

Evaluation of the Department of Geosciences University of Padua

Panel report

12.11.2008

The “Performance and Quality Assessment Council” of the University of Padua (UP) has launched a project for the evaluation of the research programmes and of the overall organisation of all the Departments of the University. UP has appointed an international evaluation panel for assessing the performance of the Department of Geosciences (DG). The panellists are asked to make an individual evaluation report, visit the DG for contacting the scientists and seeing the facilities and to make an overall evaluation.

The main goal of the project is that of gaining a well-based knowledge of the quality of the research programmes - as well as of the strategic planning behind them - of each Department and of the University as a whole, in order to adopt a policy of “quality improvement” at all levels. This knowledge will also be useful for decisions by the University governing bodies concerning the allocation of resources.

Evaluation Panel Experts

The appointed panel members are:

Prof. Dr. Ross J. Angel

Professor of Crystallography

Virginia Polytechnic Institute and State University, Blacksburg, USA

(Research areas: mineralogy and crystallography)

Dr. Massimo Cocco

Research Scientists

Istituto Nazionale di Geofisica e Vulcanologia, Sezione Roma1, Italy

(Research areas: seismology, earthquake and fault mechanics, tectonics)

Prof. Dr. Bruno D'Argenio

Professor of Geology

University Federico II Naples, Department of Earth Sciences, Italy

(Research areas: sedimentary geology, stratigraphy, carbonate rocks, regional geology)

Prof. Dr. Ugur Yaramanci

Professor of Applied Geophysics

Berlin University of Technology, Department of Applied Geosciences, Germany

Leibniz Institute of Applied Geosciences, Hannover, Germany

(Research areas: applied geophysics, rock physics, hydrogeophysics)

The panel appointed Prof. Yaramanci as chairman and Dr. Cocco as the secretary.

Evaluation basis

This evaluation of the Department of Geosciences at the University of Padua is based upon:

- Self evaluation report of DG for 2003-2007 (including the Evaluation Report of DMP 2000-2004)
- Visit of the panel to Padua 1.-3. Oct. 2008 and panel meetings
- Meeting of the panel with the director of DG, Prof. Dr. Domenico Rio
- Meeting of the panel with the programme coordinators
- Meeting of some project leaders (of 1.4., 1.5., 2.1., 3.3., 4.2. as decided during the visit).
- Meetings with students staff
- tours of the department facilities and laboratories

Prof. Angel was unable to join the panel, but he met some of the faculty, students and staff during a 10-day visit to the Department during the summer of 2008.

History and size of DG

The Department of Geosciences (DG) has been founded in 2006. It is the merger of two former departments, Department of Mineralogy and Petrology (DMP) and Department of Geology, Palaeontology and Geophysics (DGPG). DG started full work in 2007.

DG staff in 2007, in the first year of operation after the merger, is:

10 Full Professors, 25 Associate Professors, 13 Assistant Professors,
20 PhD students (on university grants), 25 Post-Docs (on university and project grants),
18 administrative staff, 14 technical staff and 3 Museum Curators.

Scientific Programmes of DG

The DG is running its research activities in 4 major programmes, which are subdivided in projects. These are:

1. Deep Earth

- 1.1. Evolution of thermodynamic properties as function of composition, temperature and pressure for geological materials
- 1.2. Petrology and geochemistry of magmatic systems
- 1.3. Metamorphic petrology
- 1.4. Deformation mechanisms of shear zones
- 1.5. Regional geology, tectonics and geodynamics of Mediterranean region

2. Sediment systems, past life and deep time

- 2.1. Regional geology and basin analysis
- 2.2. Investigating past life
- 2.3. Geologic time
- 2.4. Past climate

3. Mineralogy, petrography and geophysics applied to cultural heritage

- 3.1. Archaeological materials produced by heat transformations: a) glass, b) metal, c) pottery
- 3.2. Raw materials: rocks, mortars, plasters and pigments
- 3.3. Geophysical survey in archaeological areas
- 3.4. Biomineralogical investigations

4. Geological and hydrogeological hazards

- 4.1. Dynamics of gravitational processes
- 4.2. Characterisation, evaluation and protection of groundwater resources
- 4.3. Near surface geophysics

Evaluation of the Department Self-Assessment

(numbers refer to the self evaluation report)

3: Formal Collaborations

The location of the CNR facilities and laboratories within the Department is of great mutual benefit to both parties, and should be continued. The Department is to be congratulated on developing new links at the EU level since the previous evaluation of the DMP, but further involvement in EU collaborative programs must be pursued.

4: Mission

The new combined department already has developed a clear and unified mission, of fundamental research and teaching, with applications to societally-relevant issues such as geohazards, cultural preservation and industrial applications.

5: Research Programs

The four research programs in the Department are coherent and successful. The rationale for the strategic vision for identifying these four research programmes is therefore convincing. There is a clear strategy and a shared approach to organize research activities and to distribute human and economic resources. This is a substantial improvement over the situation found by the review of the DMP in 2005, and justifies the decision to merge the two departments. More detailed comments on each program are given below.

6: Human Resources

The Department and the previous DMP and DGPG have made very good progress over the past 4 years towards rebalancing the ratio of junior to senior faculty, by replacing senior retirements with additional associate and assistant professors. The number of support staff is adequate.

7: Funds and Research Grants

The operating budget of 119.000,- € is clearly inadequate for a department of this size and quality, especially if this sum is also used to cover the expense of operating the museum and library. This must be addressed by the University if it wishes the Department to succeed in the future. Research funding is low by international standards, but high by national standards. Industrial sponsorship levels are excellent for a Geosciences department.

8: Space and Equipment

The current buildings for the department are inadequate, but this will be addressed by the move to a new building in the near future. The equipment is partly of a very high standard, and provides fundamental tools for promoting innovative research.

9: External links

Members of the department continue to collaborate at both the informal and formal level with many other research institutions. With the exception of the participation in the EC Marie-Curie programme Eurispet, collaborations to develop support and education of graduate students remain inadequate. Cooperations with other departments within the University of Padua are weak. They can be improved especially by developing much stronger interactions with engineering departments through research programmes 3 and 4.

10: Research Consultancy Services

These continue to improve, and new opportunities must continue to be pursued by all members of the department provided they support, and do not detract from, the fundamental research goals of the department.

11: Other Activities

The involvement of faculty in organizing sessions at conferences is restricted to a relatively small proportion of the members of the department. The museum and library represent a wonderful opportunity for outreach activities that would benefit both the University and the department.

12: PhD programs

The DG won an Initial Starting Grant of European Research Council in 2007, which is external proof of excellence of some PhD programs. The number of PhD students is low by international standards, but normal by national standards. Mobility is, however, low, because most of the post-docs have graduated from the same research group. This is quite common in the Italian system, but an exchange of PhD students might improve integration among different research groups and their synergy. The low number of PhD applicants is surprising considering the reputation and the scientific rank of the Department; efforts must be made to improve the visibility of the Department with potential students, both nationally and internationally.

13: Research Output

The number and the quality of research outputs are impressive and unusually high for the Italian educational and research system. Research programmes 1 and 2 have excellent productivity in terms of articles in ISI international journals and presentations in national and international meetings. Programmes 3 and 4 have lower productivity, and some individual research lines have particularly low productivity. Recommendations as to how to address this issue are given below.

14: SWOT analysis

The SWOT analysis appears to be a realistic assessment of the department as a whole.

15: National and International Ranking

A national evaluation by CIVR (Comitato Italiano per la Valutazione della Ricerca) ranked the DG as the best Geoscience department in Italy on the basis of quality of research output. The national and international reputation of individual researchers is very good and it is well above the average level of Italian University Departments.

16: Strategic Plans

The strategic plan, and especially the hiring plan, is realistic given the limited resources available to the department. Further comments are provided in the *recommendations* below.

Evaluation of the Research Programmes

(according the format by the university)

The research activity of the Department of Geosciences is organized in four programmes. The rationale for the strategic vision for identifying these four research programmes is convincing. There is a strategy and a shared approach to organize research activities and to distribute the available human and economic resources. Funds have been dedicated to implement particular projects (i.e., research lines or sub-programmes). New positions have been opened to hire professors to further promote the development of identified strategic lines. There is a clear vision of the career progression and for hiring new professors for the future.

Integration of scientific programmes is one of the key issues for future planning to better stress collaborations. The implementation of instrumentations and facilities is coordinated to guarantee a shared and common use for research. The plan for opening positions is another

key issue for designing the future strategic vision. The strategy is to have appropriate facilities and brilliant people.

The scoring scheme, as suggested and by the university and used by the panel, regards

- Quality (novelty of approach, programme coherence, national and international reputation of researchers, quality of research products)
- Productivity (ratio between number of research products and number of researchers)
- Relevance (with particular reference to the discipline as well as to society, in general)
- Future possibilities (based on tangible results, future plans and projects, recent and foreseeable developments within the discipline).

The scoring for Relevance and Future Possibilities (Perspective) considers to a great extent the external environment and importance of the subjects in the programmes and projects and is not only and strictly related to the performance.

The scores used are: excellent, very good, good, satisfactory, unsatisfactory

Program 1: Deep Earth

Quality: excellent

These researchers are the national leaders in the general area of mineralogy, petrology and the related field studies, and many have strong international reputations, producing high-quality papers which are well-cited.

Productivity: very good

Relevance: excellent

This program is providing a combination of fundamental data for mineralogy and petrology, while projects 4 and 5 have immediate societal relevance.

Future prospects: excellent

Overall rating: excellent

Comments: This program is well-organised and builds upon strengths from the two former departments by combining the research faculty from both. The programme will benefit from further integration of the five project areas, especially between projects 1 and 4. Project 5 (regional geology etc) is much broader than the others, and the general rationale for this project is not well-developed, although it is clear that local geological studies and geologic mapping must be included in a more general research programme.

Program 2: Sediment Systems, past life and deep time

Quality: excellent

The individual projects are of high quality, are well-organised and internally coherent, and have developed strongly over recent years, while building on the traditional strengths and research programmes of the former DGPG.

Productivity: very good

There has been a notable improvement in productivity in recent years.

Relevance: excellent

The results from these research programmes provide controls on the mechanisms of climate change, and have implications for biodiversity.

Future prospects: excellent

Overall rating: excellent

Comments: In some senses, the division of this programme in to sub-projects is artificial, since the methodologies, research areas and results of all four programmes strongly overlap. Similarly, the division between sub-project 2.4 and the geological mapping that continues under sub-project 1.5, may be argued to be artificial, as it merely represents the difference between “basin analysis” and “geological mapping”. Further collaboration between these two groups, especially at the undergraduate and graduate level, is to be encouraged, and can provide the basis to tie programmes 1 and 2 together.

Program 3: Mineralogy, petrography and geophysics applied to cultural heritage

Quality: very good

This programme is characterized by the application of modern mineralogical and geophysical methods to cultural heritage issues. The project leaders have international reputations in the methodologies and the group as a whole therefore has the opportunity to make novel contributions to this field.

Productivity: good

Related scientific publications have recently increased considerably. It should be noted that in many cases the results of this research are published in scientific journals, that although are in themselves of great relevance, are not properly categorized in the ISI system and therefore can not be adequately classified.

Relevance: very good

These analytical capabilities play an important role in the modern interpretation of physical, climatic and biological parameters of natural processes that have significantly affected civilisations and their products.

Future prospects: very good

Overall rating: very good

Comments: A wide range of strong collaborations with a number of non-geological agencies, including several Italian agencies with responsibilities for the Fine Arts and for Monuments, attests the quality of this research programme, independent of the traditional measure of journal publications. In contrast to programme 4 (below), relevant geophysical methods have not yet been fully exploited in this programme, and this is an area which should be considered for future development. See recommendations at the end of this report.

Program 4: Geological and hydrogeological hazards

Quality: good

This program is characterized by a traditional approach to geologic and hydrogeologic risk related problems, with modern methods and important socio-economic repercussions. The importance of research in this sector is without a doubt very high and of wide and topical interest. The quality of the work, and the scientific reputation of the researchers, is good.

Productivity: good

The productivity of this group is lower than the other programmes in the Department, but this is in some respects typical of this area of research, because of its more applied nature.

Relevance: very good

These projects are of immediate societal relevance

Future prospects: very good

Overall rating: very good

Comments: Despite being called “geological hazards” only project 1 in this programme is strictly concerned with hazards, while it clearly does not include traditional hazards of earthquakes or volcanic systems. Nonetheless, this programme will always be able to contribute to societal questions involving civil engineering (groundwater, slope stability etc). The groundwater project 3, has good interactions with the structural geologists in programme 1. Nonetheless this project needs to be better integrated within the departmental research structure as a whole. See recommendations at the end of this report.

Detailed Scoring

Additional to the scoring for the programmes as above, the detailed scoring at the level of projects is also provided. The scoring for the projects is obviously the basis of the scoring for the programmes. The scores for the programmes, however, are not necessarily the simple averages of project scores.

The scoring of projects is expected to allow a differentiated and just judgement.

The scores are: e = excellent, vg = very good, g = good, s = satisfactory, u = unsatisfactory

Pr	Quality	Productivity	Relevance	Perspective
1.	e	vg	e	e
1.1.	e	e	vg	e
1.2.	e	e	vg	e
1.3.	e	e	vg	e
1.4.	e	e	e	e
1.5.	vg	vg	e	vg
2.	e	vg	e	e
2.1.	e	e	vg	e
2.2.	e	vg	vg	e
2.3.	e	vg	vg	e
2.4.	e	vg	vg	e
3.	vg	g	vg	vg
3.1.	vg	vg	vg	e
3.2.	vg	vg	vg	e
3.3.	vg	vg	vg	e
3.4.	vg	vg	vg	vg
4.	g	g	vg	vg
4.1.	vg	g	vg	e
4.2.	vg	g	vg	vg
4.3.	vg	vg	vg	e

Further detailed comments

Programmes

The panel appreciates very much the well prepared report for Self-Evaluation in structure and content as well as the care of the department given by the visit of the panel. The constructive approach and openness of the Department accompanied the evaluation, for which the Head of the Department, Prof. Rio, respectively all members of the Department is thanked for. It was very much present that the department is trying hard to motivate and activate its members for improved working and production and there is a positive spirit for this. This is essential for the future work and impressed the panel most.

The evaluation started with the presentation of the coordinators of the four programmes including brief descriptions of the programmes and perspectives. The rationale for the strategic vision for identifying these four research programmes is convincing. There is a strategy and a shared approach to organize research activities and to distribute human and economic resources. Funds have been dedicated to implement particular projects i.e. research lines and sub-programmes. New positions have been opened to hire professors to further promote the development of identified strategic lines. There is a clear vision of the career progression and for hiring new professors for the future.

The plans of scientific programmes in the next five years were discussed. Integration is one of the key issues for future planning to better stress collaborations. The implementation of instrumentations and facilities is coordinated to guarantee a shared and common use for research. The plan for opening positions is another key issue for designing the future strategic vision. The answer is to have appropriate facilities and brilliant people.

The cooperation with other departments within the University of Padua has been in particular discussed. They are presently weak, and they must be improved in the future. Also the cooperation with other national and international institutes and universities has been discussed. This must be improved and strengthened in the future. The importance of implementing the interactions with engineering department in particular for Programmes 3 and 4 is emphasised.

We have discussed the critical issue of how to face the low productivity of some research lines belonging to some programmes. In particular, we faced the issue of the visibility of research activities looking at the presentations in national and international meetings. The number of abstracts appears reasonable if compared with the total number of scientific publications, since it is expected that most of presentations must become publications.

The DG declares a large enough number of PhD students and PostDoc's. PhD students are well involved in research activities. This issue must be better emphasized in the self evaluation report. In general, it might be useful to quantitatively assess the contribution of PhD students in each project. The good productivity of PhD students in some research lines should be considered by the University to allocate more students to those programmes. The DG won an Initial Starting Grant of European Research Council in 2007, which is a proof of excellence of some activities.

Laboratories

We have visited the laboratory facilities. These infrastructures are of high technological level and represent a fundamental tool for promoting innovative researches. The presence of a CNR lab in the department is extremely positive, since it also represents a formal collaboration with a public research institution. These experimental facilities must be maintained in the long term. Their sustainability as well as their implementation should be also promoted by national and international collaborations. Financial support to instrument implementation is suggested.

Selected projects

The evaluation panel invited several sub-program leaders to discuss the rationale of the programme organization and few issues that needed to be clarified more in detail. We have discussed Programme 1 and in particular project 4 in depth, which presents a quite complex subdivision in lines of activity. The scientific organization of this programme and of this project is grounded. Worthy of note are the interactions and the potential collaborations between projects 1 and 4 in Programme 1. We have also clarified that Programme 1 joins researchers from both the two previous departments.

Therefore, project 5 in Programme 1 was closely evaluated. The title and the goals of this project are quite broad and general and more information is needed to understand the rationale for this project. Project 5 contains geological mapping as well as geodynamic investigations through GPS data at regional and Mediterranean level. The main reason to include this project is to maintain local geological studies and geologic mapping inserted in a more general research programme. The research activities on geodynamics of Mediterranean area, although scientifically well motivated, is not well integrated into the whole programme.

The link between 2.1. and 2.4. appear coincident as far as analysed stratigraphic sections are concerned, and the quality of the research illustrated is of high level. The differences between project 1.5 and 2.1 need some clarification. This is indeed an issue under discussion and the main difference is geological mapping against sedimentary basin analysis. However, it seems the project 1.5 might be better integrated in other projects.

We have discussed in detail the goals of applied geophysical investigations in Programme 3 and 4. There are specific skills to these tasks. While these investigations are well and successfully established in Programme 4 their contribution to Programme 3 are still unexploited. This is presently a field for future implementation in Programme 3 and stronger implementation of applied geophysics seems to be reasonable. During discussion it has been envisaged the likely increased use of applied geophysics to environmental sciences.

We have discussed project 2 in Program 4 in particular. This project includes hydrogeological studies of groundwater and the protection of aquifers and there is a connection with structural geology and with project 1 in Programme 4. The title of Programme 4 claims to contribute to hazards, however only project 1 contributes to hazard somehow. This project is obviously very good in fund raising, but less productive in terms of scientific publications. It needs a better imbedding in the structure.

Educational activities

The evaluation panel have met several PhD students and the PostDoc's. The meeting was extremely useful for the tasks of the evaluation panel. The discussion focused on the involvement of PhD students and PostDoc's in research programs as well as their judgement on the educational activities of the Department. Teaching activity to PhD student is not organized in a formal way in the Department and there is no requirement for a minimum of classes to be followed by PhD students. Most of the Post-Docs took the PhD in the same research group, and sometimes with the same tutor. This is quite common in the Italian system, but an exchange of PhD students might improve integration among different research groups and their synergy. The total number of applicants to PhD positions is only slightly larger than the number of available positions. Considering the reputation and the scientific rank of the Department, this might require the improvement of the visibility. Finally, there are few post-docs coming from foreign countries.

It was not possible to evaluate the educational activities at the undergraduate level (i.e. laurea corresponding to BSc) and first postgraduate level (laurea magistrale corresponding to MSc) as there was no information available on these. The special evaluation of these, however, was not asked for by the university, but should be included in the future evaluations.

Conclusions

1. The self-assessment report is accurate representation of the present situation and future prospects of the Geosciences Department of the Padua University about 18 months from its creation from the DMP and DGPG. The Department has successfully used the merger to integrate and re-structure its research programmes.

An evaluation at a later time might have been more appropriate as to have allowed DG to grow even more in its merger and get more established.

2. The structure of the self-assessment report, as far as research activities (programs, projects i.e. research lines) are concerned, is a rationalization of the pre-existing projects in order to simplify their presentation.
3. The four research programmes in the Department are coherent and successful. Research programs 1 and 2 are successful and have high international standing. The lower productivity of programs 3 and 4 is of some concern. The future research intentions and plans are appropriate and positive, but better integration of some programs is desirable.
4. The combination of the description of past research productivity with future plans in the self-assessment report makes it difficult to evaluate in places. Future self-assessment reports should clearly distinguish past results from future plans.
5. The retirement of senior faculty is being balanced by the recruitment of outstanding young faculty. There is a clear plan to continue this policy with appropriate hires, and this can only further strengthen the department.
6. The low research productivity of some faculty is of concern.
7. The PhD students and PostDoc's are of good level and happy with their research topics and supervisors.
8. The Department's strategic plan for the future is realistic considering the resources available. If supported by appropriate resources, its future is very promising.
9. The cooperation with other departments within the University of Padua is a critical issue. Collaborations are still presently weak, and they must be improved in the future. Also the cooperation with other national and international institutes and universities must be improved and strengthened in the future.

In summary, the panel concludes, that the Department of Geosciences of the University of Padua is well established, producing a large quantity of research of very good to excellent quality with a very good to excellent degree of societal relevance. It has excellent prospects for the future.

Our overall rating excellent.

Recommendations

1. The merger and the evaluation have obviously given a positive push to the department for scientific structuring and to identify the potential and use of integration. The momentum derived from the merger of the two departments should be kept alive and utilised for further improvements and changes. It is important for the continued success of the department that the leadership is maintained and is supported with resources by the University, especially with respect to the extraordinary costs that will be incurred in moving the department to a new building.
2. The scientific production of the department is in general very good and for many individuals excellent. But there are sections with a small production if compared with others. Mechanisms should be introduced to encourage and monitor research productivity. The current evaluation and strategic plan can be used as a framework to evaluate research programs and faculty on an annual basis. Research productivity should be rewarded with additional resources and investments, as well as public acknowledgement of success.

3. The current evaluation is accepted and supported by the members of the department to a great extent. This should be used for future evaluations. In fact, it should be considered to conduct self evaluations on the yearly basis to the rules of the university and current evaluation. This will allow for close monitoring of strengths and weaknesses and in particular of changes and allow dynamic handling and application of measures.
4. The different research programmes contain different proportions of research that may be categorised as "basic" or "applied". Given that modern geosciences are expected to contribute societal benefits through its applied research, the Department needs to monitor the balance between basic and applied research components.
5. The cutting-edge research in the Geosciences Department requires the use of state-of-the-art instrumentation. The current experimental facilities must therefore be maintained, and further developed in the long term. Their support and upgrades should be promoted by national and international collaborations, and supported by the University. A clear policy to recognise and develop the skills and motivation of the technicians should be established.
6. In order to address the uneven productivity within the Department, we recommend that research programmes 3 and 4 be merged in to a single programme in the area of “Shallow Earth - Applied Geosciences” which together with the programmes 1 “Deep Earth” and programme 2 “Sediment systems, past life and deep time” would define a object oriented framework for the department’s research programmes. This would raise programmes 3 and 4 to a level with critical mass and reduce the number of projects, thus avoiding some non productive project areas. The new programme would also allow new aspects of applied geosciences of societal relevance (e.g. in the areas of environment and climate change, natural resources, geoenergy, geohazards and groundwater systems) to be developed and pursued. The balance and interaction between basic and applied research must be developed and carefully monitored, and the societal benefits of research programmes considered where appropriate. In fact it is recommended to organise the projects not strictly after methodology but after objects for understanding of geosystems looking also for interrelations and temporal development.
7. Graduate recruitment and education should be improved through participation in EU programs, the involvement of further industrial partners, and the development of international exchange programs (formal or informal) for students. Applications from, and exchange of, graduate students in other Italian universities must be encouraged. This could be improved if stipends for graduate students were increased.