

# Bakeng se Afrika

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Participants in the first Kick Start Meeting visited Sterkfontein caves in February 2019.

## Reflecting on our progress

Bakeng se Afrika is almost two years old and the project has thrived despite the global pandemic. We have grown as a community and have made progress towards establishing a digital skeletal repository of South African individuals.

We recently obtained feedback from the EU about the quality of our reporting (see page 4 for details), and we are happy to share this summary with anyone interested in the progress of Bakeng se Afrika.



Bakeng se Afrika is an EU-cofunded initiative to create a comprehensive digital imaging database of micro-CT scanned donated skeletal material of South African individuals for ethical use in teaching and research. The Bakeng se Afrika Consortium consists of eight institutions, namely: the University of Pretoria (UP), the Sefako Makgatho Health Sciences University (SMU), Stellenbosch University (SU), the South African Nuclear Energy Corporation (Necsa), the University of Bordeaux (UB), the Centre National

de la Recherche Scientifique (CNRS), the KU Leuven (KUL) and the University of Coimbra (UC). The server for the Bakeng se Afrika (BsA) digital 3D repository will be housed and maintained at the coordinating institution, the University of Pretoria.

Bakeng se Afrika addresses five (3, 4, 9, 16 and 17) of the 2030 sustainable development goals, namely: health and well-being; quality education; innovation, industry and infrastructure; peace justice and strong institutions; and partnership.

## Message from the Coordinating Institution

We would like to extend our warmest appreciation to our partners for helping us to make the Bakeng se Afrika project a success so far. This project has changed the way we prepare for and conduct research and teaching at the Forensic Anthropology Research Centre at the University of Pretoria. We are grateful for the opportunity to grow and to contribute to capacity building in health sciences research and education on an international level, while maintaining national relevance. We are halfway through the funding period of our project, and we have made great strides towards achieving our goals. Despite sharing the setbacks associated with the pandemic with the rest of the world, we have maintained our momentum and would like to use this newsletter to share our progress with our stakeholders.



Co-funded by the  
Erasmus+ Programme  
of the European Union

**Talk to us**  
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# News and Updates



The NecsA portion of the server was purchased by the University of Pretoria on the 20th of November 2019 and delivered on the 21st of January 2020. The operating system has been loaded on to the server and the hardware has been tagged as property of UP. The server will be transported to NecsA and installed within the next month. After both parts of the server are installed, the South African contingent of the Bakeng se Afrika team will start uploading scans for use nationally and internationally.

We purchased the Bakeng se Afrika server on the 28th of January 2020 and the hardware was delivered (with some delay due to Covid-19) to the University of Pretoria's main campus on the 16th of July. The IT Department at UP is in the process of installing the server and linking it up to the university systems. The University of Pretoria will be responsible for the maintenance of the server, ensuring the sustainability of the project.

We congratulate Alecia Erasmus from SU and Dr Alison Ridel from UP on the birth of their babies.

We are glad to announce that the Centre National de la Recherche Scientifique (CNRS) will be added as an 8th partner to the Bakeng se Afrika consortium.

The CNRS will collaborate in research and supervision of students on mobility to France. The budget for the CNRS comes from the University of Bordeaux's staff cost and the change will come into effect with the payment of the second pre-financing.

Dr Frikkie de Beer, the BsA Project Manager at NecsA, has retired, leaving BsA in the capable hands of his team. We wish Frikkie all the best in his new adventures.



# Feedback from the EU on the First Round of Reporting

"The project is progressing well in terms of the activities realized so far."

The EU sent feedback for our first report on the 28th of July 2020. We received a review of "Very Good" - which means we achieved 75 - 100 points. The EU considers Bakeng se Afrika to be implemented in accordance with the original work programme and timetable. The report provided all the information and evidence needed and there were no particular concerns or areas of weakness.

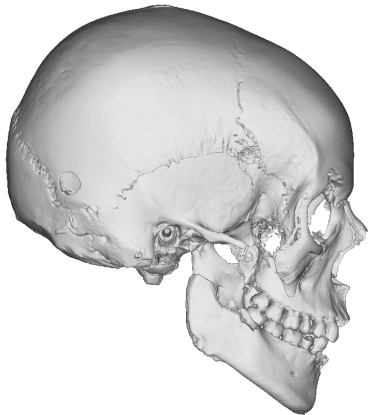
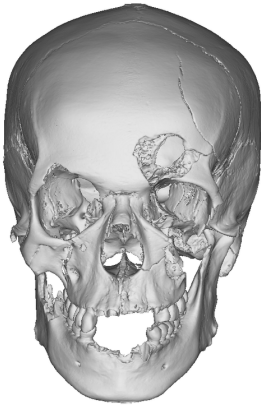
## Reporting: Lessons Learned

Thank you to all the partners and individuals who worked with us (sometimes with very short time frames) to complete the first official report for Bakeng se Afrika. We submitted the reporting documents to the European Union on the 13th of May 2020. During the reporting period, we learned a lot about the intricacies of the reporting process and these lessons will help us to continue to provide high quality work. The Bakeng se Afrika project has been a steep learning curve for all of us, and we would like to share a few key lessons during the reporting process:

- Allocate yourself time to complete the administration - then double it.
- Read and re-read the Guidelines for Use of the Grant.
- Double check all values against the given parameters and guidelines.
- The distance travelled must be calculated using the Distance Calculator, and must correspond with the Individual Travel Report.
- The dates of work and the amount of days worked, must correspond on the timesheets and Joint Declarations. This might require additional calculations, depending on the way work time is measured at your institution.
- The employment contract must be valid and must cover the dates on the time sheets.
- It helps to know people at your institution's support departments - last minute help from a finance, human resources or marketing person can be invaluable.
- Maintaining a friendly and professional composure is difficult in stressful environments, but it remains necessary.
- Communicate your needs clearly:
- Use the appropriate words to describe documents to avoid misconceptions, taking into consideration that the terminology used might differ from institution to institution.
- Give clear guidelines of what is expected: a specific question will generate a specific answer.



# Scanning Progress



Anterior and lateral views of the 3D rendered skull featured in the Bakeng se Afrika Logo.

Scanning standard operating procedures (SOPs) are created as the Bakeng se Afrika repository is populated. These SOPs include guidelines with regards to selecting skeletal material to be scanned, and properly transporting the material to Necsa. Colleagues at Necsa are also creating SOPs for physical scanning procedures, specific to scanning human bone.

As of August 2020, **983 scans have been conducted and collected**, consisting of 295 crania, 416 mandibles, 147 maxillae, 16 femora, 36 radii, 33 ribs and 40 vertebrae. The distribution across institutions are as follows:

- **University of Pretoria:** 686 scans in total.
  - 183 crania, 386 mandibles, 117 maxillae.
    - 292 new scans specifically for BsA: 119 crania, 56 mandibles, 117 maxillae.
    - 394 collected scans available from previous projects: 64 crania and 330 mandibles.
- **Sefako Makgatho Health Sciences University:** 176 scans in total.
  - 64 crania, 30 mandibles, 30 maxillae, 16 femora, 36 radii.
- **Stellenbosch University:** 121 scans in total.
  - 48 crania, 33 ribs, 40 vertebrae.

The scanning processes are proceeding according to schedule, and if the current pace continues, we will have well over 1000 scans available on the repository by August 2021.

One of the major hurdles we are facing is temporary storage capacity, as the physical server for the Bakeng se Afrika repository is not operational yet.

# Hardware and Software

The hardware and software components of the repository consist of the physical setup of the server, as well as building capacity for manipulating micro-CT scan data by individual researchers.

The physical hardware of the server belongs to the University of Pretoria, and has components that must be installed at both UP and Necsa. Both the UP and Necsa components have been purchased and delivered, and are in the process of being installed by the relevant people at each institution. The server must also have the appropriate software to run on and the software for the Necsa server has been installed.



Delivery of the hardware for the UP part of the Bakeng se Afrika server

The Figshare platform will function as the meta-data sharing front-end of the repository. Although the decision has been finalised to use Figshare through the University of Pretoria's library system, the physical acquisition of a Figshare licence is still in discussion among the UP library and IT services. Although all of these processes are still underway, they have been delayed considerably due to the escalation of Covid-19.

In terms of building researcher capacity, each South African institution has purchased a powerful laptop computer with sufficient capability to manipulate large micro-CT scan data sets. The project has also purchased perpetual licences to Avizo, a 3D visualisation and analysis software, for the University of Pretoria and Sefako Makgatho Health Sciences University.

# Ethics

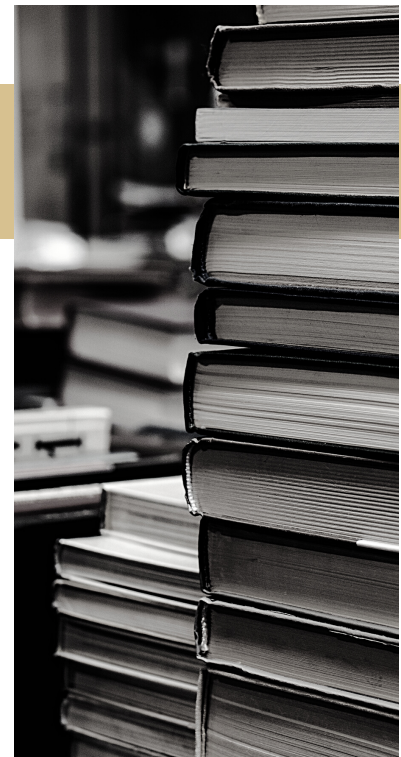
An Ethics Constitution Committee was created in 2019, including members from all of the Higher Education Institutions involved in Bakeng se Afrika. The ethics constitution is in development and will be one of the deliverables at the end of the project. Prof Ericka L'Abbé is also in the process of creating a proposal for submission to the Health Sciences Research Ethics Committee at the University of Pretoria, to obtain permission for the repository as a whole.

Researchers wishing to use data from Bakeng se Afrika should please contact any of the following people for guidance with regards to obtaining ethical approval at the University of Pretoria:

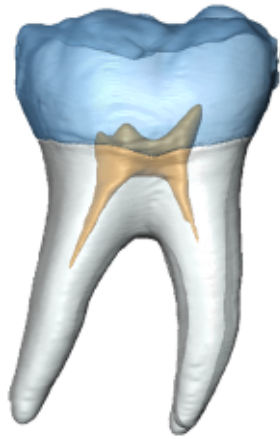
- Professor Ericka L'Abbé:
  - Project Coordinator of Bakeng se Afrika at the University of Pretoria
  - ericka.labbe@up.ac.za
- Clarisa Sutherland (van der Merwe)
  - Junior Project Coordinator of Bakeng se Afrika at the University of Pretoria
  - sutherlandclarisa@gmail.com
- Gabi Krüger
  - Curator of the Pretoria Bone Collection
  - gabi.kruger@up.ac.za

## Research

Currently there are four PhD, seven MSc and three BSc Honours students working on projects related to the goals of Bakeng se Afrika. Bakeng se Afrika staff have attended three conferences involving scans and 3D prints of bone. Several manuscripts for publication in peer reviewed journals are in progress. All of the research projects involve national or international collaboration among institutions.







# Current Research Topics

Featured on the left: Micro-CT based 3D reconstruction of a virtually extracted molar - by Dr M. Cazenave

Although many more areas of interest exist within the project, some of the current research topics related to Bakeng se Afrika include:

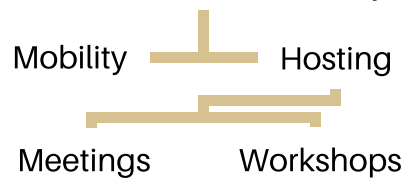
- The size and shape of the zygoma (for design of zygomatic implants)
- The fine structure of the nasal cavity (conchae) on skull micro-CT images
- Validating the radiological images generated on the Medtronic O-arm
- A radiographic analysis of tuberculosis-associated skeletal changes in ribs and vertebrae
- Calvarial bone changes with age and sex using micro-computed tomography
- Pelvimetry of males from the Western Cape with rectal cancer: Anatomical and clinical implications
- Predicting mouth morphology in edentulous skulls
- Explore facial variation among African groups, so as to assist medical practitioners in developing prosthetics to treat facial disfigurements
- Developing an automated computer facial approximation for the South African Police Services
- Variation, covariation, adaptation and evolution of nasal cavity and nasal airways
- Investigating variations in the morphology of first molar roots and canals among African groups, so as to create more efficient tools and treatment procedures for root canals among rural communities
- The nasal wall thickness and position of anatomical structures (for design of Nazalus implants)
- The size and shape of the pterygoid region and the nerves and blood vessels nearby (for design of the pterygoid implants)
- Comparative analysis of dental measurements using different modalities: caliper vs micro-CT
- Do populations of lower socioeconomic status exhibit more severe stress markers (i.e. facial fluctuating asymmetry and linear enamel hypoplasia)?



## Travel and cost of stay

In Bakeng se Afrika, travel and cost of stay is divided into 2 categories: Mobility and Hosting. Hosting comprises of Meetings and Workshops. The funds for mobility are paid out to the institution from which the person travelling is from. Hosting funds are paid out to the institution hosting the meeting or workshop.

### Travel and cost of stay



"Although the trip to Coimbra was eventful and fun, the journey also had a profound impact on the direction of my career."

- Samantha Muller (pictured left) reflecting on her trip to Portugal in 2019

As of August 2020, 70 of the 122 planned travellers for Bakeng se Afrika have embarked on their trips. Nine of the planned 57 mobilities were completed. Of the 65 planned travels associated with hosting, 39 have been completed.

We have created plans to complete our mobilities and hosting, despite the global pandemic. Please see our travel spreadsheet for all information on completed and proposed travel



# Dissemination

The requirements of the EU for dissemination and exploitation have given the BsA staff and students the motivation to engage on social media and science communication through writing, networking and skill building through workshops.

Featured above: Energetic discussions during dinner at our first interim meeting in Cape Town, 2019

## Bakeng se Afrika has five Dissemination & Exploitation (D&E) goals:

1. Communicating project processes to achieve the establishment of the repository
2. Communicating the availability and use of the repository
3. Communicating research processes and results
4. Personifying the researcher
5. Networking

Twitter: 101 followers, 64 tweets  
 Facebook: 91 followers, 32 posts  
 Instagram: 110 followers, 38 posts  
 Blog: 648 visitors, 2055 page views

## Bakeng se Afrika Blog in detail

- 14 blog posts, with two in the process of edit and review.
  - About the various BsA meetings and workshops organised (x5), BsA procedures and creation of the repository (x4), mobilities (x3) and conferences attended (x2).
- **Visitors from all continents:**
  - High traffic from BsA participating countries: South Africa, France, Portugal, Belgium.



- But also from countries not part of the consortium: UK, USA, Canada, Switzerland, India, Spain, Brazil, among others.
- African countries also represented: Namibia, Rwanda, Nigeria, Burundi, Mozambique, among others.



# Grey literature

While publications in peer reviewed journals are in the process of being created, the Bakeng se Afrika team have been busy with science communication on blogs, websites and news platforms.

**Communication on our partner websites include:**

- UP's own 'Bones' and MakerSpace hopes to print replicas of human bones in 3D, by P. Gower, on UP website (27 June 2020).
- Workshops promoted by the European project Bakeng Se Afrika, by C. Coelho, on UC LFA laboratory website (19 September 2019).
- UP launches three-year Africa-focused programme to 3D-capture digital skeletal images, on UP website (08 March 2019).

In addition to the publications on our blog, **science communication publications** on other platforms include:

- 3D Printing and the Murky Ethics of Replicating Bones, by S. Wild (South African science journalist), in *Undark Magazine* (January 2020).
  - Article re-published by several online press websites: Science Beta, Salon, Impact Lab, etc.

Bakeng se Afrika have also been communicated through the **websites and newsletters of South African scientific societies:**

- 'Bakeng se Afrika': Forensic applications of micro-CT, by S. Matthews, in the Micro-computed tomography 3D X-ray imaging special issue of *Quest: Science for South Africa*, magazine published by the Academy of Science of South Africa (2019).
- Bakeng se Afrika project – Digital repository of South African human skeletons, by Dr M. Cazenave, in *PLEXUS*, the newsletter of the International Federation of Associations of Anatomists (2019).

# A call to action

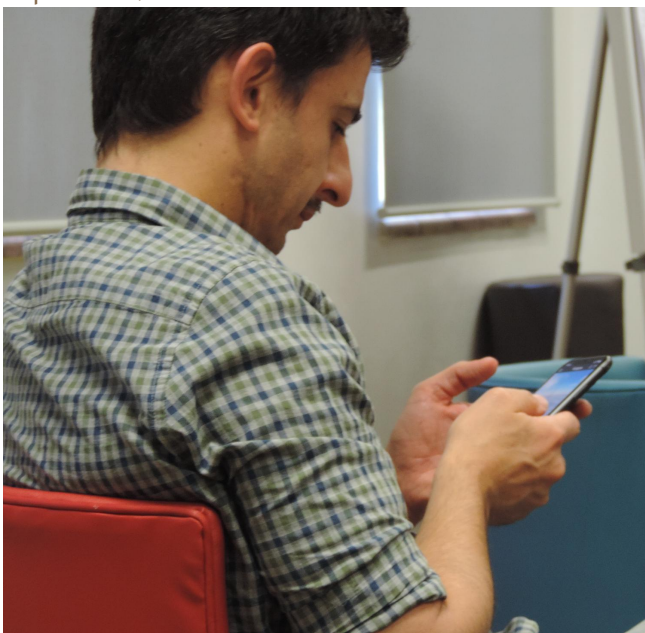
We have been communicating our progress on our website, or blog and our various social media platforms. We would like to invite our partners and various stakeholders to submit any interesting nuggets of news, a recent success, a publication or blog post to the dissemination team at UP.

We look forward to sharing our successes and stories with the world. For dissemination about a Bakeng se Afrika related endeavour, please contact:

**[bakengsa@gmail.com](mailto:bakengsa@gmail.com)**

We would also like to invite you to check out our online presence through the following links. Please feel free to tag the project, should you share your research on your own social media platforms.

Dr Rudolph Venter participating in online dissemination during our first interim meeting in Cape Town, 2019



**[Bakeng se Afrika on the EU registry](#)**

**[Bakeng se Afrika Website](#)**

**[Bakeng se Afrika Blog](#)**



**[@BakengSA](#)**



**[@BakengSeAfrika](#)**



**[@bakeng\\_se\\_afrika](#)**

# The way forward

The lifespan of EU funding for Bakeng se Afrika is 3 years and during this time, we are building capacity not only with the acquisition of hardware and software, but also in the skills and knowledge of our staff and students to conduct valid and ethical research using digital skeletal material as data. Bakeng se Afrika has increased collaboration among South African universities, dentists, medical practitioners and Necsa. Our network has also been extended to include other Higher Education Institutions (HEIs) internationally.



A miniature 3D printed skull with the newly acquired computer for MicroCT analysis at the University of Pretoria

By connecting multi/transdisciplinary departments from within the universities, we have increased awareness around the lack of current legislation on the ethical use of digital skeletal remains in research and education.

The creation of physical media and the increase in skills of the BsA team has opened avenues of possible sustainability in generating funds for BsA after the duration of funding has ended.



A 3D print of a section of skull with ballistic trauma, with a Bakeng se Afrika business card. The skull was MicroCT scanned and segmented at Necsa, and then branded with Bakeng se Afrika's details and 3D printed at UP MakerSpace. The 3D print could then be transported internationally where it was used in bone trauma workshops in 2019.

The possibilities for third-stream income involve two avenues:

1. Selling physical 3D prints as well as printable meshes of skeletal material (specifically trauma and pathology).
2. Providing external consultation services from the newly trained BsA team.



The sale of 3D prints of human skeletal remains will be underpinned by ethical guidelines, and will be marketed in conjunction with the publication of an Atlas of the internal structure of the human skeleton, authored by Dr Marine Cazenave. The contract services the BsA team will be able to provide include data manipulation in 3D imaging, data collection (reconstruction in meshes, segmentation, measurements etc.) and consultation services for biostatistics and scientific editing.

Bakeng se Afrika, while creating a digital skeletal repository, will also impact the way in which research is done: the quality of data, the skills to manipulate large imaging datasets, and in contributing to the emerging field of ethics in digital versions of human remains, both nationally and internationally. In many ways, Bakeng se Afrika's journey is just beginning.

