



Committee for the Evaluation of Geology and Earth Science Study Programs

General Evaluation Report

August 2013

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Chapter 1: General Background

The Council for Higher Education (CHE) decided to evaluate the study programs in geology and earth science during the 2012/2013 academic year.

Following the decision of the CHE, the Minister of Education, who serves ex officio as Chairperson of the CHE, appointed a review committee consisting of

- Prof. Edward Stolper, Division of Geological and Planetary Sciences, California Institute of Technology, USA (review committee chair);
- Prof. Henry Elderfield, Department of Earth Sciences, University of Cambridge, UK;
- Prof. Kenneth Larner, Department of Geophysics, Colorado School of Mines, USA;
- Dr. Yair Rotstein, U.S.-Israel Binational Science Foundation, Israel;
- Prof. Gerald Schubert, University of California Los Angeles, USA; and
- Prof. Mark Thiemens, University of California San Diego, USA;

with Ms Daniella Sandler serving as coordinator of the committee on behalf of the CHE.

Within the framework of its activity, the review committee was requested to examine the self-evaluation report, submitted by the institutions that provide study programs in geology and earth science and to conduct on-site visits at those institutions; submit to the CHE an individual report on each of the evaluated academic units and study programs, including the committee's findings and recommendations; and submit to the CHE a general report regarding the examined field of study within the Israeli system of higher education, including recommendations for standards in the evaluated field of study.

The process was conducted in accordance with the CHE's October 2012 Guidelines for Self-Evaluation. The first stage of the quality assessment process consisted of self-evaluation, including the preparation of a self-evaluation report by the institutions under review. This process was conducted in accordance with the CHE's guidelines as specified in the document entitled "The Self-Evaluation Process: Recommendations and Guidelines" (October 2008).

Chapter 2: Committee Procedures

The review committee held its first meetings on January 8, 2013, during which it discussed fundamental issues concerning higher education in Israel, the quality assessment activity, and geology and earth science study programs in Israel.

From January 9-16, 2013, the review committee visited the Ben Gurion University, Tel Aviv University, and Hebrew University. During the visits, the review committee met with various stakeholders at the institutions, including management, faculty, staff, and students.

This report deals with geology and earth science studies in Israel as a whole.

Chapter 3: The State of Israeli Geology and Earth Science

In this brief note, the review committee summarizes its conclusions regarding the state of teaching and research in the earth sciences in Israel¹. Most of these points are described in the individual reports on the three universities that we visited, but we repeat them here when there is a theme, pattern, or common issue that we discerned among all three universities.

We note at the outset, however, that our comments and observations do not provide a complete evaluation of the state of earth science in Israel because our charge did not include the evaluation of several important programs: the program in geochemistry and planetary science at the Weizmann Institute, the School of Marine Sciences at University of Haifa (although we did ask for and get a roughly one-hour presentation by Professor Zvi ben Avraham on this latter program). Additionally, there are several programs in physical geography that have significant impact on the state of earth science in Israel (e.g., their teaching and research activities and faculty would most likely be in earth science departments in Europe and the United States), and although they were referred to indirectly several times, the review committee had no direct information as to how these fit into the larger picture. Without having reviewed these programs, our ability to be comprehensive in our evaluations of Israeli earth and environmental science as a whole is necessarily limited. Likewise, although we recognize that the review of the Geological Survey of Israel and the Geophysical Institute of Israel and the Technion- especially its Faculty of Civil and Environmental Engineering (which includes water resources and hydraulic engineering) is beyond the brief of the Committee on Higher Education, these organizations nevertheless have significant actual and potential impact on the state of Israeli earth science, and future reviews would benefit from interactions with these organizations.

Subject to these caveats, our observations and, where appropriate, our recommendations are as follows:

1. As we state in the individual reports on the three universities, the level of the research and education in Israeli universities is overall high by international standards. However, except for the program at the Hebrew University, the departments are small, limiting their abilities to provide a uniformly high-quality education focused on earth science or to sustain programs that would be judged to be among the handful of the leading international research programs in the world. Most comparably sized universities in the United States and Europe have programs in earth science that are two to three times larger than those at Tel Aviv and Ben Gurion universities. In an era of growing interest in environmental issues (including marine science, water resources, and climate change) and in which the earth sciences play a major role in educating the work force and in conducting research that helps to understand the complex feedbacks operating over ranges of temporal and spatial scales (including anthropogenic effects), the small size of the overall program in earth science in Israel could provide significant strategic limitations over the coming decades. One approach to strengthening and amplifying these efforts would be to pursue partnerships across traditional disciplinary boundaries, including physics, chemistry, biology, engineering, etc. We also note that a large and growing number of Israeli students are interested in these important topics.

¹ We refer to the earth sciences throughout, but this includes the earth, environmental, and planetary sciences in the broadest sense.

2. Given financial realities and the competition within universities for resources, we recognize that teaching and research in earth science on the national scale is likely to grow incrementally and slowly at best. One possibility for enhancing the impact of teaching and research of the earth sciences at a time of such restrictions is for Israeli universities to look for opportunities for stronger intra-university programs (e.g., coupling with geography, engineering, astronomy, etc.) and inter-university programs (e.g., in marine science, fossil fuels, geophysics), in which different departments and different universities, governmental agencies, and even industry share resources (including instrumentation) in order to offer more comprehensive programs. We saw several creative examples of this during our visit; we applaud them and encourage that more such joint operations be contemplated when they make sense (i.e., they should be chosen carefully and not undertaken unless there is significant leverage and amplification for the department, university, and/or nation. The small distances involved within Israel could make such efforts more feasible than in other nations, and could thus be a competitive advantage relative to larger nations.
3. Teaching and research in geophysics exists at all three universities (and now at Haifa University). Nevertheless, the review committee sees opportunities for all three programs to focus more on geophysical approaches to the earth sciences. We feel that a greater emphasis on seismology, with a strong core of global rather than regional or applied seismology, would be a very valuable investment that would nucleate a broader interest and impact in the larger area of solid-earth geophysics. This global core would spill out to several of the critical needs of the country (e.g., fossil fuel research, exploration geophysics, marine geophysics, regional seismicity and associated natural hazards, geological engineering) by stimulating a significantly larger research and educational effort. Although the current situation is not dire, the committee did feel that most Israeli students in earth sciences are not as broadly exposed to geophysics and its unique approaches to solution of earth science problems as they are to geochemistry, for example. Expansion of research and education in geophysics nationally would be an excellent investment that would contribute directly and forcefully to the nation's readiness to respond to opportunities for discovery and exploitation of oil and gas resources.
4. A substantial fraction of Israeli university graduates in earth science go to work for the government or industry in fields such as environmental engineering and assessment, geophysical exploration, atmospheric science, and meteorology. Although we did not have access to systematic data, it appeared to the committee that the graduates were generally successful in finding employment that they considered to be interesting and valuable, and therefore rewarding (particularly after earning an M.Sc. degree). We recommend that the departments take a more active role in preparing their students for such careers through activities such as visits and seminars by alumni working in industry, encouragement of internships with government and industry, and perhaps some curricular modifications (e.g., the development of M.Sc. programs in fossil fuels that are currently under consideration). Moreover, we urge that the departments work at maintaining up-to-date databases on their alumni and try to maintain closer ties with them on a continuing basis. The central administrations of the universities could provide considerable help with this.
5. The committee was struck by the large number of mandatory courses for undergraduates at all three of the universities, in some cases comprising 85% of the courses taken by students during their studies. This leaves little to personal choice. Additionally it impacts the teaching load of the faculty, with the undesirable result that an insufficient number of graduate level classes are taught because the faculty are preoccupied with the courses they require of their undergraduates. We strongly urge that all three of the departments we visited reconsider this approach to educating their

students. A smaller core of required classes with a specified minimum number of electives that the students choose in consultation with their advisors is uniformly believed by the review committee to be a better pedagogical approach. Note also that most of the students appear to go on to get a master's degree, often considered as an entry-level requirement for employment in industry, so the notion that every student has to learn everything that they might need for professional training during their undergraduate studies does not necessarily make much sense, especially given the universal complaint of the graduate students that there are not enough classes offered at the graduate level. The committee also discussed the possibility of a five-year B.A.-M.Sc. programs that would incorporate some of these suggestions and greater research appointments for undergraduate students.

6. The committee was struck by the fact that most Israeli students in earth sciences tend to continue to graduate studies in the same university and department in which they undertook their undergraduate studies. This pattern, which we were told characterizes the entire Israeli higher education system, prevents students from being exposed to the broadest possible range of ideas, approaches, and knowledge. Although we recognize that there are sometimes family and financial reasons for this, the pattern is too persistent for this to be the main reason for what this observation; indeed, we were even told that the faculty encourages this in order to have a stream of students who can work effectively with (and for) them as graduate students. We also note that this pattern exacerbates the problems of insufficient graduate classes being available, since most students have already taken most of the classes that are offered as required classes when they were undergraduates at the same university. We urge the universities to work together to encourage mobility of their graduates and to emphasize its value; students might still choose to continue at a single institution, but they would be made aware of factors that do not always make this optimal for their training. We also think that it could be useful for the Committee on Higher Education to look into this matter.
7. Exposure to the earth and environmental sciences is critical for an educated citizenry, both from a fundamental viewpoint (i.e., all educated people should know something about the planet on which they live) and from a more practical standpoint since some level of exposure to the science behind these issues is important for making wise collective decisions (i.e., our society will be faced with critical decisions about resources, climate change, etc.). This is particularly important for technically educated citizens. We urge that earth science faculty and departments be encouraged to offer instruction aimed at the larger community of students beyond those choosing to get degrees in the earth sciences. Sadly, we perceived that in some situations, the manner in which students are "counted" is related solely to the number getting degrees in the earth sciences; regrettably, particularly in a period of limited resources, teaching broadly for the good of the university is thus neither encouraged nor rewarded. We urge the departments and universities to find creative approaches to engaging the earth science faculty in broad education of their undergraduate science and non-science populations.
8. An issue common to all three programs that the committee reviewed is their small number of postdoctoral scholars relative to that in major earth science programs in Europe and the United States. A flow of high-quality postdoctoral scholars provides stimulation for the faculty and students, brings new energy and ideas to the department, provides a competitive edge for faculty (and particularly junior faculty) by bringing the best researchers to their labs, and provides a proving ground for potential faculty members. The committee understands that grant funding typically does not provide sufficient funds for postdoctoral scholars and that university resources in Israel do not traditionally provide such funds, but creative approaches to funding postdoctoral scholars, especially via competitive prize fellowship programs, would provide a significant competitive advantage for Israeli earth science programs. The

committee was also surprised that in some cases startup funds could not be used to support postdoctoral scholars; as mentioned above, postdoctoral scholars can provide a particularly powerful boost for young faculty members who are just starting their research programs, and we urge that whatever impediments might currently exist for such use of startup funds be removed. A related need is for funds to bring visiting faculty from abroad to Israeli earth science programs; these visitors would provide stimulation and generate a cadre of international supporters of Israeli earth science whose support would extend over decades.

9. Another issue that came up at all three programs related to concerns over inadequate technical support to maintain state-of-the-art laboratories. The committee strongly agrees that such support is crucial in modern experimental science and that this issue transcends the earth sciences. The departments are urged to find balanced, responsible mixes of sources of funding for technical support. Such mixes could departmental funds, grant funds, and funds from the central administration. The departments and universities should also consider programs that could bank funds during good times so as to provide buffers for those periods when grant funds run low; part-time teaching positions (when appropriate) to provide partial support for technical personnel; and sharing of technical support personnel between several faculty members and labs.
10. The committee encountered the widespread belief that the pool of potential faculty members for Israeli universities is limited to Israeli's working abroad, or who recently completed high-profile postdoctoral experiences abroad, or who received their PhD's from high-quality graduate programs abroad. In particular, there is a sense that non-Israelis would not be attracted to academic jobs in Israel. While the committee accepts that this may be the reality on average, we urge our Israeli colleagues to consider broadening their faculty searches, perhaps even to senior people. If the programs and opportunities are attractive enough and the departments and universities are creative and bold enough, the committee believes that it should be possible for Israeli earth science programs to compete for a wider range of potential faculty members, specifically non-Israeli citizens. This may be a small fraction of faculty appointments, but we urge the community to search for such opportunities.

Signed by:

Edward Stolper

Prof. Edward Stolper- Chair

Henry Elderfield

Prof. Henry Elderfield

Yair Rotstein

Dr. Yair Rotstein

Ken Lerner

Prof. Kenneth Lerner

Gerald Schubert

Prof. Gerald Schubert

Mark Thiemens

Prof. Mark Thiemens

Appendix 1: Copy of Letter of Appointment

February 21, 2012

Prof. Edward Stolper
Division of Geological and Planetary Sciences
California Institute of Technology
USA

Dear Professor Stolper,

The Israeli Council for Higher Education (CHE) strives to ensure the continuing excellence and quality of Israeli higher education through a systematic evaluation process. By engaging upon this mission, the CHE seeks to: enhance and ensure the quality of academic studies, provide the public with information regarding the quality of study programs in institutions of higher education throughout Israel, and ensure the continued integration of the Israeli system of higher education in the international academic arena.

As part of this most important endeavor we reach out to world-renowned scientists to help us meet the critical challenges that confront the Israeli higher education by accepting our invitation to participate in our international evaluation committees. This process represents an opportunity to express our common sense of concern and to assess the current and future status of education in the 21st century and beyond. It also establishes a structure for an ongoing consultative process among scientists around the globe on common academic dilemmas and prospects.

I therefore deeply appreciate your willingness to join us in this crucial enterprise.

It is with great pleasure that I hereby appoint you to serve as the chair of the Council for Higher Education's Committee for the Evaluation of Geology and Earth Science. The composition of the Committee will be as follows: Prof. Edward Stolper (Chair), Prof. Harry Elderfield, Prof. Ken Lerner, Dr. Yair Rotstein, Prof. Gerald Schubert, Prof. Mark Thiemens.

Ms. Marissa Gross will coordinate the Committee's activities.

In your capacity as the chair of the Evaluation Committee, you will be requested to function in accordance with the enclosed appendix.

I wish you much success in your role as chair of this most important committee.

Sincerely,
Gideon Sa'ar
Minister of Education,
Chairperson, the Council for Higher Education