

PROJECT FINAL REPORT

Grant Agreement number: ERG 268404

Project acronym: IDIS

Project title: Identification by Isotopes for human provenance

Funding Scheme: PEOPLE- Marie Curie Actions - ERG grant

Period covered: from June 2011 to February 2013

Name of the scientific representative of the project's co-ordinator¹, Title and Organisation:

Prof. Gareth Davies

Deep Earth Cluster – Faculty of Earth and Life Sciences

Vrije University Amsterdam

1085 De Boelelaan, 1081HV Amsterdam, The Netherlands

Tel:+31205987329

E-mail: g.r.davies@vu.nl

Project website² address:

<http://www.falw.vu.nl/en/research/earth-sciences/deep-earth-and-planetary-science-cluster/research/isotope-provenancing/index.asp>

¹ Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.

² The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

4.1 Final publishable summary report

4.1.1 Executive summary

Stable ($\delta^2\text{H}$, $\delta^{18}\text{O}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$) and radiogenic (Sr and Pb) isotopes are becoming used in human provenancing studies in forensic sciences to track the origin and movements of humans. The isotopic composition in human tissues, acquired through dietary intake has been shown to have a general correlation with the isotopic composition of the environment (i.e. drinking water, soil, pollution). In forensic sciences, isotopic methods, mostly on stable isotopes, have been recently applied to track the place of origin and recent movements of present-day deceased unidentified individuals sometimes related to murder cases. Used as forensic intelligence, the isotopic data has been combined with DNA to aid identification. Despite the potential of the isotopic methods their application is still limited and the huge potential of combining multiple isotopic systems to provide provenance information is almost unrecognized. This project is designed to undertake some of the basic validity studies required to assess the actual potential of the methodology.

The results derived from this project have demonstrated the potential of the multi-isotope method in accurately identifying regions of origin of unknown individuals. The results have been used for forensic intelligence in investigations by the Dutch police in The Netherlands and by the Dutch Army. This project has demonstrated that the multi-isotope method provides robust information and proves very valuable when other methodologies such as DNA are not useful or have failed.

4.1.2 Project context and objectives

Stable ($\delta^2\text{H}$, $\delta^{18}\text{O}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$) and radiogenic (Sr and Pb) isotopes are used in human provenancing studies in forensic sciences to track the origin and movements of humans. The isotopic composition in human tissues, acquired through dietary intake has been shown to have a general correlation with the isotopic composition of the environment (i.e. drinking water, soil, pollution). In forensic sciences, isotopic methods, mostly on stable isotopes, have been recently applied to track the place of origin and recent movements of present-day deceased unidentified individuals sometimes related to murder cases. Used as forensic intelligence, the isotopic data has been combined with DNA to aid identification.

Despite the potential of the isotopic methods their application is still limited and the huge potential of combining multiple isotopic systems to provide provenance information is almost unrecognized. This study, therefore, aimed to rigorously evaluate the capabilities of a multi-isotopic approach by combining isotopic ratios of both light and heavy elements. In this study multi-isotope analysis $\delta^2\text{H}$ - $\delta^{18}\text{O}$ - $\delta^{13}\text{C}$ - $\delta^{15}\text{N}$ -Sr-Pb have been analysed in human tissues, such as hair and teeth from human volunteers to validate and further develop the multi-isotope method. The isotopic data analysed in hair and teeth from donors in The Netherlands has been used to build isotope databases of bio-available elements in the environment in The Netherlands. In addition, these data have been used to test correlations with environmental isotopic data, such as drinking water, soil, street dust, etc. available from data bases and from samples collected around The Netherlands and neighboring countries.

After the validation phase, one of the objectives of the project was to apply the multi-isotopic technique on 3-5 blind studies already solved by the NFI. However, in mid-2011 the project priorities changed, due to the initiation of a large project together with the Amsterdam-Amstelland Police in The Netherlands. The project consisted on applying the isotope method to a number of cold case investigations (n=12) to help identifying the geographical place of origin of unidentified individuals found dead in the Amsterdam area during the last 20-15 years and who had remained unidentified until the present time. This project was established in 2011 but was carried out during the second part of this project (July 2011-February 2013). One of the unidentified individuals from one of these cold cases was identified during the process of the isotope investigation by the police using "standard" investigative techniques. This case was therefore used for validation purposes.

Other cases in collaboration with the Dutch police and with the Recovery Unit of the Royal Dutch Army provided successful results that were used also for validation purposes of the method. More details about these cases are explained in section 4.1.3.

One objective of the initial project was to obtain different types of bones, hair and teeth from individuals from autopsies to test the homogeneity of isotope composition within individuals that always lived in The Netherlands and from individuals that moved from abroad to The Netherlands and some point in their lives. Despite having reached an agreement with the VU-Medical Center specialists and having had numerous meetings since the start of the project in 2010, it was not possible to obtain the autopsy samples for the research, because detailed information about the patient life could not be retrieved that was essential for our study. This part of the project could not be completed during the grant period but we are, however, still pursuing this study through other laboratories in The Netherlands.

Overall, this project has demonstrated that the multi-isotope method provides robust information and aids the police in their investigation to help identify the place or origin of unidentified individuals. This method is proving very valuable when other methodologies are not useful or have failed.

4.1.3 Main results

- (1) Testing and validating the optimal cleaning protocols of human hair to remove external surface contamination for subsequent isotope analysis, specifically for Sr and Pb, of hair keratin. The methods used (a) chloroform, methanol and milli-q water and (b) leaching the hair for few seconds with 0.2M HNO₃ acid. The cleaning protocols were tested using hair from individuals (donors) that lived in The Netherlands and did not travel. When the most efficient cleaning protocol was established, Sr and Pb isotope analysis were carried out along hair of a woman who moved from India to The Netherlands. This test was carried out to study the potential of using Sr and Pb isotope ratios in human hair to determine mobility. The main result was that such elements are useful if the Sr and Pb isotope composition of the origin and destination locations have contrasting isotope composition. The same experiments were carried out using facial hair of a man traveller that moved from The Netherlands to the USA and back. This study was presented as a poster presentation in the 19th IAFS – International Association of Forensic Sciences Conference in Madeira, Portugal, September 2011. This work was also published in the Journal of Analytical Atomic Spectrometry in 2012.
- (2) Testing existing cleaning protocols of hair samples for stable isotope analysis ($\delta^2\text{H}$, $\delta^{18}\text{O}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$) of human hair. A full validation report was written establishing factors such as the weight range of hair sample ideal for an accurate and precise isotope analysis for either $\delta^{13}\text{C}$ - $\delta^{15}\text{N}$, and $\delta^2\text{H}$ - $\delta^{18}\text{O}$, gas flows, GC column, linearity, etc. In the case of $\delta^{18}\text{O}$ analysis, it was established that interferences with N₂ were taking place and improvement of the analytical method was necessary. This development work is now planned for after the end of the project.
- (3) Establishing the best technique for separation of collagen protein from bone was also tested and validated using existing methods. The existing published methods were used for archaeological bone, thus small modifications were applied for modern bone. Once the method was established, we continued validating the analysis of $\delta^{13}\text{C}$ - $\delta^{15}\text{N}$ values in bone collagen, optimising the weight range necessary for a precise and accurate analysis.
- (4) Validation and development of $\delta^{18}\text{O}$ analysis in phosphates. The objective was to develop a method to analyse $\delta^{18}\text{O}$ values in the phosphate phase of bone bio-apatite and tooth enamel. The method was established and resulted in successful analysis of tooth enamel samples but further improvement is necessary in bone bio-apatite. The $\delta^{18}\text{O}$ values in the phosphate phase in tooth

enamel was compared to $\delta^{18}\text{O}$ values in the same samples analysed in the carbonate phase. The data showed a good correlation comparable to published results of other studies. The main conclusion was that $\delta^{18}\text{O}$ analysis in enamel carbonate produced accurate and precise results. Moreover, this method is faster and more efficient than separating and analysing the phosphate phase from tooth enamel.

- (5) Validation and testing sample preparation protocols of tooth enamel such as surface cleaning, drilling and sample dissolution for Sr-Pb isotope analysis. Sr and Pb fractions were separated from the same dissolved sample aliquot. Sample amounts were established to obtain adequate Sr and Pb concentrations for precise and accurate analysis. Tests to minimise the amount of samples required were validated in the second half of the project establishing that sub milligram sample sizes are viable.
- (6) Collection of water samples, soil samples and hair samples from around the Netherlands and abroad was started by the researcher of the project and collaborators as well as with collaboration of the Dutch police around The Netherlands. Isotope analysis of the samples were carried out with the purpose of building an isotope database of bio-available elements in The Netherlands and neighbouring countries. Available isotope databases and published relevant data such as Pb isotopes in teeth from different countries, $\delta^{18}\text{O}$ - $\delta^2\text{H}$ isotope data of precipitation around the world and Sr isotope data of geology and bio-available Sr from different parts of the world, for instance, were collected and collated for building a database. This task started at the beginning of the project and continued through out and will be an ongoing action in the new employment of the researcher.
- (7) The researcher (Dr. Laura Font), project coordinator (Prof. Gareth Davies) and collaborators of the project at the Netherlands Forensic Institute - NFI (Dr. Gerard van der Peijl, Dr. Els van Wetten and Dr. Wim Heijnen) met regularly, every 6 months, to evaluate project objectives during the following 6 months period and evaluate the progress reports and validation reports of the techniques that were written and submitted to NFI. Dr. Laura Font was validated as an expert for the application of the isotope method for human provenancing for police case investigations by the NFI and external expert Prof. Peter Horn from the Department of Earth and Environmental Sciences – Ludwig Maximilians University Munich, after all the validation of methods were completed.
- (8) The researcher, Dr. Laura Font, worked on a police case investigation as a “blind study” and as part of the validation as an expert. The case was investigated by isotope experts Prof. Peter Horn (Munich), Prof. Gareth Davies (VU) and Dr. Gerard van der Peijl (NFI). The results of both parties were compared at the end of the investigation. The conclusions established by the experts and researcher were in agreement and the arguments and protocols used by Dr. Font were evaluated as optimal by the experts.
- (9) A collaboration with dentists from the aural surgery department of the Vrije University Amsterdam Medical Centre (VUmc) was set up to collect third molar samples from donor patients. The objective was to obtain third molars from patients born and living always in The Netherlands and patients that moved during childhood from abroad into the Netherlands. Sr, Pb and $\delta^{18}\text{O}$ isotopes were analysed to test the variations in isotope composition between Dutch and foreign born individuals and also to set up a database of bio-available Sr-Pb and oxygen in The Netherlands and abroad.
- (10) Two bachelor thesis (Simone Mooibroek and Kay Vogel) were completed during this period as part of the validation and method development of $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ analysis in human hair. The thesis of Simone Mooibroek concentrated on establishing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ variations in groups of people living in The Netherlands but potentially following different types of diet due to their different cultural background. Simone acquired samples from Dutch students of a school in Nijmegen and from

foreign students (mostly Asian) attending the same school. The results show that most of the students, Dutch and foreign, followed a standard omnivore diet with comparable $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values and no major influence of different culture in diet were observed. The thesis of Kay Vogel focused on analysing $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values in hair of individuals travelling and group of individuals from the same family following the same diet and consuming the same products. The main result was that travellers showed $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ changes during travel due to access of different food types (i.e. travelling to USA vs Europe – maize vs wheat) and also individuals from the same family and consuming the same food showed differences due to variations in the metabolism (i.e. men vs women).

- (11) A project was established in collaboration with the Amsterdam-Amstelland Police (The Netherlands) – application of the isotope method to a number of unidentified individuals (n=12) found during the last 20-15 years in the Amsterdam area and remained unidentified until present time. This project was established in 2011 and the analytical and interpretation of results started in July 2011. From this project one of the unidentified individuals from one case became identified during the course of the isotope investigation. The cold case team and researchers at VU (Dr. Font and Prof Davies) and NFI (Dr. Van der Peijl) decided to use this case for validation of the isotope method. The results of the multi-isotope study proved to be successful, and suggested a region in Eastern Europe including parts of Poland and The Carpathian region. The individual originated from South Poland. This study has been submitted to Science and Justice for a publication.
- (12) A project in collaboration with the Dutch Army for the identification of two World War II soldiers was established. Since DNA, dental records and other methodologies did not provide the identity of these two casualties, isotope analysis were conducted to try to established the place of origin of the two casualties. The isotope results suggested a provenance from the United Kingdom. These results were later confirmed by some of the remains of equipment found with the bodies, which indicated the individuals belonged to the British Royal Marines. The results of this study will be published in Science and Justice in 2014 (proofs returned).
- (13) A project in collaboration with the Dutch police (Utrecht Police) was arranged in 2012 to do a multi-isotope study on remains from a body of a girls found in 1976 near Utrecht – “The girl from Heul case”. The isotope results suggested a provenance from Germany. This is a still ongoing investigation. The isotope results for this case together with other results for this investigation have been broadcasted in a TV program on the Dutch television (<http://www.uitzendinggemist.nl/afleveringen/1342176>) and in numerous news papers (i.e. <http://www.volkskrant.nl/vk/nl/2686/Binnenland/article/detail/3399331/2013/02/25/Nieuw-onderzoek-werpt-sprankje-licht-op-moordzaak-Heulmeisje-1976.dhtml>)
- (14) Other successful cases in collaboration with the Dutch police were: a) analysis of scalp hair from a lady found dead in the water. The isotope results suggested a provenance from Germany, which was later validated as the place where she was living before death; b) analysis of hair and umbilical cord from a baby foundling. The isotope analysis suggested a provenance of the baby and mother from southern Germany. Thanks to a match found of DNA with another baby abandoned three years previously, the identity of the mother could be found and also confirmed a provenance from South Germany, as suggested by the multi-isotope study.
- (15) Another collaboration was set up with researchers at Naturalis museum in Leiden involving a case related to finding the geographical place of origin of a wolf found shot dead in The Netherlands. The question was if wolfs were living in The Netherlands or the wolf was shot elsewhere and transported to The Netherlands to hide the crime. The isotope results suggested that the wolf came from packs

living in Eastern Europe. This research was published in LUTRA Journal of the Dutch Mammal Society.

4.1.4 Ethical issues/review

An ethical approval was awarded to the project through the medical centre of the Vrije Universiteit VUmc, ultimately approved by the national ethical commission. The review was required as the research involved donated human hair and teeth samples. Anonymous questionnaires approved by the VUmc ethical where completed by donors to provide information concerning diet and geographic movement. Sample storage in locked refrigerators and the ultimate destruction of all human tissue were a condition of granting the ethical approval. The project has complied with all terms and conditions stipulated associated with the ethical approval.

4.1.5 Potential impact and dissemination activities

The results of the multi-isotope studies have been published in scientific peer reviewed journals (JAAS and Science and Justice; see table A1) and international conferences (see table A2). The isotope results of police investigations have also been broadcasted in the Dutch television (<http://www.uitzendinggemist.nl/afleveringen/1342176>) and Dutch newspapers (see table A2). (i.e. <http://www.volkskrant.nl/vk/nl/2686/Binnenland/article/detail/3399331/2013/02/25/Nieuw-onderzoek-werpt-sprankje-licht-op-moordzaak-Heulmeisje-1976.dhtml>)

Numerous presentations of the method have been given to the Dutch police and prosecutors in The Netherlands to disseminate the potential of the multi-isotope method for forensic intelligence in police investigations. The majority of presentations have been in open talks at the NFI and in workshops given by the NFI to police investigators. Other presentation have been in private as discussing the details of a particular case cannot occur in public.

A logo for this project was designed (by Joanne Davies), which was used in presentations and for promoting the project when samples were requested to the VUmc dentist from patients (see point 9 in section 4.1.3).



4.2 Use and dissemination of foreground

Section A (public)

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES										
NO.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers ³ (if available)	Is/Will open access ⁴ provided to this publication?
1	Strontium and lead isotope ratios in human hair: investigating a potential tool for determining recent human geographical movements	Laura Font	Journal Analytical Atomic Spectrometry	No 27, March 2012	Royal Society of Chemistry	Cambridge	2012	719-732		no
2	Provenancing of unidentified World War II casualties: application of strontium and oxygen isotope analysis in tooth enamel	Laura Font	Science and Justice	Accepted January 2014	Elsevier	The Netherlands	2014			no
3	Identification of the geographical place of origin of an unidentified individual by multi-isotope analysis	Laura Font	Science and Justice	Under review	Elsevier	The Netherlands	2014			no
4	The first wolf found in the Netherlands in 150 years was the victim of a wildlife crime	Barbara Gravendeel	Lutra	2013 56(2):93-109	Zoogdierverseniging	The Netherlands	2013	93-109		yes

³ A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

⁴ Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES

NO.	Type of activities ⁵	Main leader	Title	Date/Period	Place	Type of audience ⁶	Size of audience	Countries addressed
1	<i>Conference</i>	Y	<i>4th FIRMS</i>	<i>April 2010</i>	<i>Washington DC, USA</i>	<i>Researchers, Government institutions</i>	<i>100</i>	<i>International</i>
2	<i>Conference</i>	Y	<i>19th IAFS</i>	<i>September 2011</i>	<i>Madeira, Portugal</i>	<i>Researchers, Medical Doctors</i>	<i>2000</i>	<i>International</i>
3	<i>Conference</i>	Y	<i>BAHID</i>	<i>April 2012</i>	<i>Nottingham, UK</i>	<i>Researchers</i>	<i>50</i>	<i>European</i>
4	<i>Conference</i>	Y	<i>EAFS</i>	<i>Auguts 2012</i>	<i>Den Haag, The Netherlands</i>	<i>Researchers, Government institutions</i>	<i>2000</i>	<i>International</i>
5	<i>Conference</i>	Y	<i>5th FIRMS</i>	<i>October 2013</i>	<i>Montreal, Canada</i>	<i>Researchers, Government institutions</i>	<i>100</i>	<i>International</i>
6	<i>Conference</i>	Y	<i>The analytical Challenge</i>	<i>October 2013</i>	<i>Utrecht, The Netherlands</i>	<i>Researchers, Industry</i>	<i>200</i>	<i>European</i>
	<i>Conference</i>		<i>Gerard Aussie and Chicago</i>					
7	<i>Press release</i>		<i>The Volkskrant</i>	<i>February 2013</i>	<i>The Netherlands</i>	<i>Society</i>	<i>National</i>	<i>The Netherlands</i>
8	<i>TV program</i>		<i>Een Vandaag</i>	<i>May 2013</i>	<i>The Netherlands</i>	<i>Society</i>	<i>National</i>	<i>The Netherlands</i>
9	<i>Press release</i>		<i>AdValvas</i>	<i>September 2013</i>	<i>The Netherlands</i>	<i>Society, University students</i>	<i>University wide</i>	<i>The Netherlands</i>

⁵ A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

⁶ A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).

10	<i>Press release</i>		<i>De Kijk Magazine</i>	January 2014	The Netherlands	<i>Sanoma Media Nederlands B.V.</i>	National	The Netherlands
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4.3 Report on societal implications

A General Information <i>(completed automatically when Grant Agreement number is entered.</i>	
Grant Agreement Number:	268404
Title of Project:	Identification by isotopes for human provenance
Name and Title of Coordinator:	Professor Gareth Davies
B Ethics	
1. Did your project undergo an Ethics Review (and/or Screening)? <ul style="list-style-type: none"> If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? <p>Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 'Work Progress and Achievements'</p>	Yes
2. Please indicate whether your project involved any of the following issues (tick box) :	YES
RESEARCH ON HUMANS	
• Did the project involve children?	NO
• Did the project involve patients?	NO
• Did the project involve persons not able to give consent?	NO
• Did the project involve adult healthy volunteers?	YES
• Did the project involve Human genetic material?	NO
• Did the project involve Human biological samples?	YES
• Did the project involve Human data collection?	YES
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	NO
• Did the project involve Human Foetal Tissue / Cells?	NO
• Did the project involve Human Embryonic Stem Cells (hESCs)?	NO
• Did the project on human Embryonic Stem Cells involve cells in culture?	NO
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	NO
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	YES
• Did the project involve tracking the location or observation of people?	NO
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	NO
• Were those animals transgenic small laboratory animals?	NO
• Were those animals transgenic farm animals?	NO
• Were those animals cloned farm animals?	NO
• Were those animals non-human primates?	NO
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	NO
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	NO
DUAL USE	
• Research having direct military use	X No

• Research having the potential for terrorist abuse		NO
C Workforce Statistics		
3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).		
Type of Position	Number of Women	Number of Men
Scientific Coordinator	1	0
Work package leaders	1	2
Experienced researchers (i.e. PhD holders)	1	2
PhD Students	0	0
Other	0	0
4. How many additional researchers (in companies and universities) were recruited specifically for this project? On student assistant		1
Of which, indicate the number of men:		0

D Gender Aspects		
5. Did you carry out specific Gender Equality Actions under the project?	<input type="radio"/> X	Yes No
6. Which of the following actions did you carry out and how effective were they?		
	Not at all effective	Very effective
<input type="checkbox"/> Design and implement an equal opportunity policy	○ ○ ○ ○ ○	○ ○ ○ ○ ○
<input type="checkbox"/> Set targets to achieve a gender balance in the workforce	○ ○ ○ ○ ○	○ ○ ○ ○ ○
<input type="checkbox"/> Organise conferences and workshops on gender	○ ○ ○ ○ ○	○ ○ ○ ○ ○
<input type="checkbox"/> Actions to improve work-life balance	○ ○ ○ ○ ○	○ ○ ○ ○ ○
<input type="radio"/> Other: <input style="width: 200px;" type="text"/>		
7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?		
<input type="radio"/> Yes- please specify <input style="width: 150px;" type="text"/>		
<input type="radio"/> No		
E Synergies with Science Education		
8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?		
<input type="radio"/> Yes- please specify <input style="width: 150px;" type="text"/>		
X No		
9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?		
<input type="radio"/> Yes- please specify <input style="width: 150px;" type="text"/>		
X No		
F Interdisciplinarity		
10. Which disciplines (see list below) are involved in your project?		
<input type="radio"/> Main discipline ⁷ : Forensic Science		
<input type="radio"/> Associated discipline ⁷ : Earth and related environmental sciences	<input type="radio"/>	Associated discipline ⁷ :
G Engaging with Civil society and policy makers		
11a Did your project engage with societal actors beyond the research community? (if 'No', go to Question 14)	X	Yes No
11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?		
<input type="radio"/> No		
<input type="radio"/> Yes- in determining what research should be performed		
X Yes - in implementing the research		
X Yes, in communicating /disseminating / using the results of the project		

⁷ Insert number from list below (Frascati Manual).

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	<input type="radio"/> <input checked="" type="radio"/>	Yes No
12. Did you engage with government / public bodies or policy makers (including international organisations)		
<input type="radio"/> No <input checked="" type="radio"/> Yes- in framing the research agenda <input checked="" type="radio"/> Yes - in implementing the research agenda <input checked="" type="radio"/> Yes, in communicating /disseminating / using the results of the project		
13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers? <input checked="" type="radio"/> Yes – as a primary objective (please indicate areas below- multiple answers possible) <input type="radio"/> Yes – as a secondary objective (please indicate areas below - multiple answer possible) <input type="radio"/> No		
13b If Yes, in which fields?		
Agriculture Audiovisual and Media Budget Competition Consumers Culture Customs Development Economic and Monetary Affairs Education, Training, Youth Employment and Social Affairs	Energy Enlargement Enterprise <input checked="" type="checkbox"/> Environment External Relations External Trade Fisheries and Maritime Affairs Food Safety Foreign and Security Policy Fraud Humanitarian aid	Human rights Information Society Institutional affairs Internal Market <input checked="" type="checkbox"/> Justice, freedom and security Public Health Regional Policy <input checked="" type="checkbox"/> Research and Innovation Space Taxation Transport

13c If Yes, at which level?		
<input checked="" type="checkbox"/>	Local / regional levels	
<input checked="" type="checkbox"/>	National level	
<input checked="" type="checkbox"/>	European level	
<input checked="" type="checkbox"/>	International level	
H Use and dissemination		
14. How many Articles were published/accepted for publication in peer-reviewed journals?	3	
To how many of these is open access⁸ provided?	0	
How many of these are published in open access journals?		
How many of these are published in open repositories?		
To how many of these is open access not provided?	3	
Please check all applicable reasons for not providing open access:		
<input type="checkbox"/> publisher's licensing agreement would not permit publishing in a repository <input type="checkbox"/> no suitable repository available <input checked="" type="checkbox"/> no suitable open access journal available <input type="checkbox"/> no funds available to publish in an open access journal <input type="checkbox"/> lack of time and resources <input type="checkbox"/> lack of information on open access <input type="checkbox"/> other ⁹ :		
15. How many new patent applications ('priority filings') have been made? <i>("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).</i>		
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	
	Registered design	
	Other	
17. How many spin-off companies were created / are planned as a direct result of the project?	0	
<i>Indicate the approximate number of additional jobs in these companies:</i>	0	
18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:		
<input type="checkbox"/> Increase in employment, or	<input type="checkbox"/> In small & medium-sized enterprises	
<input type="checkbox"/> Safeguard employment, or	<input type="checkbox"/> In large companies	
<input type="checkbox"/> Decrease in employment,	<input type="checkbox"/> None of the above / not relevant to the project	
<input checked="" type="checkbox"/> Difficult to estimate / not possible to quantify		
19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (FTE = one person working fulltime for a year) jobs:	<i>Indicate figure:</i> 1.3	

⁸ Open Access is defined as free of charge access for anyone via Internet.

⁹ For instance: classification for security project.

Difficult to estimate / not possible to quantify	<input type="checkbox"/>
I Media and Communication to the general public	
20. As part of the project, were any of the beneficiaries professionals in communication or media relations?	
<input type="radio"/> Yes	<input checked="" type="radio"/> No
21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?	
<input type="radio"/> Yes	<input checked="" type="radio"/> No
22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?	
<input checked="" type="checkbox"/> Press Release	<input type="checkbox"/> Coverage in specialist press
<input checked="" type="checkbox"/> Media briefing	<input checked="" type="checkbox"/> Coverage in general (non-specialist) press
<input checked="" type="checkbox"/> TV coverage / report	<input checked="" type="checkbox"/> Coverage in national press
<input type="checkbox"/> Radio coverage / report	<input type="checkbox"/> Coverage in international press
<input checked="" type="checkbox"/> Brochures /posters / flyers	<input checked="" type="checkbox"/> Website for the general public / internet
<input type="checkbox"/> DVD /Film /Multimedia	<input checked="" type="checkbox"/> Event targeting general public (festival, conference, exhibition, science café)
23 In which languages are the information products for the general public produced?	
<input type="checkbox"/> Language of the coordinator	<input checked="" type="checkbox"/> English
<input checked="" type="checkbox"/> Other language(s)	

Question F-10: Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES

- 1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]
- 1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)
- 1.3 Chemical sciences (chemistry, other allied subjects)
- 1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)
- 1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2. ENGINEERING AND TECHNOLOGY

- 2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)
- 2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]
- 2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as

geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

- 3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immuno-haematology, clinical chemistry, clinical microbiology, pathology)
- 3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)
- 3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

- 4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)
- 4.2 Veterinary medicine

5. SOCIAL SCIENCES

- 5.1 Psychology
- 5.2 Economics
- 5.3 Educational sciences (education and training and other allied subjects)
- 5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary, methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

- 6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)
- 6.2 Languages and literature (ancient and modern)
- 6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]

2. FINAL REPORT ON THE DISTRIBUTION OF THE EUROPEAN UNION FINANCIAL CONTRIBUTION

This report shall be submitted to the Commission within 30 days after receipt of the final payment of the European Union financial contribution.

Report on the distribution of the European Union financial contribution between beneficiaries

Name of beneficiary	Final amount of EU contribution per beneficiary in Euros
1.	
2.	
n	
Total	