

# human origins

Investigating our evolutionary beginnings

## Don's message



photo by Tom Story

### Don's new book

Don Johanson's recently completed book co-authored with Kate Wong, writer and editor at Scientific American, is due to hit the shelves in March. "Lucy's Legacy: The Quest for Human Origins" picks up where Johanson's previous work, "Lucy: The Beginnings of Humankind," left off, exploring the latest thinking on human species evolution and the current state of paleoanthropology.

As I sit here in Cape Town, South Africa, with Table Mountain as a backdrop, I am humbled by how far we have come together. And, I am energized by the major new insights into our distant past that are being made at an astonishing pace, across the globe. Public interest in human origins has never been higher.

The Institute of Human Origins is uniquely poised to make enormous strides in our ability to achieve our ever-expanding scholarly agenda of understanding human origins. Our robust and highly visible bio-behavioral field research program has expanded in size and quality and attracts exceptional postdoctoral

research associates and graduate students. The guidance and generosity of our Board of Directors and members are unmatched. Our travel programs are wildly successful (read more on page 4). In short, we are flourishing as one of the most vital research centers at Arizona State University.

I am also pleased to report steady progress in our efforts to identify a suitable space to cluster all of IHO's campus operations. A few weeks ago, after reviewing nearly 20 proposals, ASU hired an architect to develop plans for refurbishing Matthews Hall for our use.

Conveniently situated adjacent to the School of Human Evolution and Social Change's two major buildings, Matthews Hall is on the National Register of Historic Places and is named for Carrie Matthews, wife of Arthur Matthews, who was president of the school from 1900 to 1930. The structure's Prairie School design preserves its Frank Lloyd Wright influence, and the two-story layout offers the functionality we need. We will keep you informed of developments on this topic as they unfold.

This is also an exciting time for me, personally, since I assumed the new role of founding director on July 1, 2008. A reduced administrative portfolio will allow me to focus on outreach, including my public lectures, our online presence and innovative ways to engage younger students. Nothing could be more exciting for me than to advance paleoanthropology to our next wave of supporters!

After 28 years as director, I am still as passionate about learning where we come from and how we have become the most dominant species on the planet. Now, I will have the joy of working with colleagues around the world to establish a wider base of support for our work, partnering with other institutions to develop workshops and public symposia on human origins and expanding our membership, volunteer and donor reach.

The wonderful accompanying news is that Bill Kimbel has accepted the directorship of the Institute of Human Origins. Bill was a logical choice due to his crucial role in the institute since 1985, his leadership abilities and his stellar scholarly reputation. A new role of associate director to assist with expanding administrative support has been assumed by Curtis Marean. Curtis is an accomplished archaeologist whose successful excavations in South Africa at Mossel Bay are offering a new perspective on the origins of modern humans and the impact of climate change on the planet.

So, as we look forward together toward the next phase of IHO's evolution, thank you for continuing to follow our progress, participating in our programs and spreading the word that this is the time and ASU is the place for the study of paleoanthropology.

Donald C. Johanson, Ph.D.  
Founding Director

# collaborative research project—SACP4

## South African Coast Paleoclimate, Paleoenvironment, Paleocology, Paleoanthropology Project

Scientists at IHO are involved in a number of important collaborative research projects designed to develop a continuous record of our human origins. The SACP4 project, currently backed by over \$3 million in grants, including one from the National Science Foundation's HOMINID program, is the first large transdisciplinary project to attempt to develop a unified record of climate and environmental change over the last 400,000 years in South Africa. Curtis Marean, a professor at IHO and lead scientist in the SACP4 project in Mossel Bay, South Africa, leads a team of international colleagues targeting three goals: 1) developing a continuous and detailed paleoclimatic and paleoenvironmental sequence from 400-30,000 years ago on the south coast of South Africa; 2) correlating that record to the global record for paleoclimatic change as reflected in the marine sediment and ice core records for the northern and southern hemispheres; and 3) testing a series of specific hypotheses about the relation between paleoclimate and paleoenvironmental change and human evolution. Collaborating scientist Zenobia Jacobs of the University of Wollongong is using optically stimulated luminescence (OSL) dating to investigate the when and where of anatomical and behavioral origins of modern humans, and the paleoenvironmental context in which the origins and evolution occurred. Her lab is one of the premiere luminescence labs in the world.

A project like the SACP4 project pushes all the boundaries of OSL dating. The sheer time-scale of interest is in itself a challenge. OSL dating of sediments is best applied to sediments up to 150,000 years old. The aim of the project is to cover the last 400,000 years. Techniques to push back the dating range of OSL need to be developed and refined. In addition, archaeological sites are complex and require the dating of individual sand grains to ensure accuracy and precision. One of the greatest challenges is to always keep the context in mind. One cannot apply OSL dating blindly; it is important to understand the stratigraphy,

the site formation processes and any potential for post-depositional processes and disturbances.

Combining geology with archaeology on a macro- and micro-scale makes the SACP4 project unique. Humans have been—and still are—an integral part of the environment. Neither can be examined in isolation. Applying the OSL dating technique to vastly different scales—determining changes in sea level over many thousands of years, as opposed to possibly short-term occupation of cave sites by humans in the past—makes it both unique and challenging.

Researchers like Jacobs have the opportunity, for the first time in Middle Stone Age archaeology, to apply the OSL technique to an evolving project in a systematic manner, resulting in remarkably consistent and precise results across both the archaeological and geological studies. This has enabled the detection of patterns that were previously impossible to note due to the chronological 'noise.'

In addition, scientists are able to verify the OSL ages against independent age control in the form of uranium-series dating. The solid correlation between the two techniques is now used as a good example of the applicability and reliability of the OSL dating technique. Jacobs thinks the single most important aspect of this project is that there are Pinnacle Point Middle Stone Age deposits dating back to at least 170,000 years, a time associated with 'advanced' behaviors. Although there are other deposits within South Africa of similar antiquity (e.g., Border Cave), this is the first well-described study that allows us to critically assess the behavior and subsistence strategies of our early ancestors, couched within a well-defined environmental context. We now have archaeological evidence for the presence of modern humans at similar times in north, east and southern Africa, and they are close to the genetic coalescence ages and the earliest known fossils representing the origins of *Homo sapiens*.

## contents

### 2 Don's message

### 3 research

### 4 cruise

### 6 new initiative

### 7 jaws of steel

Institute of Human Origins  
Arizona State University  
PO Box 874101  
Tempe, AZ 85287

480.727.6580  
iho@asu.edu

editor: Jodi Guyot  
jodi.guyot@asu.edu  
designer: Trish Yasolsky  
contributors:

Debra Palka  
Laurie Porter  
Rebecca Howe  
Carol Hughes

## CRUISE

### celebrating the contributions of Charles Darwin

#### experience luxury travel and world archaeology

The IHO travel program continues to grow with professional organized tours led by world renowned experts. Study the cave art in France and Spain. Walk in Charles Darwin's footsteps on the Galápagos Islands. Visit Olduvai Gorge, Lake Turkana and Hadar in eastern Africa, meet the Taung Baby in Johannesburg and see Curtis Marean's field team in action. Or visit and observe the great apes of Africa and trek in Madagascar forests to thrill at the site of lemurs. Get an exclusive view along the path of our human origins with your personal guides from IHO.

In 2009 people all over the world will celebrate the 200th anniversary of Charles Darwin's birth and the 150th anniversary of his ground-breaking book "On the Origin of Species." These celebrations include lectures, seminars, theatre performances, live radio shows and travel—exotic trips to the Galápagos Islands where Darwin made his famous observations about the variations found in the natural environments of each of the islands. IHO director William Kimbel has organized a 10-day charter cruise aboard the luxury yacht La Pinta to the Galápagos Islands scheduled for May 6–16, 2009. The cruise, operated through Luxury Adventures, S.A., of Quito, Ecuador, has onboard accommodations that are the best in its class. This trip of a lifetime includes an exclusive on-board program of evening presentations offering travelers a close-up perspective on Darwin, the Galápagos and their role in understanding our place in the natural world.

The Galápagos Islands are a series of volcanic islands located around the equator, west of Ecuador. The oldest island is thought to be more than 10 million years old, and the youngest islands,

Fernandina and Isabela, are still being formed through volcanic eruptions. The beauty of the Galápagos Islands lies in their geology and their many unique species of bird and aquatic life—the blue-footed boobies, the flightless cormorants, the Galápagos tortoise, the giant marine iguanas and Darwin's finches, renowned for inspiring Darwin's ideas about "descent with modification."

The Galápagos Islands were made famous in 1835 by a scientific study of geology and biology by the young naturalist Charles Darwin.

During his 1831 voyage on the HMS Beagle, Darwin studied the animals of the Galápagos, which led to a breakthrough in his ideas. Darwin discovered that each Galápagos Island supported its own form of wildlife, all closely related, yet all different in important ways. He theorized that nature selects the species that should survive in any given environment, and the varieties of animals that thrive in their environments will be the most successful in survival.

One of his first discoveries was the study of the variety of finches between the islands. Darwin realized that the finches'

photo by William H. Kimbel





photo by William H. Kimbel

environment had a rather dramatic impact on how each finch species adapted to different environmental conditions.

Over many generations, the animals would change anatomically to allow them greater success in finding and eating food, and in the reproduction of their species. This theory of natural selection has become one of the most widely studied for the past 150 years.

## upcoming events

February 12—National Institutes of Health, Bethesda, MD; Johanson is a panel member for Darwin Days event

March 18—Johanson lecture “Lucy’s Legacy” for Arizona 5 Arts Circle held at Culinary Arts Institute, Scottsdale, AZ

March 20—Johanson lecture “Lucy’s Legacy” at Porterville College, Porterville, CA

April 2—Johanson lecture for World President’s Organization (WPO), Phoenix Chapter, at Arizona State University, AZ

April 17 and 18—Santa Barbara Museum of Natural History Symposium on Human Origins, Santa Barbara, CA; This will be a symposium on human evolution held at the museum. Don Johanson, Bill Kimbel, Curtis Marean and Ian Tattersall will all participate in various panels and lectures.

For more information about the IHO cruise to the Galápagos Islands, please contact Laurie Porter, program coordinator, at 480-727-6571 or [porter.iho@asu.edu](mailto:porter.iho@asu.edu).

## tours

**Galápagos Islands**  
with Bill Kimbel  
**May 6 - 16, 2009**

## book now!

**480-727-6571**  
or  
**[porter.iho@asu.edu](mailto:porter.iho@asu.edu)**

## IHO mission

The Institute of Human Origins (IHO) conducts, interprets and publicizes scientific research on the human career. IHO’s unique approach brings together scientists from diverse disciplines to develop integrated, bio-behavioral investigations of human evolution. Through research, education, and the sponsorship of scholarly interaction, IHO advances scientific understanding of our origins and its contemporary relevance. Combining interdisciplinary expertise and targeted funding, IHO fosters the pursuit of integrated solutions to the most important questions regarding the course, cause, and timing of events in human evolution.

## new initiative probes human evolution— late lessons from early history

### about the school

Known for its leadership in innovative education and research, the **School of Human Evolution and Social Change** integrates tools and knowledge from across the sciences and social sciences to discover not only who we were, but where we are going and how we may alter our destiny.

From anthropologists, mathematicians and geographers, to sociologists, economists and natural scientists, our diverse faculty are defining revolutionary approaches to longstanding questions and contemporary issues challenging humankind.

Visit us on the Web:  
[shesc.asu.edu](http://shesc.asu.edu)

For more information, contact:  
**Sander van der Leeuw, director**  
480-965-6215  
[shesc@asu.edu](mailto:shesc@asu.edu)

photo by Donald C. Johanson

ASU's School of Human Evolution and Social Change is charting new territory in transdisciplinary, use-inspired research. The Late Lessons from Early History initiative, supported with \$2.5 million dollars over five years from ASU's Intellectual Fusion Investment Fund, includes research projects designed to take science where it has never been, and urgently needs to go.

The purpose is to fund projects that allow multidisciplinary teams the freedom to pursue research that may not fit neatly into traditional funders' disciplinary categories—yet are essential to understanding and addressing society's major challenges.

A team of researchers, led by IHO faculty member Kaye Reed, is working on a project that will build a “cyberinfrastructure” of geoinformatics-based data for the study of the Pliocene fossil-bearing strata of the Hadar Basin in Afar, Ethiopia.

Understanding the relative roles of internal and external ecological, climatological and tectonic forcings in the evolution of our early ancestors, *Australopithecus aferensis*, requires integration of a wide range of data with different formats, time frames and spatial indexes. The Hadar geoinformatics project

seeks to solve this paleoanthropological and geological research challenge by building an infrastructure to store, integrate and compare the disparate data of this critical region with all the power of today's computing technology. As a result, scientists will have unprecedented abilities to analyze massive amounts of data to answer longstanding questions and new ones about the rise of key adaptations of the human species. It will revolutionize the way we do anthropological and earth sciences research, from isolated projects to collaborative and comparative discovery on an international scale. This is especially important for studies on climate change and other topics that are inherently global phenomena.

The 5-year project includes a new digital geology module of IHO's renowned Hadar Field School. Students equipped with computer “tablets” will be capable of locating an attribute “on the fly” and relating it to the mapped geology of the region or a digital terrain model. The tablets will also provide 3D viewing of a landscape that can include overlays of multiple data sets, such as geology and fossil sites. The project harnesses ASU's advanced computing and state-of-the-art visualization technology so that students from anywhere in the world will be able to experience “virtual fly throughs” of Hadar.

The Hadar Basin geoinformatics database will become a vital tool for future research, monitoring and protection of the basin's paleoanthropological sites. A vital component of the project is a training program for Ethiopian university students who will play a critical role in conserving the sites for the future.



## early humans had ‘jaws of steel’

Computer simulation shows early humans had jaws to eat diet of hard seeds and nuts

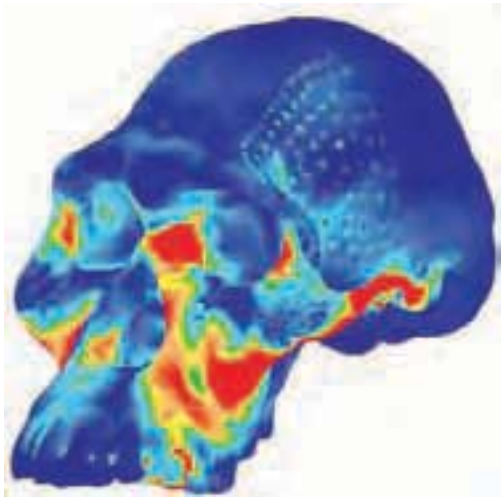


Figure legend: Compressive stress in the cranium of *Australopithecus africanus*, an extinct early human, imposed by biting on the premolar teeth. Bright colors correspond to high stresses, and indicate that a bony pillar running alongside the opening of the nasal cavity acts as a strut that structurally reinforces the face against premolar loads.

“We started with a CT scan of a skull that is one of the most complete specimens of *A. africanus* that we have,” said Spencer, a lead investigator on the project, which was funded by the National Science Foundation and European Union. This would be a later ancestor of Lucy—STS5—who is affectionately known as “Mrs. Ples.” The skull, discovered in 1947, has struts on the side of the nose, but no teeth. “We meshed those data with the data of another specimen with teeth to make the virtual model of the bone and tooth structure.

“Then we looked at chimpanzees, who share common features with *Australopithecus*, and took measurements of how the chimp muscles work and added that to the model. We were able to validate this model by comparing it to a similar model built for a species of monkey called macaques,” Spencer explained.

The result—a rainbow colored virtual skull that illustrates forces absorbed by the cranial structure in simulated bite scenarios and how their unusual facial features were ideally suited to support the heavy loads of cracking hard nuts.

“It was like watching ‘Mrs. Ples’ come to life,” Spencer said.

“This reinforces the body of research indicating that facial specializations in species of early humans are adaptations due to a specialized diet,” said Spencer. “The enlargement of the premolars, the heavy tooth enamel and the evidence now that they were loading forcefully on the molars suggest the size of the objects were larger than the previously hypothesized small seeds and nuts.

“These fall-back foods—hard nuts and seeds—were important survival strategies during a period of changing climates and food scarcity,” he added. “Our research shows that early, pre-stone tool human ancestors solved problems with their jaws that modern humans would have solved with tools.”

Your mother always told you not to use your teeth as tools to open something hard, and she was right. Human skulls have small faces and teeth and are not well-equipped to bite down forcefully on hard objects. Not so of our earliest ancestors, say scientists. New research published in the February 2009 issue of *Proceedings of the National Academy of Sciences* reveals nut-cracking abilities in our 2.5-million-year-old relatives that enabled them to alter their diet to adapt to changes in food sources in their environment.

Mark Spencer, an Arizona State University assistant professor, and doctoral student Caitlin Schrein in ASU’s School of Human Evolution and Social Change, are part of the international team of researchers who devised the study featured in the article “The feeding biomechanics and dietary ecology of *Australopithecus africanus*.” Using state-of-the-art computer modeling and simulation technology—the same kind engineers use to simulate how a car reacts to forces in a front-end collision—evolutionary scientists built a virtual model of the *A. africanus* skull and were able to see just how the jaw operated and what forces it could produce.

### DIRECTOR

William H. Kimbel, Ph.D.

### ASSOCIATE DIRECTOR

Curtis W. Marean, Ph.D.

### FOUNDING DIRECTOR

Donald C. Johanson, Ph.D.

### OFFICERS OF THE BOARD

Bruce W. Schnitzer,  
Chairman

Harry A. Papp,  
Treasurer

### BOARD OF DIRECTORS

Robert M. Beck

Thomas F. Hill,  
Founding Chairman

Thomas P. Jones, III

David H. Koch

Linda Lederman, Ph.D.,  
Ex-Officio

Mrs. Kenneth Leventhal

Herb Roskind

Laura Roskind

Edgar L. Sands

Janet Dowling Sands

Peter Saucier

Ian Tattersall, Ph.D.

Arnold M. Travis

Joan D. Travis

Sander van der Leeuw, Ph.D.  
Ex-Officio

### COORDINATOR

Laurie Porter

### WEB MASTER

Jay Greene