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Session C04 – Technology and Methodology for Archaeological Practice: Practical applications for the past reconstruction

## Advanced Methods for Dating

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### Abstract

AMS dating requires only minute amount of fast growing organic material (desiccated human skin, reef, straw). Eclipse Simulation freeware EMAPWIN of Shinobu TAKESAKO in association with GPS Simulation freeware Google Earth provide now access for a large public to the detailed investigation of relevant past Solar Ephemerides and Eclipses. New data are presented concerning:

- Evidence for an Imhotep connection with the launching of the Egyptian Calendar.
- Evidence for the oldest mummified skull and its connection with paleoamerican young child funerary ritual and datation of Omaguacan Rock Art.
- Chronology of the Amarna Heresy
- Evidence for an Amarnian Heritage in the Abu Simbel Temple

**Key-words** : Chronology, mummy, Akhenaton, AMS, solar eclipses

## Nouvelles pratiques de datation

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### Résumé

Les *gratuiels de rétroprédiction & Google Earth* donnent maintenant accès aux outils pour l'investigation détaillée des éphémérides et éclipses solaires significatives du passé, alors qu'une datation à l'aide d'un *spectromètre de masse atomique (AMS)* nécessite moins de 100 mg de matériel organique à croissance rapide (peau desséchée, roseau, paille). Les nouveaux résultats présentés concernent:

- la présomption d'implication du vizir Imhotep dans le lancement du calendrier égyptien.
- l'âge du plus ancien crâne momifié connu à ce jour, en relation avec le rituel funéraire d'un jeune enfant, ainsi que la datation d'art rupestre omaguacan.
- la chronologie de l'Hérésie Amarnienne
- les traces d'un possible héritage amarnien au temple d'Abou Simbel

**Mots-clés** : Chronologie, momie, Akhenaton, AMS, éclipses de soleil

Let us begin with an comprehensive survey of a *mnemotechnical cyclic time scale*: The Ancient Egyptian Year Period had three seasons, of four thirty days months, and five additional days amounting to 365 days. It is a little bit short to match the solar year, and generates *a shift of nearly one month by century*. **1 Akhet I**, is the first day of Thot (the first month) of the season of inundation. It must have something to do with the starting of the flood of the Nile, which occurs, in the tropical strategic check-point of Elephantine (the Island near Assouan), at Summer Solstice. As the pupils of the Ecole Naguid Mahfouz, there, posted it on the web, on June 21<sup>st</sup>, 2001 at 10:50 UT: “incroyable, on a beau regarder, il n’y a plus d’ombre”. Due to the earlier mentioned slow seasonal *shift* of the beginning of the Egyptian Year, the calendar has to be calibrated, in order to synchronize events with our Julian calendar. It happens that in the Leiden Museum, there is a log-book of a ship on “recycled” papyrus mentioning “*the New Moon Festival in the City of Pi-Ramsesses, the 27<sup>th</sup> day of the 2<sup>nd</sup> month of the season Peret, in the 52<sup>nd</sup> regnal year*”. The named city points out toward a Pharaoh of the Ramses Dynasty, but actually only Ramses II reigned long enough to be candidate. There was New Moon on -1238.12.22. There was even on this day a solar eclipse over Siberia, but not over Egypt. G. Bonani, Zahi Hawass & al measured, at the AMS Laboratory, in Zürich, the ratio  $14C / 13C / 12C$  of lot of old Egyptian samples, among them one of reef and straw from a mud brick of the 3rd tier of the Step Pyramid in Saqqara. Their results (see Radiocarbon, 43, pp1297-1320, 2001 is quite exciting: with 84% probability, the Djoser’s Pyramid has been built in year  $-2741 \pm 74$ . It also means that the life of the great architect IMHOTEP occurred then, ...and, if the Mnemotechnic Egyptian Year Period did not suffer any alteration, Imhotep might be the one who launched it on 1 Akhet I, i.e. on summer solstice -2767.07.16.

With help of the AMS technique another exciting result is the dating of a well preserved naturally mummified human head. In 1936, Justiniano TORRES APARICIO, MD in Humahuaca (Prov. Jujuy, Argentina) and well-known popular music composer, found three naturally desiccated mummies, at 3680 m.o.s.l., in the Quebrada of Rio Chulin, in the level 1A de la “Cuevas de Las Momias” (previously called inca cueva 4) (see Fig 1&2). Thanks to Mrs. Alicia TORRES, owner & director of the Museo TORRES, in Humahuaca, who authorized the study, the “Chulina Project”, aimed at the AMS datation of “Cabeza J.T.A.-240”, an Andean Mummified Head (see Fig 3). This project was launched with the collaboration of Léo DUBAL & Monique LARREY of the Virtual Laboratory for Archaeometry, Georges BONANI & Irka HAJDAS of the AMS Radiocarbon Laboratory / ETH-Zürich and Alicia FERNANDEZ-DISTEL of the University of Jujuy.

Two samples of temporal skin (*see Fig 4*) of about 3 cm<sup>2</sup> in area and a weight of 120 milligrams have been dated. The  $\delta^{13}\text{C} = -19.5 \pm 1.1$  o/oo, typical for not contaminated human skin. While the mummy of Ötzi gave  $4'546 \pm 17$  BP (*BeforePeriod*), see

<http://www.ipp.phys.ethz.ch/research/experiments/tandem/posters/Oetzi.pdf>,

Chulina gave, for *sample a*:  $5'260 \pm 50$ BP and for *sample b*:  $5'335 \pm 50$ BP i.e.: a calibrated age of  $4'170 - 3'972$  BCE (*Before Common Era*) with 82.5% probability.

Conclusion, Chulina lived seven centuries before Ötzi....No notes of J.T.A, have been found. It is nevertheless reasonable to assume that this remote cave has not been visited since Chulina was deposited there. One could presume that the mummy of Chulinita (*see Fig 5*) is as old as Chulina. This reveals the age of paleoamerican young child funerary ritual. Another follow-up is that the Omaguacan Rock Art on the walls of this shelter (*see Fig 6-8*) is also 6'000 years old, as old as *Chulina-the-Painter*. Now, let turn our attention to application of ephemerides in dating Pharaoh Akhenaton.

The radiocarbon dating made 20 years ago is quite imprecise:

$-1'325 \pm 65$  (68%).

From engraved stele, we know that he was crown on **1Peret I**, i.e. **reignal year I**. Three years later, there was a Jubilee and probably his wedding with Nefertiti on **1Peret I**, i.e. **ry IV**.

He founded then a year later his new capital AKHET-Aten on **13Peret IV** i.e. **ry V**. This date appears on a stele at the site of the first temple where the new capital started. Marc Gabolde made there, 4 weeks before the vernal equinox, on 2005.02.19 at 04:38 UT, a most exciting observation (*see Fig 9*). The sun rises out of the cradle of the wadi like in the hieroglyph "AKHET" (*see Fig 10*).

One can therefore date the celebration to 4 weeks before the vernal equinox, on **-1'349.03.06**. We will refer to this setting toward the rising sun four weeks before the equinox as the "Amarna Staging".

Assuming the spin of the Earth to have had a continuous deceleration over the last 4000 years (*see Fig. 11*) one can retrodict a 4 minutes long total solar eclipse over the city of Akhet-Aton on **-1'337.05.14** at 12 UT (see: <http://www.archaeometry.org/titanic.htm>).

As the Solar Pharaoh died in reignal year **XVII**, one can conclude that his death is correlated with this solar eclipse (more chronological details about the Amarna period are given in <http://www.archaeometry.org/nefertiti.htm> ). It is often asserted that after Akhenaton's death, the Amarnian Heresy has been eradicated. In fact, Ramses II's shrine in Abu Simbel, with its narrow entrance (*see Fig. 12*) and 65 meter long corridor, is illuminated twice a year, 4 weeks before equinox....



1. Cueva de las Momias, from Rio Chulin



2. View from the Cueva de las Momias



3. Naturally Mummified Head J.T.A. 240 found in 1936 in la Cueva de las Momias



4. The two small sample of the left temporal skin, 120 milligrams each

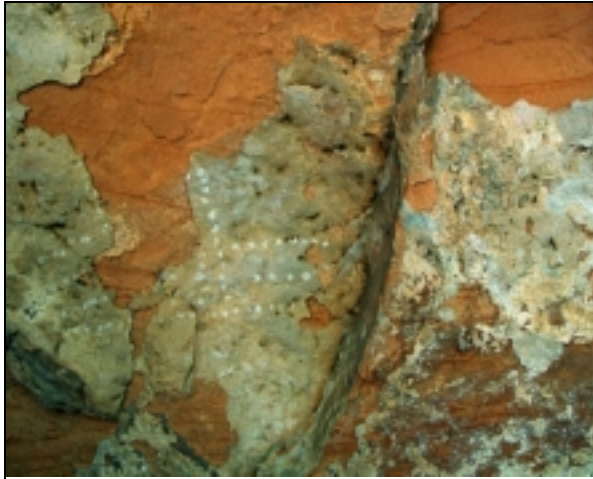


5. Naturally mummified young child found in 1936 in la Cueva de las Momias



6. Red strokes Rock Art on the walls of the Cueva de las Momias





7. White dots Rock Art on the walls of the Cueva de las Momias



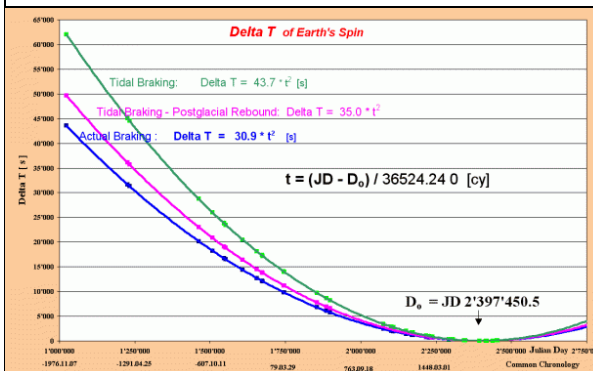
8. Ochre dots Rock Art on the walls of the Cueva de las Momias



9. Sun rising over the wadi seen from Akhet-Aten's first Temple, 4 weeks before vernal equinox



10. Hieroglyph Akhet meaning "Horizont" but also "Genesis of Time".



11. Chart of the slowing down of Earth's spin, assuming tidal braking only, corrected for post-glacial rebound and actual braking certified by solar eclipses.



12. Measuring the entrance of the 65 m long corridor at Abu Simbel main Temple.