Programme title: **EARTHTIME – The European Contribution**
Programme acronym: **"EARTHTIME-EU" (with global dimension)**
Acronym of Standing Committee: LESC
Acronym(s) of additional Standing Committee(s): not applicable
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Keywords: (max 5) Geological Time Scale; radio-isotope dating; astronomical calibration; magnetostratigraphy; biostratigraphy

Abstract: (max 300 words)

This Research Network Programme (RNP) proposal is part of a broader international initiative "EARTHTIME: a community-based scientific effort aimed at sequencing Earth history through an integrated geochronologic and stratigraphic approach". The ambition is to broaden the EARTHTIME platform in Europe with this RNP, which combined with a proposed FP7 Marie-Curie Initial Training Network ("GTS_{next}"), will also serve as the basis for wider outreach towards the Earth Science community, and allow crucial construction of databases and teaching activities with a global dimension.

The Geological Time Scale (GTS) is the fundamental measurement yardstick and the key to reconstruct Earth history. We want to (1) develop a next generation fully integrated GTS for the last 100 million years, and (2) exploit the scientific predictions arising from this improvement. This time scale, with unprecedented accuracy, precision, resolution and stability, can be achieved by integrating independent dating techniques. The numerical calibration of the GTS is the main focus of the GTS_{next}-ITN. With the RNP we specifically aim to link the much improved numerically calibrated time scale with other stratigraphic disciplines to arrive at a fully integrated GTS.

Combining the RNP with GTS_{next}, the expected scientific contributions and breakthroughs are 1) new insights into key geological processes including climate change, catastrophic impacts, and volcanic hazards, 2) a stable time scale that is beneficial for academia and industry, 3) full integration and intercalibration of different numerical dating and stratigraphic techniques, leading to 4) significant improvement in the consistency of these techniques; 5) progress towards a fully astronomically-tuned and stratigraphically integrated GTS over the last 100 million years.

A fundamental comprehension of geological time and the time scales at which key processes occur is appropriate in view of the impact we have on System Earth. The website for the EARTHTIME-EU contribution is http://www.earthtime-eu.eu.

Previous or concurrent applications to the ESF:
ESF RNP Call 2007: 07-RNP-026
ESF Exploratory Workshop
"Earthtime: The European Contribution - Integration of High-Precision Geochronology and Astronomical Tuning for Calibration of the Cenozoic and Mesozoic Timescales". Amsterdam, Netherlands, 22 - 24 April 2007. Ref: EW06-046.
Non-ESF: Proposal under the Marie-Curie Training Network Call FP7-PEOPLE-2007-1-1-ITN ("GTSnext", currently under evaluation in Stage 2). NOTE: the current RNP proposal is envisaged as a broader Network initiative, while the Marie-Curie proposal specifically aims to train young researchers.

Research field, scientific context, objectives and envisaged achievements:

Research field:

This proposal aims to facilitate an ESF Research Network Programme that brings together the European and pan-European specialists in the Research Field of developing and improving the Geological Timescale. It results from a successful ESF sponsored Exploratory Workshop, held in April 2007. Knowledge and understanding of detailed ages and durations of events, and therefore rates of processes, are the fundamental basis for Earth System Science in general, and crucial for tackling current challenges such as driving forces and feedbacks at the global scale and understanding abrupt or extreme changes in the Earth System in particular. We plan an ongoing exchange between the refinement and development of detailed age scales with direct applications to elucidate, e.g., mechanisms of climatic change. This Network Programme fits directly into most EU national science funding agencies' key challenges and strategies.

Scientific context:

The need for much improved knowledge of the durations and ages of climatic and geological events, such as the Palaeocene-Eocene Thermal Maximum (~55 million years ago), has become urgent within the Earth science and climate modelling communities. The exact dating and timing of fluxes into and out of the marine carbon reservoir can differentiate between competing hypotheses of climatic change. Highly detailed reconstructions of Earth history allow us to assess whether past climatic change can be used as an analogue for the current and future change of ocean acidification and climate. The Earthtime project, and this RNP application, are an international effort with the goal to further this quest for a well calibrated and stable time scale that will allow more precise dating of rock layers and minerals (Kuiper et al., 2008).

Radioisotopic dating methods have a small but significant error that hinders our ability to assess geologically short-lived climate events. For instance, the most widely used method for the Cenozoic era is $^{40}Ar/^{39}Ar$, which has an error of up to 2.5% and few tie points of known age. Yet, over the last two decades much progress has been made in exploiting the imprint of Earth's orbital variations in palaeoclimatic records. This has dramatically increased the potential age resolution of approaches like cycle-counting and pattern matching, to less than 40,000 years throughout much of Cenozoic time (the past ~66 million years, Pälike & Hilgen, 2008).

Unfortunately, there have been a number of inconsistencies and discrepancies between ages and durations derived from radioisotopic and astronomical dating. What is now needed is a more systematic and co-ordinated approach to provide a detailed intercalibration of radioisotopic clocks (U-Pb, Ar-Ar methods), the rock standards that are used for these methods, and geological tie-points with astronomical ages. At the same time, Cenozoic palaeoclimatic compilations need to be improved by closing existing gaps, verifying data from single sites, and supplementing the database of magneto- and biostratigraphy so we can improve the accuracy of existing age calibrations.

For all Earth Science applications time is a fundamental, essential for the integration of disparate datasets, unravelling cause and effect relationships (not only in the climate context), and for the quantification of rates and durations of geological processes. Temporal relationships are often the key to causality arguments in Earth Sciences, for example between environmental and biological change during mass extinction events. The Geological Time Scale (GTS) is instrumental for the quantification of geological time. However, published time scales are commonly based upon a limited number of geochronological tie-points of variable quality, and derivative age models that are of different and widely disparate quality. The accuracy and resolution of such time scales are also variable, generally in the order of 1 to 0.5% at best. Large uncertainties - on the order of several millions of years - still exist in our

estimates for the age and duration of key geological intervals. The integration of revised numerical ages with key stratigraphic information requires a concerted and coordinated approach at the European level to tackle these important research questions, and we thus seek a broad collaborative effort through workshops, outreach and scientific exchange activities.

Objectives and envisaged achievements:

The principal scientific objective of the network is to link the much improved numerical calibration of the GTS that comes out of the ITN to other stratigraphic disciplines (bio-, magneto-, chemo-, and cyclostratigraphy) in order to arrive at a fully integrated GTS for the last 100 million years. Such a time scale, with its stratigraphic underpinning, underlies all fields in the Earth Sciences. The broader stratigraphic community that will work on the integration can also directly start to apply the new time scale. Thus biostratigraphers can have a much more precise look at evolution and the influence of environmental changes, magnetostratigraphers are interested in reversal history and frequency, sequence stratigraphers in the potential link to eccentricity, cyclostratigraphers at the possible orbital control on sequence stratigraphy and long-period hypothermals and ocean anoxic events, astronomers are eager to find out about the expression of the chaotic behaviour of the Solar System. To achieve both objectives, Earthtime-EU will bring together acknowledged expertise in all sub-disciplines of time scale calibration techniques found within the European Earth Science community, with a strong cross-disciplinary character including astronomers, the radioisotopic dating community, the wider stratigraphic community as well as climate scientists, industry, and the Integrated Ocean Drilling Program and similar initiatives. This European-centred effort (http://www.earthtime-eu.eu), which will be closely linked to a broader international initiative EARTHTIME (www.earth-time.org), focuses on (1) the integration and intercalibration of these techniques in order to exploit both their strengths and to address their weaknesses, and specifically (2) a major effort to intercalibrate different bio-, magneto- and cyclostratigraphic efforts under a strategic umbrella. Increased communication and cooperation between the different communities will result in a fundamental change in the approach Earth scientists take in quantifying geological time. The achievements are planned to be supported through several different strands:

1) Training of a new generation of PhDs and PostDocs is envisaged within the framework of a Marie Curie ITN (FP7-PEOPLE-2007-1-1-ITN, submitted proposal "GTS_{next}", currently in Stage 2 of evaluation).
2) A broader networking component of stratigraphers is envisaged under this RNP proposal, involving principal investigators, key collaborators, and the PhD and Postdoc cohort, all from the wider science community (open calls). This will provide integration and synthesis of the results from (1), and result in applications such as better understanding of climatic changes for the past and future. This proposed effort will be made wholly in concert with the continuously ongoing work by IUGS/ICS to improve the GTS.

Supported by these programmes, geochronologists will be fully capable to apply and evaluate the various state-of-the-art dating techniques for the first time.

Expected breakthroughs of the Earthtime-EU RNP are:

- Exchange of expertise, multi-disciplinary training, and teaching for the next generation of young multi-disciplinary geochronologists with established laboratories and key researchers in a pan-European context.
- Strengthening the ties between researchers across Europe (particularly new EU member countries) as stratigraphic data from Eastern European and circum-Mediterranean countries will be indispensable to reach the formulated targets
- Development of extensive outreach activities encompassing the direct network specific topics as well as highlighting the direct application of this science to societal challenges, including climatic change on different time scales. Outreach will be achieved through development of teaching materials ("e-learning"), workshops, Summer schools, production of displays and exhibits, and through a dedicated website, hosted at http://www.earthtime-eu.eu.

- Development of an integrated stratigraphic database that incorporates and converts between different astronomically and radioisotopically derived ages and age models.
- An accurate and precise intercalibration of the improved numerical dating techniques in the context of stratigraphic data
- Significant progress towards an integrated (astronomically-tuned and radioisotopically calibrated) Geological Time Scale (GTS) over the last 100 million years, in concert with GTS_{next} and EARTHTIME.
- A time scale that is robust and stable, and will be employed by academia and industry because the proliferation of new time scales will essentially be avoided.
- Increased appreciation of the potential for highly resolved time scales in addressing outstanding issues in Earth System science.
- An improved understanding of Earth history through the application of this timescale by gaining new insights into key geological processes, including climate change, catastrophic impacts and volcanic hazards.

The ESF Research Network Programme will aid the wider EARTHTIME and the FP7 ITN GTS_{next} initiative and collaboration with other projects as shown in Fig. 1.

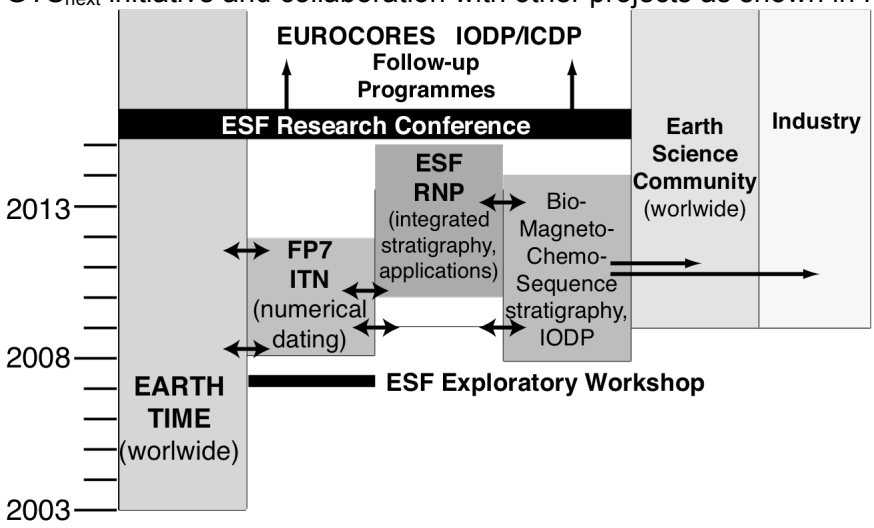

Figure 1: Relationship between Earthtime-EU initiatives (Marie-Curie ITN Proposal, ESF RNP proposal) and other entities.

Radioisotopic dating provides the benchmark for the determination of absolute ages for a wide range of geological materials that range in age from recently formed sediments to the oldest terrestrial rocks. These methods include ^{14}C, U-Th-Pb, $^{40}Ar/^{39}Ar$, Rb/Sr, Re-Os and U-series methods. Those currently most widely applied for time scale calibration are U-Pb and $^{40}Ar/^{39}Ar$ dating of volcanic minerals. ***Astronomical tuning*** has the potential for an unprecedented accuracy and high-resolution, but, in contrast to radioisotopic dating, is limited to specific sedimentary systems and is viable "only" over the last 250 Myr due to limitations of the astronomical solution and stratigraphic continuity. The Earthtime-EU ambition is to strive towards the development of a fully integrated GTS for the last 100 Myrs based upon astronomical tuning that is intercalibrated for various key time slices with $^{40}Ar/^{39}Ar$ and U/Pb radioisotopic systems. The situation at present is that the Neogene GTS (<23 Ma) is based solely upon astronomical tuning, the Paleogene GTS (23 to 65.5 Ma) is based predominantly upon ^{40}Ar-^{39}Ar dates and the Mesozoic GTS (65.5 to 251 Ma) is based predominantly upon ^{238}U-^{206}Pb dates. The issue of intercalibration is of fundamental importance if we are to develop a seamless, bias free standard GTS. We are focussing upon target intervals within the past 100 Mr, because of limitations in the accuracy of astronomical solutions (±40 kyrs at 65 Ma to ±250 kyr at 250 Ma) and availability of datable ash beds.

Of paramount importance for this effort, in addition to the improvement and intercalibration of numerical dating methods, is the necessity to tie records together on a global basis through stratigraphy. All of bio-, magneto-, chemo-, isotope-, and

cyclostratigraphic approaches are necessary to achieve this. Amongst these disciplines, magnetostratigraphy is unique in that it allows the division of the rock record into fundamentally isochronous time slices (magnetic chrons), which are in principle independent geographically and global in nature. This global nature of reversals provides a sharp tool to correlate discontinuous and fragmentary archives over long distances, through the help of the other stratigraphic disciplines. The stratigraphic toolkit is also a prerequisite to actually apply a refined time scale to Earth Science problems, and necessitates a coordinated community effort. The proposed Earthtime-EU RNP will provide a platform for such an effort.

The inherently fragmentary nature of rock records has resulted in disparate datasets that have to be integrated in order to develop a (near) complete picture of environmental and biological change in the past, and how different components of the Earth System interact. These disparate datasets, (e.g. deep marine versus continental records) require integration commonly achieved via the GTS. However, as outlined above, different chronometric techniques are applied depending upon the particular attributes of a given record (e.g. such as presence of datable volcanic material) and it is becoming increasingly clear that there are systematic biases between ages obtained by different independent techniques. The result is a loss of resolution, greatly reducing our ability to assess cause and effect relationships, lags and leads between forcings and response to environmental/biological change, and quantification of rates and duration of geological processes.

The integration and intercalibration of astronomical and radioisotopic chronometers can work in either of two ways. In Neogene successions, where the astronomical solutions are robust, the tuned time scale can be used to assess the accuracy of radioisotopic techniques. In older successions, where the accuracy of the astronomical solutions is reduced and the tuning is less certain, the inverse approach can be followed by using radioisotopic dates to 'anchor' floating astrochronologies and to test astronomical solutions. Figure 2 illustrates the integrated approach that will be adopted in Earthtime-EU and the FP7 proposal ("GTS_{next}"), and expanded upon in this RNP by including the stratigraphic community. Combined, these approaches offer the potential for a future situation where all geochronometers can be used interchangeably without a loss of precision due to substantial systematic uncertainties, greatly increasing our resolving power, with additional information from the stratigraphic community on how these refined ages can be applied globally, in the absence of datable material.

Clearly stability in chronostratigraphic classification is the key to a much improved geological time scale. Applications of a revised GTS include a better understanding of climatically and/or tectonically induced global oceanographic changes, such as Bonarelli Oceanic Anoxia Level (OAE 2) characterizing the Cenomanian/Turonian boundary or OAE3 at the Coniacian/Santonian boundary. In that way it will follow the suggestions for a revised unit-stratotype approach as outlined in Hilgen et al. (2006).

Facilities and expertise accessible to the Programme:

There are five key facilities and research communities to be linked by the Network. These include 1) the cyclostratigraphic analysis expertise, 2) the radioisotopic dating community and laboratory facilities, 3) the astronomical community, 4) the wider stratigraphic community, and 5) industry. The scientific goal of Earthtime-EU is to make a major step forward towards a fully integrated and intercalibrated GTS for the last 100 Myr. Central to the proposed Network is the concept of bringing together all five research communities that traditionally had limited interaction for time scale development, and thus make this Network timely and productive. During the planning of the network (including an ESF Exploratory Workshop) it has become clear that the "added value" benefits of enhanced collaboration are substantial and potentially far-reaching. Further interaction is envisaged with the (palaeo-) climate communities. Earthtime-EU will have a truly global scope as strong ties exist with the existing EARTHTIME network that originates from a US NSF sponsored initiative, and existing strong ties between the European groups and groups from China (CAS Institutes), Australia and Canada.

Expected benefit from European collaboration in this area

European researchers provide some of the key strengths of Geological Timescale Development, but currently lack a common strategy and networking facility. European collaboration in this area, within a global dimension of EARTHTIME, will likely result in a fundamental improvement of expertise, capacity, and laboratory facilities on all levels, and provide industrial and climate science applications a much improved tool to estimate ages and rates of change within the Earth System. The next generation of the Geological Time Scale (GTS), the main scientific objective of our network, will be instrumental to help understanding critical issues in Earth history of direct relevance to European citizens and policy makers. The vital importance of highly accurate and high-resolution geological time scales is best illustrated by

- The great success of the marine (oxygen isotope) astrochronology developed by large international projects with large European contributions such as SPECMAP in the 1970s, which tackled the fundamental problem of the origin of the great Ice Ages in the Pleistocene (Hays et al., 1976).
- The extended integrated tuned time scale was successfully employed to solve key issues related to the Messinian Salinity Crisis in the Mediterranean (Krijgsman et al., 1999), one of the largest evaporite giants in Earth history, and to link abrupt climate events and mammal evolution and migration to long-period astronomical climate forcing on million-year time scales (Van Dam et al., 2006).
- During an extreme greenhouse event (55 Ma) the Earth suddenly became warmer by ~5°C. At present several hypotheses (dissociation of methane hydrates in continental margin sediments, volcanics, climate, cracking of coal during rifting of the northern North Atlantic Ocean) compete to explain the abrupt initial warming (e.g., Lourens et al., 2006; Storey et al., 2007), which is used as a partial analogue for future global climate change. An exact determination of the duration of this event has a large impact on assessing on what time scales ocean acidification events and recovery operate.
- The next generation GTS will be instrumental to help solving such outstanding and important issues in Earth System science. In fact, the GTS can even be used to resolve the degree of chaotic behaviour of the Solar System and constrain the validity of its dynamical models.

European context:

List of relevant R&D networking activities at the European level related to the proposal

So far, all advances in the context of the Geological Time Scale on the European Level have come from bilateral and ad-hoc collaborations. Therefore the proposed Research Network is extremely timely and likely to provide key added value and a co-ordinated research strategy. The current Earthtime-EU collaboration is based on the broader EARTHTIME initiative that originated in the US and had some key European contributors. The ESF sponsored workshop that resulted in this current proposal was the first step towards a European networking initiative, and has resulted in the submission of a proposal for the 2007 Marie-Curie Training Network call ("GTS_{next}"), which is currently at the second invited stage of evaluation (see Fig. 1). The workshop has demonstrated that the European dimension of EARTHTIME contributes some key elements that are necessary for a highly accurate timescale, and will thus be a high-profile contribution. In addition, Earthtime-EU will increase the visibility of the European research effort in this important field on a global level, while strengthening the capacity in new EU member states.

Urgency of Pan-European Cooperation:

The overall EARTHTIME initiative is an organised, global, community-based scientific network aimed at sequencing Earth history primarily through the integration of high-precision geochronology and quantitative chronostratigraphy. The US NSF provided funds to establish an organisational hub, a series of ongoing workshops and initial research into issues such as interlaboratory bias, identified as a priority during the first workshop (www.earth-time.org). EARTHTIME is now at the 'proof of concept' stage. Several European scientists have been involved in the US-led effort and some

European national funding agencies have supported efforts. The proposed Earthtime-EU network (this proposal, http://www.earthtime-eu.eu) will add an important, uniquely European component to this international initiative by tackling the fundamental issues of the age calibration of the GTS and the consistency of radioisotopic and astronomically derived time scales within a European Hub. The remarkably strong European expertise in the field of astrochronology, combined with established expertise in radioisotopic dating, and integration of techniques already sharpened, offers a unique opportunity to intercalibrate the fundamentally different techniques used in time scale calibration and to apply them to construct the next generation of the GTS. At the same time, a new generation of geochronologists, fully capable of integrating the widely different techniques that until recently belonged to separate scientific communities, will be trained (proposal to Marie-Curie ITN, funding agreed), bearing the bright prospect of applying the much improved GTS to such important issues as climate change, evolution and geodynamics.

In addition, efforts need to be channelled to develop new methodologies for a consistent intercalibration of stratigraphic information with numerical ages, and to include researchers from Eastern European and circum-Mediterranean countries. Consensus must further be reached within the community to avoid the proliferation of time scales based on different astronomical tunings for the same interval and to promote a uniform codification of the cycles used to calibrate the GTS. Finally, but not by any means less important, fundamental applications of the much improved GTS should be explored already within the Earthtime-EU effort.

Duration*:*

We propose a duration of the Network of 60 months to achieve our objectives. Ideally, the RNP should start approximately 1 year after the ITN numerical dating initiative. The RNP will then also roughly coincide with other major initiatives such as the current Integrated Ocean Drilling Program. It will be beneficial to network over this time frame to fully exploit the added European value as well as to develop close collaborations with industry and the wider Earth Science Community. We intend to plan an ESF sponsored Research Conference at the end of this period to consolidate progress achieved.

Proposed activities, key targets and milestones:

We propose to add value to the European Earthtime initiative through several dedicated activities. All activities should follow an open-call, either for participation of individual scientists, or for proposing dedicated workshop themes, and will be operated through the Steering Committee. Industry involvement and input is sought where possible. Outreach, Teaching and Publicity Activities will be incorporated from the outset.

Steering Committee Meetings

We propose 1 Steering Committee Meeting per year over the duration of the Network, with 15-20 participants. The Steering Committee will discuss overall strategy, organise open-calls for workshops, meetings and outreach activities, and provide crucial interaction between members on scientific grounds. The Steering Committee will assess crucial targets and milestones each year.

Science Workshops and Summer Schools

We plan a series of dedicated workshops and schools that bring together the Earthtime-EU science community, including researchers, students and PostDocs. We envisage 4 Workshops and one Summer School (both 15-20 participants each) during the first 48 months duration of the programme. Two of the yearly workshops will be under a theme agreed by the Steering Committee, with an open call for participation. These themes will fall under the four main strands of GTS_{next} effort ("Confirming the Neogene", "Calibrating the Paleogene", "Exploring the Cretaceous" and "Fundamental Aspects of Timescale calibration Tools"), and be significantly broadened with expected participation from the cyclostratigraphy, radioisotopic dating, and stratigraphic disciplines (see Fig. 2), closely aligned to the Marie-Curie GTS_{next} initiative, but with

wider and open participation of stratigraphers. The other two workshops will follow open calls for more specific aspects of the GTS and its application. Examples could include "Integrated and revised chronologies for the Eocene / Oligocene greenhouse to ice-house transition", "Rates of change across the Paleocene Eocene Thermal Maximum" etc. The Steering Committee will administer open calls for topical and cutting edge workshops that contribute to the Earthtime-EU initiative. Each year (for 5 years) there will be a call for a Summer School geared towards current PhD students, and taught by Earthtime-EU researchers, that focuses on a specific technique of time scale development. This activity will link with outreach activities (developing teaching material and providing e-learning web material such as recorded lecture webcasts).

ESF Research Conference

One of the key targets of the network for the final year of the Network will be the organisation of a larger (~120 participants over 3 days) ESF Research Conference, synthesising the scientific objectives, producing a contribution for the next update of "The Geological Timescale" publication (together with the ICS), as well as formulating a strategy to continue the Earthtime-EU initiative through further Initiatives, and/or participation in other funding mechanisms. This Conference will focus on the major achievements of the Earthtime-EU and GTS_{next} initiative.

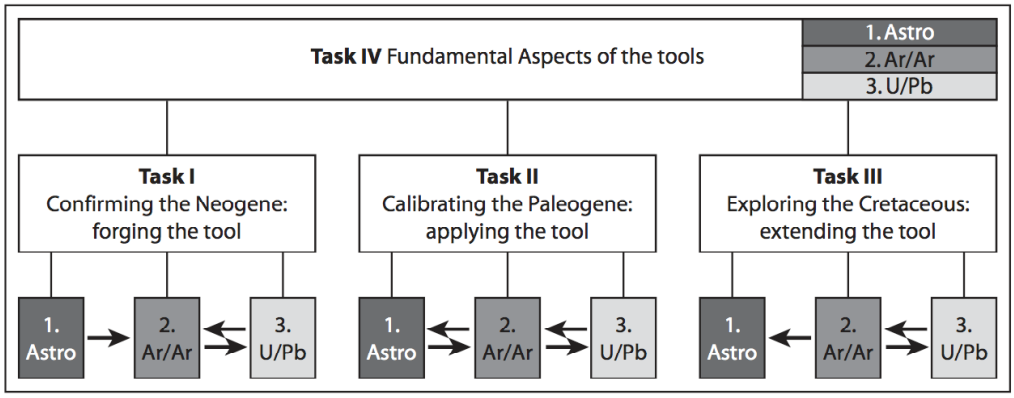

Figure 2: Relationship between GTS_{next} tasks and dating methods.

Grants for Short and Exchange Visits

A different pillar for the RNP will be provided by open-call short (1-2 weeks) and Exchange visits (2 weeks to 6 months) between European laboratories, ideally targeted at early career researchers and PhD students. These activities will provide crucial capacity building and knowledge exchange in the overall Earthtime-EU effort. Open-calls will be formulated by the Steering Committee, and selected candidates of Exchange Visits will be expected to contribute to outreach and publication activities, as well as providing a report of scientific achievements (milestones).

Database development, maintenance + hosting

A major legacy of a network will be a web-enabled portal that integrates all new stratigraphic and radioisotopic ages and age models developed through the network, including facilities for easy access, conversion and integration with partner databases and their interfaces, for which joint standards have to be defined. We envisage the development, set-up, maintenance, data-quality assurance, and archiving of a portal, which will be linked to the Earthtime-EU dedicated website. Rather than duplicating effort, this database will be a working document of the community and closely link with existing databases (such as the Integrated Ocean Drilling Program databases initiative (SEDIS), PALEOSTRAT, WDC-MARE PANGAEA, as well as the ICS website that hosts the current GTS2004 ages). The hosting of the database can be done on the publication website, but we request funds for Honoraria to develop a contents management and portal system operated by research scientists from Earthtime-EU. The portal structure and contents will be peer-reviewed and open access, and linked to existing initiatives through open protocol meta-data harvesting.

Publicity, dedicated website and Outreach:

All of the above activities will be closely coupled with a strong outreach activity. A dedicated website (http://www.earthtime-eu.eu, already active) will host the exchange of scientific achievements with the wider science community as well as integrate the database component (hosting costs requested). We propose a programme of producing outreach and teaching materials through the web-casting of Summer School Lectures and the production of teaching materials at a public level (website and electronic flyers) as well as a more specific material (detailed time series analyses and stratigraphy courses). Where possible we will seek synergies with existing efforts (e.g., the Urbino Summer School in Europe: http://www.uniurb.it/ussp/). A major outreach and publicity activity is envisaged to coincide with the final-year ESF Research Conference.

Budget estimate (in €) by type of activities and per year of programme:

Budget (k€), rounded to nearest 0.1k€, all in k€	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total	
Publicity, dedicated Website, Outreach, Publics	4	7	7	7	15	40	
Database development, maintenance + hosting	30	30	25	25	25	135	
Science Workshops (2+2) + Schools (1)	50	50	50	50	10	210	
ESF Research Conference					50	50	
Grants for Short and Exchange visits	15	15	15	15	15	75	
Steering Committee Meeting (1/yr)	10	10	10	10	10	50	
Total by year	109	112	107	107	125	560	k€
ESF fee (7.5 %)	8.175	8.4	8.025	8.025	9.375	42	

Budget notes and justifications:

Publicity and Outreach activities will ramp up at the beginning of the network, and include a larger expenditure coinciding with the ESF Research Conference. at the end. Expenditure includes website hosting, flyer and brochure production, production of outreach electronic material (web-hosting of Summer-School lectures) etc. We have currently secured a web domain (http://www.earthtime-eu.eu) as a private initiative. The RNP start would coincide with the International Darwin Year in 2009, and provide a good opportunity to showcase this important field of multi-disciplinary science. Science workshops (4 for 4 years) and Summer Schools (1 per year) are budgeted assuming 15 attendees each, 3 day durations, per diem €40 subsistence, €100 accommodation + airfare. ESF Research Conference is estimated for 120 participants and 3 days. Grants for Short + Exchange visits are budgeted with max. €500 for travel, and a €1600 per month pro rata subsistence allowance, giving an average of 6 5-weekly visits per year with flexibility to adjust and include short visits. Steering Committee meetings are estimated at 3 day duration, 15 participants, €150 economy travel, and per diem €100 accommodation + €40 subsistence. These will include a global dimension by participation of key (1-2) EARTHTIME key personnel on occasion.

Database development + maintenance tasks include site hosting, and Honoraria for professional infrastructure development, which can then be operated by the research community. At an hourly consultant rate of €100 this provides about 6 weeks/year of service + hosting costs.

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