

## *FINAL REVIEW OF EUROCORES PROGRAM TOPOEUROPE*

PREPARED BY THE TOPOEUROPE REVIEW PANEL

TopoEurope represents a new approach to solid earth science for the European science community. It brought together interdisciplinary teams of researchers across national boundaries, and trained a cadre of young scientists that have embraced this model of integrative research. As is clear from the reports of the individual CRP, the level of productivity within TopoEurope has been very high. Many of the research outputs represent interdisciplinary work that would have been unlikely to occur outside the TopoEurope framework. It is the conclusion of the Review Panel (RP) that overall the TopoEurope program should be considered highly successful and TopoEurope represents both an approach to science and a specific disciplinary area of science that merit continued cross-national research support.

In this final review document (that supplements previous intermediate reviews conducted by the RP) we highlight the contributions and outcomes from TopoEurope that would have been unlikely to occur without this EuroCores program. We also provide a set of recommendations for future TopoEurope-like programs that may develop. These recommendations reflect some of the lessons learned during the evolution of the EuroCores TopoEurope program, and what we see as some of the specific successes of this program.

### TOPOEUROPE OUTCOMES

*TopoEurope Young Scientists.* The RP believes that one of the enduring successes of the EuroCores TopoEurope program will be the cadre of young scientists who were trained through one of the CRP. They are a different style of researcher, as compared to ones trained under more traditional research programs, in that they have been exposed through interactions within their CRP to a much more interdisciplinary approach to Earth science. These TopoEurope young scientists have also had significant cross-fertilization of ideas through a series of summer schools and other cross-CRP activities. The annual TopoEurope meetings provided additional venues for networking by this community of young scientists. The building of an interdisciplinary peer group of young scientists (both Ph.D. and postdoctoral researchers) is an outcome that both strengthens the current research and will bear fruit for decades to come as these scientists move through their careers.

*Integrative Earth Sciences.* Accomplishing successful interdisciplinary and integrative science does not happen by simply placing disparate researchers together. Rather

thoughtful leadership is needed to help the group move in directions not possible by any individual. The RP is very impressed by the research outcomes in many of the CRP that reflect truly integrative research. We believe this reflects strong and effective leadership within these CRP. These successes point out the key role played by the Program Leaders in helping facilitate effective interdisciplinary research.

*Cross-CRP Interactions.* There are also several documented examples of new interdisciplinary research projects that were spawned by interactions between different TopoEurope CRPs. This is an extremely positive outcome that (as discussed below) should be a consideration in future TopoEurope-like programs.

## RECOMMENDATIONS

*Importance of TopoEurope Science.* Although TopoEurope is just now completing its initial cycle as a cross-national integrative science program, it has demonstrated through its products and outcomes the high impact value of its research. The RP recommends that this approach to science and this focus on interdisciplinary science that brings together Earth science researchers working from Earth's mantle to its surface be continued.

*Focus on Training the Next Generation.* As discussed above, one of the clear successes of TopoEurope has been in training a new generation (and a new type) of Earth scientist in Europe. The RP very strongly encourages a continuation of opportunities for developing integrative Earth scientists. Whether under a TopoEurope aegis or another mode, we believe continuing this opportunity is critical.

*Integration across CRPs.* What distinguished the EuroCores TopoEurope program from more traditional Earth science research in Europe was its interdisciplinary and integrative mode of research. Within CRPs this is seen in all aspects of the program, and through summer schools and other cross-CRP networking opportunities, integrative cross-disciplinary research was facilitated for Ph.D. and post-doctoral students within the program. Although this was not an explicit requirement of the overall research program, such cross-CRP interaction did occur, particularly when there were overlapping memberships of researchers. Examples of this can be seen in linkages between CRPs such as Topo-Alps and Thermo-Europe, TopoMed and VAMP, and SedyMont and Topo-Alps. It is problematic to explicitly require such cross-CRP interactions in a competitive proposal driven selection process, but the RP, which was able to see potential synergies quite early in the selection process, recommends that in any future TopoEurope-like programs that this cross-CRP interaction be explicitly included and encouraged.

## FUTURE OF TOPOEUROPE

As noted in the introduction to this review, the EuroCores TopoEurope program represented a new approach to solid-earth science in Europe. The RP strongly encourages the TopoEurope community to continue this research endeavor and further develop it. Several key activities that are beginning to develop, and which the RP strongly supports include:

1. The geographical expansion into North Africa and the Middle East. The physical processes key to advancing the science do not stop at the European borders.
2. Forging strong global partnerships, for example with global research initiatives such as IODP (scientific drilling) and IGCP (UNESCO Geoscience initiative).
3. TopoEurope has directly and indirectly spawned national and other pan-European efforts aimed at similar science questions (e.g. TOPO-IBERIA, the European Plate Observing System (EPOS) [on the Roadmap for funding via Large Scale European Science Infrastructure (ESFRI)] etc.). These focused (geographic, facilities, etc) programs are strongly synergistic to the goals of TopoEurope.

Many of these continued and additional linkages can be incorporated into follow-on programs such as the nascent TOPO-EUROPE 2020 (launch meeting end of September in Istanbul), the development of which the RP fully supports.

Finally, as noted in our review, the RP believes that one of the highest impact legacies of the EuroCores TopoEurope program is the cadre of young scientists that have been trained under this new model of research. We are encouraged to see that the Young Scientists Meetings are continuing (last April in Bratislava and shortly in September in Utrecht); we strongly encourage continued European support for these opportunities that facilitate the next generation of scientists to develop networks and build collaborations.