Dinners. He really enjoyed working with people.

He was an officer in Serb National Federation Lodge #237 and a member of the Eastern Orthodox Men’s Society of Youngstown.

George is survived by his daughter Melanie Belich of Bridgeville, PA, sons George Mirich Jr., at home, and Louis Mirich of Youngstown; as well as grandchildren Jaden and Ilija Belich; several brothers, sisters, nieces and nephews. In addition to his parents, George was preceded in death by brothers John, Mike and Pete, Jr., and sister Marianne Berich.

Father Bosko Stojanovich offered a prayer service with the Holy Trinity Church Choir singing the responses. Funeral service was offered by His Grace Bishop Irinej, Reverend Fathers Bosko Stojanovich, Dragom Goronjic, Sava Medakovich, Golici and Sinsa Hravec. A daica took place at the Serbian memorial Hall prepared by the Circle of Serbian Sisters after the funeral.

George will be greatly missed but not ever forgotten. Memory eternal.

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DELIVERIES BENEFIT HEALTHCARE IN NIS

NIS, SERBIA – Last month Their Royal Highnesses Crown Prince Alexander and Crown Princess Katherine delivered a 3D mammography machine worth $300,000 to the Centre for Radiology at the Clinical Centre Nis. On the same day they presented a patient monitor worth more than $10,000 for the pediatric surgery and orthopedics unit there. These donations were by way of the Princess Katherine Foundation in cooperation with the American company Hologic, Inc., and Lifeline New York. The Royals were accompanied Kyle Scott, Ambassador of the United States of America to Serbia and Momcilo Miric of Hologic.

“...The Foundation donated a mobile mammography to the Clinical Centre Nis in 2009 and to this day it has examined more than 100,000 women,” said Her Highness. “I am happy that the American company Hologic has realized how much (we are) fighting to prevent breast cancer and has donated this $300,000 mammography machine.

The Crown Princess Katherine Foundation has been advocating breast cancer prevention since its founding. This is the fifth mammography machine delivered to improve the conditions of diagnosis and treatment. Helping children’s hospitals is also a priority for the Foundation’s work.

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