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# Alain Tabbagh

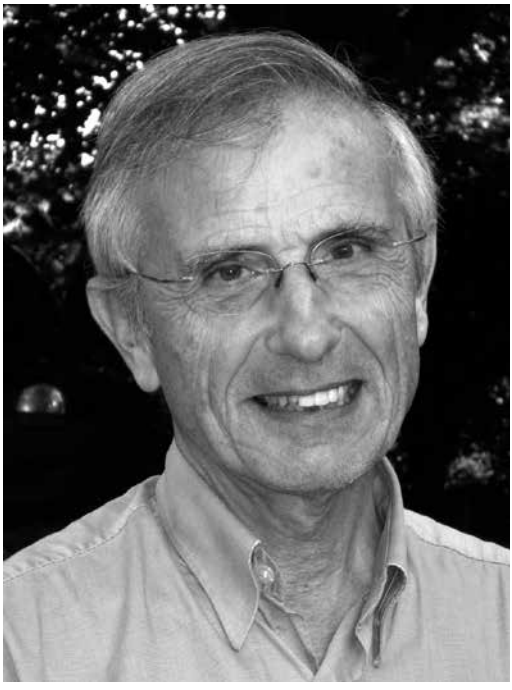

Photo: C. Tabbagh

Alain Tabbagh is one of the most eminent French geophysicists of the past 40 years. It is difficult to give an exhaustive overview of such a rich career, in which so many new avenues of research were initiated, that had barely been scratched before.

Having completed a PhD on the use of electromagnetic methods in archaeology under the direction of Albert Hesse in 1971, Alain Tabbagh became Assistant Lecturer at the University of Pierre et Marie Curie (UPMC) in 1972. He spent his entire career thereafter at the UPMC: Assistant Lecturer 1972–1978, Lecturer 1978–1984, Assistant Professor 1984–1988, Professor of applied geophysics 1988–2012, Professor Emeritus since 2012.

His research in geophysics concerns different applications, such as hydrology, soil science, civil engineering and archaeology. In the latter domain, he is one of the most eminent figures of French archaeometry. He is one of the founding members of the GMPCA in 1976 (Group for Physical and Chemical Methods in Archaeology, renamed Group for Interdisciplinary Methods Contributing to Archaeology in 1987) and presided over it from 1991 to 1995. He headed from 1988 to 1989 the Geophysical Research Center at Garchy, which was one of the pioneer institutions in Europe for the application of

geophysical methods in archaeology. He was also Director of the Sisyphe laboratory (renamed METIS in 2014) from 2001 to 2008. Alain Tabbagh is also member of several international societies: European Association of Geoscientists and Engineers (EAGE), Society of Economic Geologists (SEG), International Society for Archaeological Prospection (ISAP, honorary member since 2014), American Geophysical Union (AGU), International Union of Soil Sciences (IUSS), Institute of Electrical and Electronics Engineers (IEEE), and associated editor of various international journals.

As professor at the UPMC, he was Study Director of the engineering section in geophysics and geotechnics from 1992 to 2005, and Director of the postgraduate programme 'Sciences de l'Univers, Environnement, Ecologie' from 2004 to 2011. He supervised 40 PhD theses, including several in applied geophysics in archaeology, among them theses by Michel Dabas, Christophe Benech, Julien Thiesson and François-Xavier Simon. He has published more than 130 articles, demonstrating a broad range of research in the application of geophysics in archaeology.

With his extensive experience in both theoretical and experimental approaches, Alain Tabbagh initiated important developments in the EMI domain. For small-sized dipole-dipole instruments using the slingram configuration, he was the first to make the measurement of magnetic susceptibility possible by using the in-phase response and built the first stabilized EMI device for archaeology (SH3) as well as a large series of different instruments of similar type enabling simultaneous measurement of apparent magnetic susceptibility and apparent electric conductivity. He proposed also a 3D-modelling technique based on the moment method, taking into account contrasts both in conductivity and magnetic susceptibility, and calculated the theoretical response for the different coil orientations to estimate the most pertinent configuration for the best depth of investigation. He developed also new TDEM devices to measure the magnetic viscosity of archaeological structures. All these technical and theoretical innovations were decisive for a more extensive use of EMI methods in archaeology and not just in environmental studies. The measurement and characterization of different kinds of magnetization helped considerably with the interpretation of magnetic properties of soils and their relationship with human occupation. Experiments with these instruments in the field (including the EM15 by Geonics) improved the interpretation of the physical nature of responses (anomalies) produced on survey maps by specific archaeological targets. Alain Tabbagh participated or directed many successful field surveys, including such prominent projects like the search for Bronze Age deposits in Marchezieux, delimitation of ancient metallurgic workshops as revealed by direct measurement of the magnetic susceptibility of slag deposits and the exploration of pavements of diverse churches and other buildings.

He initiated the development of electrostatic devices with the use of non-galvanic arrays, particularly useful in urban contexts and less limited than with the GPR in the case of conductive soils. He developed systems for different depths and with different array configurations and established the 1D- and 3D interpretation of the data. Such

systems are particularly powerful in urban context and represent a good alternative to GPR devices when the penetration depth is limited by too conductive environments. Electrostatic systems have been used successfully for the study of the ancient topography of modern cities, like Tours in France and Alexandria in Egypt, and also for investigation inside historic buildings, like cathedrals.

As an alternative to traditional aerial archaeology, Alain Tabbagh developed new devices to measure the variations of surface temperature of the soils by using airborne and satellite infrared remote sensing as a thermal geophysical exploration method. Variation of soil temperature had already been used in aerial survey for the detection of archaeological structures like ditches, particularly when the snow is melting, which limited such investigations to a very short period during the year. By using a radiometer to measure radiation transmitted by ground soil, he carried out very impressive thermal surveys over wide areas, detecting Neolithic ring ditches and ancient land divisions. The use of the method was very limited due to the complexity of data processing and interpretation, but Alain Tabbagh computed the 3D numerical model, evaluated the thermal inertia contrasts and established the heat exchange conditions at the soil' surface favourable for surveying.

He also pursued a collaboration initiated by Albert Hesse during the 1980s with Polish colleagues Tomasz Herbich and Krzysztof Misiewicz. He participated in the publication of EM surveys with the SH3 on the sites of Słonowice and Milanówek and came back to Poland with Julien Thiesson in 2004 for the study of the pottery workshops in Stołpie.

His lifetime of work had impact on applied geophysics far beyond the specific context of archaeology that is summarised here in brief. However, it is for archaeological prospection that he invested his energy and enthusiasm and the many ways of research that he initiated are still being pursued by a younger generation of geophysicists. It is indeed a great gift to young students who are starting on their PhD to give them visionary and innovative subjects of research to help them find a place for themselves in the scientific community.

*Christophe Benech and Albert Hesse*