

Unique collaboration reveals mummy's face after 2,200 years



For over two millennia she remained hidden beneath layers of linen bandages. Yet, without ever disturbing the wrapping, a unique collaboration involving the University of Western Ontario and other partners has revealed an accurate 3-D picture of this woman who died 2,200 years ago.

In the 1940s the Sulman, or Chatham Mummy, named Cleo by the researchers studying her, was donated to the Chatham-Kent Museum. Thanks to a collaboration between scientists and a local artist, forensic facial reconstruction has been done without ever touching the skull - for the first time ever in North America.

The work, led by Western's Dr. Andrew Nelson, Associate Professor of Anthropology, involved digital data from CT scans combined with a

laser 3-D virtual imaging technology to create the best view of the Egyptian mummy without disturbing the wrapping.

The virtual image of the skull was transformed into a physical model using cutting edge 3-D printing processes, normally used to design machine parts and products, to grow a plaster replica layer by layer.

Using the skull and forensic reconstruction techniques, London-based artist Christian Cardell Corbet was able to recreate her facial features, which he believes is a 90 percent accurate depiction of what she looked like when she was alive.

The amazing results were officially revealed at a press conference at the Chatham-Kent Museum on January 16.

The digital image can now be manipulated in a variety of ways for research and education; for example, using the data in a virtual reality CAVE environment, researchers can "travel" under the wrappings of the mummy, viewing at will every aspect from any angle.

Dr. Nelson notes this approach not only allows researchers to learn all they can about artifacts such as these, but also preserves them for future study.

"If we were to unwrap the mummy to get a better look at the skin, tissue, bones and so on, the process would be inherently destructive," he said. "If, ten years from now, other researchers or students want to look for something that we might have missed, they're out of luck. The evidence would have been destroyed.

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Reaching into the data through broadband



What will it take for future researchers, educators and students to access and maximize their use of the data created by the Sulman Mummy project?

For the Sulman Mummy research team, that meant taking over 2GB of CT Scan data and laser mapping data and combining them into 3-D models that were suitable for viewing in virtual environments such as a CAVE (Computer Aided Virtual Environment). Once this information gets uploaded to a server connected to an ultra high-speed network capable of at least 100 MB per second, such as ORION, all a remote user needs is the software to manipulate the images in real time.

"Bandwidth of 100 MB would be ideal using software such as SGI's Vizserver to visualize the mummy over the Internet," said Niall Murray, Systems Manager at the National Research Council's Virtual Environment Technology Centre at the Integrated Manufacturing Technologies Institute (IMTI). Vizserver is an example of software used for high-performance large data set visualization and multi-site network collaboration.

"It only stands to reason that if you could get other artifacts processed in the way we did with the mummy, than research could be done simultaneously over great distances by viewing the information and manipulating the image from remote locations," added Gian Vascotto, Director of Systems Simulation and Control Research at IMTI.

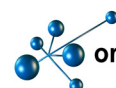
Both Murray and Vascotto see possibilities that go beyond archeology into possible uses as a medical diagnostic tool.

"For example, if a person has a condition that requires a CT scan and there's an expert some distance away that needs to see the CT scan results, with broadband the expert won't have to settle for just a couple of the most relevant cross-section slices on slides as determined by the radiologist," explains Murray. "With a broadband connection, that expert can sit at a remote workstation and manipulate three-dimensional data in real time or even view the CT-scan in real time. It puts a whole new meaning on analyzing a patient's condition." In the same vein, Vascotto added that virtual 3-D can also be used by museums, schools and research facilities to bring interactive video displays on demand to revolutionize distance education and research.

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The ORION Research and Discovery News is a monthly electronic publication providing news and information of interest to users of the Ontario Research and Innovation Optical Network and to the worldwide research and education community.



Canada's first student-designed solar array now live at Waterloo



In what is the first student-designed solar array on a university campus in Canada, solar energy is now being harnessed through a 36-panel array of photovoltaic (PV) solar panels to produce clean, free electricity at the University of Waterloo's Federation Hall.

The solar array, capable of generating electricity for 30 to 50 years or more, was unveiled on January 22. The event, which attracted as many as 80 enthusiastic supporters, including the Mayor of Waterloo Herb Epp, was a celebration for the Solar Technology Education Project (STEP), a student-led volunteer team at the University.

The array uses cutting-edge technology called "grid-tieing." The electricity produced is fed into Federation Hall's electrical panel. Surplus power is directed to the university's utility grid and used elsewhere on campus. In addition to electricity production, the array will prevent more than 1,200 kg of carbon dioxide a year from polluting the air by avoiding the burning of fossil fuels. "We aimed to highlight the role of renewable energies and energy efficiency as powerful solutions to climate change," says Jeff DeLoyde, S.T.E.P. director and fourth-year environmental engineering student.

The S.T.E.P. project started in January 2002 and has since involved more than 75 volunteers and raised more than \$40,000 from 22 sponsors including UW groups and businesses. "A project of this magnitude cannot be done without the support of many people," DeLoyde tells ORION, noting that at least 150 people assisted with the project in some way, including volunteers, professors, UW staff, contractors, media, and others.

"Everyone was pleased with the final product and we're already talking about other solar projects on campus. Renewable energy projects on campus have gained momentum and many are eager for the start of STEP phase 2," he said.

"We aimed to highlight the role of renewable energies and energy efficiency as powerful solutions to climate change."

This could include the largest PV array on a university in Canada (50 kW), a solar hot water system for UW's Physical Activity Centre PAC, and a solar sculpture, involving a globe where the oceans are made up of PV, which moves when the sun is out.

The team has also been approached to work on a new engineering building, and exploring the possibility of including PV, solar hot water, green roofs, passive solar technology, as well as a solar tracking system. "STEP will continue with the education component using the Fed Hall solar array. We will do seminars, workshops, and visiting local elementary schools to do presentations. We also plan to incorporate the array performance in an online, real-time monitoring system."

DeLoyde anticipates the team will seek to collaborate with new partners for large-scale projects. The team also plans to approach the federal and provincial governments for support for future projects. "We will continue to approach local and regional business sponsors to expand our sphere of impact," he said.

The project is only one piece of the solar boom that is taking place in Waterloo Region in which Waterloo will be the site of Canada's first solar neighbourhood. ARISE Technologies Corp. of Kitchener is working with Cook Homes to build new houses in the Eastbridge area with integrated PV systems. The City of Waterloo recently installed a solar array at city hall as a solar energy pilot project. Spherical Solar of Cambridge is developing a new solar cell that will use less silicon, thereby bringing the cost down to competitive levels. All of these initiatives complement the region's Clean Air Plan, which aims in part to improve poor air quality by pursuing initiatives such as public transit and renewable energy projects.

For information on the project, visit the team's web site, at www.STEP.uwaterloo.ca. A photo gallery of the event is located at www.graphics.uwaterloo.ca/content/photo/web_gallery.html

Unique collaboration ...

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This way, we are using cutting-edge technology to maximize the information we can extract from this artifact while, at the same time, preserving it for future generations."

This project and its accomplishments were the product of a multi-disciplinary collaboration between research and education institutions in London and Mississauga.

In addition to expertise from Western's Bioarchaeological Research Facility and the Robarts Research Institute, St. Joseph's Health Care made the CT scans of the mummy and the National Research Council's Virtual Environment Technologies Center at the Integrated Manufacturing Technologies Institute made laser scans and rendered the virtual data. Drafting Clinic Canada Ltd. in Mississauga transformed the virtual data of the skull into a physical model.

This project involved the type of collaboration and sharing of large volumes of data that is well suited to on-line collaboration over a high-speed network, such as ORION.

In fact, Western, St. Joseph's and the Robarts Institute have all been connected to ORION since August through ORION's Pop in London at LARG*net, the area's regional advanced network.

Nelson says he can already see ORION's potential for research. "In addition to the tremendous collaborative spirit of everyone involved, we were very fortunate to have a concentration of resources in Southwestern Ontario to draw on for this project," Nelson remarked.

"But what if your resources are scattered? For example, if you want to study human evolution and you want to see everything, then you have to go to South Africa, Kenya, all through Europe, Asia...you have to go everywhere. But if you could have all the material scanned and available in 3-D, virtually, via broadband Internet, then the potential for collaborative research and education just goes through the roof.

"Consider the resource we've created with our work on this Egyptian mummy," continued Nelson, "if you were a teacher doing a unit on ancient Egypt and you were able to reach in through broadband from a remote location and manipulate the images of this mummy in three dimensions, just think of the potential for grabbing your students' interest.

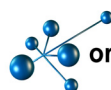
Referring to the recent looting of the Baghdad museum, Nelson lamented that we have lost a great deal of our ability to learn more about ourselves from past civilizations. "In much the same way we preserved the Sulman mummy, if there was an archive of all those artifacts before they were stolen, at least we would still have a virtual representation available for future research."

Links to more information:

Information on the Sulman Mummy Project:
http://hal.ssc.uwo.ca/media/release_3/index.htm

Christian Cardell Corbet's project page:
<http://members.rogers.com/christiancardellcorbet/>

"Daily Planet" episode on the project:
<http://www.exn.ca/video/?video=exn20030507-mummy.axs>



Cold temperature study looks at particle transport



While most of Canada hunkers down during a particularly nasty stretch of winter and many make plans for a warm-weather getaway, at least one researcher recreates and studies her own arctic blast conditions, all in the name of science.

Dr. Cheryl McKenna Neuman of Trent's University's Geography department, conducting a study on particle transport in cold climates, needs to work with Trent's unique wind tunnel in Peterborough, chilled down to -15 degrees Celsius.

The thermometer reading is what makes this study unique, Prof. McKenna Neuman says, explaining that most particle (soil, dirt, dust) transport research has been carried out in warm regions.

"We have the international distinction of doing cold-air transport simulation," she says, adding most people don't realize that some of the windiest places on earth are found in cold regions.

Although wind tunnel studies of this type are usually applied to soil erosion problems in hot deserts, the cold-temperature tests carried out at Trent extend our knowledge to earth's polar

regions, including Antarctica, and in a planetary sense, to Mars.

Prof. McKenna Neuman has recently published two journal articles that examine the physical transport of particles at cold temperatures in *Sedimentology and Boundary-Layer Meteorology*.

More recently, Prof. McKenna Neuman and her students escaped from the cold to work on beaches along the north shore of Lake Ontario to develop improved techniques for measuring the impact of soil moisture on erosion.

These highly customized tunnels are rare even on an international basis.

The results from this field work, which parallels ongoing wind tunnel simulations at Trent, were presented at the Canadian Coastal Conference in October 2003.

The remote sensing techniques developed in this work offer important improvements that will allow researchers to examine sediment transport processes over much longer time periods and distances.

While clean air wind tunnels are traditionally employed in engineering departments to examine wind stress on structures, for example, Trent's tunnel is one of only two sediment transport tunnels in Canada.

Recently Prof. McKenna Neuman was consulted on the design and construction of a new sediment transport tunnel to be set up in Spain. Engineers from the company responsible for building the tunnel spent time at Trent and have used it as an archetype.

A recent addition to the tunnel is a constant temperature anemometer system that will allow Trent to foray into turbulence research. The equipment was purchased with a 2003 NSERC equipment grant of \$97,000.

Over the next several years, the Trent wind tunnel facility will collaborate in a coordinated international study of sediment transport dynamics, which will include water flumes and wave tanks.

To learn more about Prof. McKenna Neuman's research, consult her web page at <http://www.trentu.ca/geography/CMNfrontpageExpl.html>



Video conferences over ORION now "normal course of business"



Using ORION to link participants in virtual space from multiple locations in a region the size of France has now become the norm, for the Northern Ontario Medical School (NOMS).

The next NOMS video conference, on inter-professional education, will link Lakehead University in Thunder Bay and Laurentian University in Sudbury - a distance of 990 kilometres along ORION's fibre route, through 11 signal regeneration stations.

"Learning Together: The First NOMS Workshop on Inter-Professional Education," will be held February 6 on the Lakehead University campus, while the Sudbury group will participate via videoconference over the ORION link-up.

"NOMS video conferences over ORION as a normal course of business, and we have enjoyed the great performance benefit over using ISDN connections," said Kevin Pashuk, the NOMS' Director of Technology.

"The ORION network is a key component in the delivery of events such as this workshop. This event is one of many that the School is presenting using technology such as ORION," he said.

Those not participating in the video conference will be able to view streamed portions of the conference from most Internet capable computers.

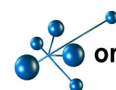
This full-day workshop will focus on ensuring that the School's curriculum follows an inter-professional approach. It is expected to draw participants in all areas of inter-professional education, including academics, health professionals, alternative practitioners, traditional healers and elders. Guest speaker, Dr. Karen V. Mann, will also facilitate the session. Dr. Mann is a Professor in the Faculty of Medicine and Director of the Division of Medical Education at Dalhousie University.

The Northern Ontario Medical School (NOMS) is a joint venture partnership of

Laurentian University, Sudbury and Lakehead University, Thunder Bay. With main campuses in Thunder Bay and Sudbury, the School will have multiple teaching and research sites distributed across Northern Ontario, in large and small communities.

The NOMS partnership serves an area the size of France, and ORION's ability to transmit multiple streams of massive amounts of data between NOMS partners is key to overcoming the great distances separating them.

Connectivity over the ORION network contributes to the School's success in many areas. Beyond advanced video conference capabilities, NOMS is looking to ORION's capabilities for collaborative research in biomedical, clinical, public health, population health, epidemiological, psychological and social sciences, health services, and educational research, including remote access to Magnetic Resonance Imaging (MRI) facilities and exploring virtual reality environments.





ORION News Briefs

Soo PoP connected

Work on the ORION PoP in Sault Ste. Marie will be completed this week. Users, including Sault College, will now be able to connect to the network, says ORION Project Director Sam Mokbel. The network node is among the last to connect to the ORION backbone. Although the network equipment had already been installed and tested, the remaining portion of the work, which involved installation of equipment at several of the repeater stations along the network route, has now been completed. The Timmins PoP is the last node on the network to be connected and Mokbel expects work to be completed within weeks.

New traffic maps show growing ORION use

ORION's new online traffic map is giving a first-hand look at the growing volume of ORION's production traffic. The new map, accessible now on ORION's web site, allows the viewer to examine current, daily, weekly and yearly traffic at each PoP specific institution. The maps reveal growing traffic on the network as more institutions get connected.

The new tool, designed and developed by ORION's Technical Support Specialist Tyson Vickers, offers regional views of the production traffic, with several options for consulting specific aspects of the traffic. "The maps give us an immediate, detailed look at the network, in a format that is intuitive," he said. "This type of reporting is crucial to understanding the flow of data throughout the network, in order to predict and respond to change in a proactive way." "I like it a lot," says Roger Watt, Group Director, Systems at the University of Waterloo. "It is an elegant way to portray that information." Bill St. Arnaud, CANARIE's Senior Director, Advanced Networks is also impressed with the new resource. "It's excellent," he said. "It will be very helpful for ORION users to diagnose problems and see traffic trends on the network." The maps can be viewed on the ORION Technical Page at <http://tech.orion.on.ca/>

ORION offers IP Multicast capability

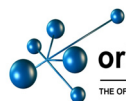
ORION is also now offering multicast service to its users. Multicast is now enabled on ORION border and distribution routers, says ORION's Senior IP Engineer, Shahid Ajaz. Multicast allows the broadcast of data from one location to multiple sites, while conserving bandwidth. This will enable ORION-connected institutions to use multicast for video conferencing and distance learning.

ORION signs Internet peering agreements

ORION has signed several peering agreements with a number of Internet providers to provide better connectivity between ORION users and the companies' customers. ORION, which has a one-gigabit Ethernet to the Toronto Internet Exchange (TORIX), has negotiated a number of agreements, which provide for the interconnection of, and exchange of network traffic with other providers. "That's good news for institutions hoping to connect to ORION, and it increases the value proposition for our network," says Randy Neals, Senior Manager of Strategic Partnerships. ORION currently has agreements with up to 20 ISPs.

New incentive to sign-up for Internet

Cogent, one of ORION's Internet suppliers is offering a "first month free" incentive program for ORION-connected institutions that sign up for 100Mb service before Feb 27 2004. Cogent pricing is \$1,000 per month for each 100Mb of bandwidth. ORION users with a VLAN connection are able to connect directly to commercial Internet providers of their choice, giving them access to a highly competitive Internet marketplace. Cogent and Telus were selected as the transit providers for the ORION Shared Internet Service, following an RFP for Internet Transit.



orion research and discovery news

THE OFFICIAL NEWSLETTER OF THE ONTARIO RESEARCH AND INNOVATION OPTICAL NETWORK

ORION is an advanced high-speed fibre optic network that connects research and education institutions to each other and to colleagues around the world. Spanning 3,700-kilometre to 21 cities throughout the Province of Ontario, ORION was created to bring leading-edge network capability to Ontario's publicly funded R&E community and to become a catalyst for creative and innovative next generation Internet applications.

For more information

ORION is owned and operated by the Optical Regional Advanced Network of Ontario (ORANO). For more information, visit our web site at <http://www.orion.on.ca>. Communicate directly with the Editor of the ORION Newsletter at info@orano.on.ca.

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ORION - CA*net 4 Days

Most Ontario colleges and universities are now connecting to the ORION network -- one of the world's most advanced R&E networks dedicated exclusively to research and education.

*ORION and CANARIE have teamed up to host ORION-CA*net 4 Days throughout Ontario. Over 300 researchers and educators have participated in these workshops and presentations from leaders in advanced networking and collaborative technologies.*

Events have been held in Windsor, Ottawa, Sudbury, Toronto, Hamilton and London. More are planned, including events in Kingston and Waterloo.

*Visit the ORION - CA*net 4 Days Archive of presentations and papers and consult our schedule of future events.*

www.orion.on.ca/orioncanet4days

For more information, e-mail us at
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