SYCH 1: Cultural Heritage in the Light of Physical Methods I

Time: Thursday 14:00–16:00 Location: HSZ 02

Invited Talk SYCH 1.1 Thu 14:00 HSZ 02

Radiocarbon dating of cultural objects: Limit — •Hans-Arno Synal — ETH Zurich, Zurich, Switzerland

Reliable age information is in many cases essential to classify cultural object into their historical context. Here, radiocarbon dating plays an outstanding role contributing most valuable dates of the organic materials from which these objects are made. Today, radiocarbon is a well establish dating technique but it is still following the fundamental principles as they were discovered by William Libby in the middle of the last century. However, modern technologies to measure radiocarbon concentrations in organic materials have substantially improved and opened up new and unique opportunities. In particular, the latest improvements in accelerator mass spectrometry have push forward radiocarbon methodology. In this contribution latest technical and instrumental developments are summarized and their implications to retrieve time information of cultural objects are highlighted. Specific examples are given to demonstrate present day possibilities and limitations of modern radiocarbon dating.

Invited Talk SYCH 1.2 Thu 14:30 HSZ 02

From Lascaux to Rembrandt. Insights into invisible traces of paintings and drawings from physical methods — •Ina Reiche — Laboratoire du C2RMF - UMR 171 CNRS, Palais du Louvre, 14 quai F. Mitterrand, 75001 Paris, France

Beyond art historical studies, analyses of works of art using chemical and physical methods can bring to light invaluable information on the objects and their history, which in turn reflects know-how and life style of past societies. Art and archaeological objects are very diverse in terms of the materials they are made of. They are heterogenous composite materials and altered over time. Consequently, problems related to the fabrication, the raw material origin, the dating or the conservation of art objects can be very varied. Characteristic markers that can reveal such information are minor or trace elements, special isotope ratios or specific phases present in small amounts. Therefore, analytical strategies using complementary physical and chemical methods are developed as a function of the object material, the raised questions and the possibility to sample for the analyses or not. Non-invasive approaches are generally privileged because of the precious nature of the objects of our cultural heritage. Laboratory equipments but also large scale facilities such as synchrotron sources are used. Taking as examples the study of Lascaux cave paintings, pigments from Ancient Egypt and India as well as drawings made by Rembrandt, van Eyck or Dürer, the physico-chemical approach in the field is illustrated. Special method developments are emphasized and data interpretations within the archaeological or art-historical context discussed.

Invited Talk SYCH 1.3 Thu 15:00 HSZ 02

IPANEMA, A European research platform for the study of ancient and historical materials — •Loïc Bertrand — IPANEMA UPS-3352 CNRS, synchrotron SOLEIL, Gif-sur-Yvette cedex - FRANCE

The IPANEMA European research platform for ancient and historical materials (archaeology, artwork conservation, palaeontology and past environments) is under construction at the SOLEIL synchrotron (Saint-Aubin, France, 25 km SW Paris). The new building adjoining the SOLEIL synchrotron is due to open in 2012 to European and international users. The activities of the facility are centred on two fields: increased support to researchers and methodological research.

Since the opening of SOLEIL, IPANEMA supported more than 20 projects including works on pigment degradation in paintings, identification of rock art painting techniques and alteration, composition of musical instrument varnishes, provenancing of mediaeval archaeological ferrous artefacts. Once the platform is fully operational, user support will primarily take place within medium-term research projects adapted to hosted scientists.

IPANEMA research will focus on 2D/3D imaging and statistical image analysis of ancient materials, including through the setting-up of PUMA, a new hard X-ray beamline currently in its conceptual design phase.

Access to SOLEIL / IPANEMA for European user groups working on ancient materials is supported through FP7 CHARISMA (EC).

Invited Talk SYCH 1.4 Thu 15:30 HSZ 02

3D X-ray view of treasures — •Birgit Kanngiesser, Ioanna Mantouvalou, and Wolfgang Malzer — Technische Universität Berlin, Berlin, Deutschland

X-radiation is the light for going into the depth. It has the appropriate energy to penetrate and explore matter on a macroscopic as well as on an atomic scale. In atoms deep core holes can be created in order to investigate the fundamental reactions of the many electron system to this *deep* perturbation. Among these fundamental reactions is the emission of fluorescence light, which may be utilised as a highly sensitive *fingerprint* of the acting atom and its chemical environment. On the macroscopic scale matter can be illuminated and investigated within depths ranging up to the cm regime. X-ray fluorescence spectroscopy is a research and technology tool which benefits from both the radiation properties and instrument developments. Besides being a spectroscopy tool it is also a highly successful non-destructive analytical method for the determination of elemental composition in a large variety of fields of application.

The newest methodological development in X-ray fluorescence spectroscopy is its expansion into the depth with a confocal set-up for X-rays using X-ray optics. If the sample is scanned systematically in the lateral dimension as well as into the depth a 3D Micro X-ray Fluorescence Spectroscopy can be performed. Just from the beginning one main field of application of the method was art and cultural heritage. On the basis of examples the wide range of application of this 3D X-ray view of treasures is outlined.