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25 Years Geothermal Institute (University of Auckland, 1979-2003)

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ABSTRACT:

A history of the Geothermal Institute (GI) at the University of Auckland is presented. The main activities and outputs until 2003 are described. Teaching of geothermal courses at the Institute began in 1979 and ceased at the end of 2002 when the NZ Aid programme withdrew its financial support. A total of 774 fellows (700 from 36 developing countries) attended the annual postgraduate Diploma Course (665 fellows) and the shorter (3 months) specialized professional training courses (119 fellows). The graduate school has been attended by 108 graduates (44 from developing countries). Alumni of the Geothermal Institute account for c. 44% of all fellows who received training at the four international geothermal training centres (Auckland, Kyushu, Pisa, Reykjavik) between 1970 and 2002.

1. INTRODUCTION

Group training of candidates from developing countries in geothermal technology started at the International School at Pisa (Italy) and at Kyushu University (Japan) in 1970. These were non-degree overview type courses lasting, on average, between 9 and 2 or 4 months in Pisa and Kyushu respectively. This was the decade which saw a rapid expansion of geothermal projects in developing countries, sponsored by international and bilateral aid. Overview teaching, however, could not cope with demand for specialized and academic type training. At the request of the UN Development Programme (UNDP) and with the support of the NZ Ministry of Foreign Affairs (MFA), the Geothermal Institute (GI) was established in 1978 at the University of Auckland (UA). Its purpose was from 1979 onward to teach a post-graduate, 10 months long, academic Diploma course for earth scientists and engineers from developing countries and from New Zealand. After this course started in Auckland, a 6-months training course began at Reykjavik (Iceland) in 1979 as part of a UNU training programme.

Fellows from developing countries attending the Auckland course received fellowships from either the UNDP - or NZ aid (1979-1989). From 1990 onwards, MFA, later the NZ Ministry of Foreign Affairs and Trade (MFAT), became the main sponsor of fellowships and continued to do so until the end of 2002 when MFAT, after creating a separate NZ aid agency, cancelled its sponsoring role. Until then a total of 24 Geothermal Diploma courses had been held at the GI. The Institute increased its role in geothermal training by running parallel to the Diploma Course a 3 months long professional course, by establishing a flourishing graduate school in the Geology and Mechanical Engineering departments, by giving short geothermal courses in developing countries, and by holding annually a Geothermal Workshop marking the end of each Diploma Course. An overview of the activities of the Geothermal Institute (GI) is given in this paper.

2. THE GEOTHERMAL INSTITUTE (STAFF AND SUPPORT)

The core activity was the teaching of the Geothermal Diploma Course. The lectures covered 6 disciplines, namely: geochemistry, geology, and geophysics in earth sciences and geothermal fluid production, utilization, and reservoir engineering as engineering disciplines. An overview paper (c. 3 months) covered the role of each discipline in the context of geothermal exploration and exploitation. The structure of the Diploma Course has been described in earlier papers (Freeston and Hochstein, 1980; Hochstein and Freeston, 1985; Hochstein, 1988). In theory, the syllabus required teaching by 6 staff members. Because of financial restrictions we started the course with only 4 academic staff, thus covering about 2/3 of the syllabus. For the remainder we relied on inputs by staff from other university departments, NZ government departments, and the NZ geothermal industry which all provided willingly support until the end. The number of staff later increased (up to 6) and from 1996, which saw the introduction of a new semester system, all disciplines were fully taught by GI staff.

Activities, policy decision, and student selection were controlled by a Board of Studies (BoS) made up by staff members of the university, representatives of NZ Government departments, the NZ geothermal industry, and the NZ Ministry of Foreign Affairs. Prof. R.N. Brothers was instrumental in setting up the GI and was the first chairman of the Board (1979-1983); those who followed were Prof. R.F. Meyer (1984-1991), Prof. R. Sharp (1992-1996), and Prof. P. Brothers (1998 to 2002).

Directors of the GI were:

A/Prof. M.P. Hochstein (1979-1994); A/Prof. P.R.L. Browne (1994-1998); A/Prof. A. Watson (1999-2002); A/Prof. S.F. Simmons took over directorship in 2003.

Teaching staff at the Institute between 1979 and 2003 were:

Geology: A/Prof. P.R.L. Browne (1979-now);

Geochemistry: Dr. K. Nicholson (1986-1989); A/Prof. S.F. Simmons (1990-now);

Geophysics: A/Prof. M.P. Hochstein (1979-1997); Dr. S. Soengkono (1990-2003);

Engineering: A/Prof. D.H. Freeston (1979-1993); Dr. M. Dunstall (1994-2001);

Disciplines:Dr. R. McKibbin (1981-1991); Mr. K.C. Lee (1992-2003); A/Prof. A. Watson (1996-2002).

Not listed are the large number (over 100) of staff and professionals from the University, NZ Government departments, and the NZ geothermal industry. Their names and contributions are listed in the Proceedings of the Geothermal Workshops held at the University of Auckland at the end of each Diploma Course.

3. ACTIVITIES OF THE GI (TEACHING AND RESEARCH)

Staff of the Institute were involved in four activities, all directed towards the training of geothermal students and professionals, namely:

1. the annual Geothermal Diploma Course (c.10 months),

2. specialised professional courses (3 months),

3. research studies centred on the graduate school, and

3. irregular short training courses given in developing countries (usually 2-4 weeks).

3.1The Geothermal Diploma Course

The course was given for 24 years from 1979 to 2002. A total 655 students (from 36 countries) attended it (Fig.1), 52% were earth scientists and 48% engineers. Our records show that 592 candidates obtained the 'Diploma in Geothermal Energy Technology' (Dip GeothermTech) after passing all examinations and producing a project report. A 'Certificate in Geothermal Technology' (Cert GeothermTech) was introduced in 1984 to recognise the achievements of candidates who passed 3 out of 4 written examinations. Between 1984 and 2002 a total of 30 fellows obtained the 'Certificate'.

The largest student groups came from Indonesia and the Philippines (together 41%), reflecting the large training demand of these two countries where geothermal projects had been sponsored by bilateral NZ Aid programmes since the 1970's. The number of students from Asia (18%), Latin America and Africa (c.15% each) were of similar proportion. About 89% of all Diploma students came from developing countries, the remainder came from New Zealand (7.5%) and Europe (3.5%). The NZ student group was the only one which declined in numbers over the years, reflecting in part the stagnant NZ geothermal industry. However, a significant number of other NZ students (total of 101) attended some geothermal lectures as part of their Master program without enrolling in the Diploma Course. The proportion of female Diploma students increased steadily with time as a result of NZ Aid policy. Overall 11% of all Diploma students were female professionals. About 75 % of all Diploma students received fellowships to attend the course, either from the UNDP programme (1979-1989) or from the NZ aid votes (1982-2002). The remainder had either private sponsorship or were NZ students with subsidised entrance. The GI also sponsored some students (e.g. a few from Algeria and Turkey). Detailed statistical data have been presented (Hochstein, 2003).

An English language training course, given prior to the start of each Diploma Course, became an integral part of the study programme. The course (c. 3 months duration) started in Wellington in 1984 to prepare students with language difficulties for the academic course. In 1987 the course moved to Auckland and was re-organised by Dr. Judith Grant. All together, a total of 284 Diploma students attended the language training course (1984-2002) with NZ MFA (later MFAT) covering the additional costs of 244 candidates and UNDP sponsoring the rest

3.2 Professional (3-months) geothermal training courses

Employers of our Diploma students told us in 1984 that the Diploma course was excellent for their junior staff but it was too long for more senior staff who required some specialized training, albeit by shorter courses. Evaluation of a questionnaire showed that 'reservoir engineering' and 'environmental problems' were quoted most frequently for prospective professional courses. Assessment by GI staff and the NZ geothermal industry indicated that a specialized training course of 3 months would adequately cover each topic. The proposal was accepted by the MFA section looking after aid programmes which made 6 fellowships available for each of the courses from 1988 onwards.

The 'Reservoir Engineering' course was organised by Dr. R. McKibbin with a large input by Prof. M. O'Sullivan (School of Engineering). The first course was given in 1988. Subsequently, it was given every year until 1997 and again in 2000 and 2001. GI staff had too little experience to teach the Environmental Course. Such a course could only be given from 1997 onwards when A./Prof.K.Brown (Geology Dept.) prepared a syllabus. This course covered environmental problems associated with geothermal developments and was given for the first time in 1998, and again in 1999 and 2002. A total of 119 candidates (from 17 countries) attended the 3-months courses (Fig.1). Most of the candidates (90) received NZ Government sponsored fellowships, the remainder were privately funded. More than half (c. 54%) came from Indonesia and the Philippines, 14 students (12%) came from developed countries (Europe and New Zealand). The proportion of female students (c. 18 %) was higher than that of the Diploma Course. A total of 18 students (15%) had previously attended the Geothermal Diploma course.

3.3 Graduate School

After the first Diploma Course, graduate students started to enrol at the Geology Dept. and the School of Engineering to undertake research of a geothermal topic which was supervised by GI staff. A total of 108 graduates completed their MSc-, ME-, or PhD study at the Institute between 1980 and 2002. Awarded were 50 MSc degrees (earth science), 30 ME degrees (engineering), 16 and 8 PhD degrees in earth sciences and engineering respectively - the 108 awarded degrees also included 4 other degrees (MPhil, BScHons).

A total of 44 graduates came from 8 developing countries and 64 graduates from 6 developed countries (46 from New Zealand (incl. 2 from Australia), 11 from the US, and 7 from Europe). One third of the graduates had previously attended the Diploma Course and almost all received a NZ Government fellowship. There were 20 female students among these graduates. The Graduate School was also attended by 10 foreign students who undertook a year of a research study at Auckland University; this group included 6 Fullbright fellows.

3.4 Geothermal Training (in developing countries)

GI staff also taught geothermal courses in several developing countries. At least 18 short courses, each lasting between 1 and 4 weeks, were given in 6 developing countries between 1979 and 2002. Most of the courses (13 out of 18) were held in Indonesia and one course each in PR China, El Salvador, Mexico, the Philippines, and Turkey. Many Indonesian courses were sponsored by NZ aid, others by PERTAMINA (Indonesian Govt. Oil Co.). Allowing for some repeat attendance, it was estimated that at least 300 candidates attended our overseas courses (see Fig. 2).

GI staff also taught candidates from developing countries at the three other international geothermal schools and at Indonesian universities. Between 1981 and 1990 staff spent about 2 months each, teaching at Reykjavik (A/Prof. Freeston and A/Prof. Browne), at Pisa and Kyushu (A/Prof. Hochstein), and at ITB Bandung (Dr. McKibbin).

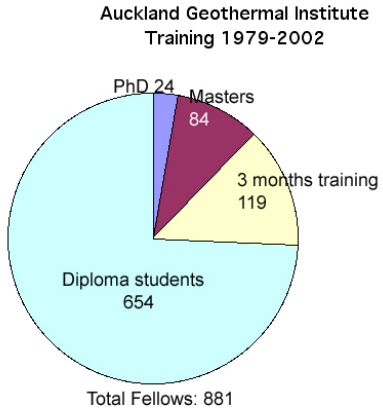

Figure 1: Auckland Geothermal Institute; proportion of training courses.

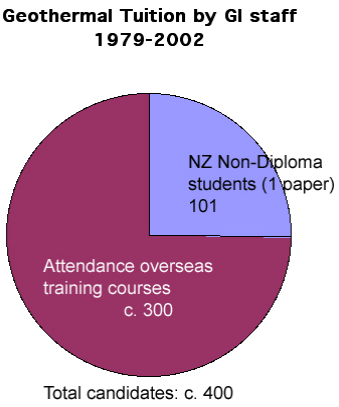

Figure 2: Other Geothermal Tuition given by GI staff.

4. RESEARCH AND AWARDS

Geothermal research has been an important activity of the Geothermal Institute, involving Diploma students, the graduate school students, and staff. Diploma students had to submit a project report (c. 2 months completion time) on aspects of geothermal exploration, assessment, production, or utilization as part of their academic course. Four or five projects were annually selected for oral presentation at the NZ Geothermal Workshop. About 600 Geothermal Diploma Projects have been deposited with the Library of the School of Engineering, their abstracts are listed in the Proceedings of the NZ Workshops (1980-2003). Several Diploma students (c. 60) published some of their work in the Proceedings, sometimes years after they had left New Zealand. Half of the students in the graduate school (c. 55) also presented some of their research work in the Workshop Proceedings.

Geothermal Institute staff published c. 60 papers in the Proceedings of the NZ Workshops (until 2003) and c. 100 papers with students as co-authors. Of the c. 1100 papers in the Proceedings since 1979, about 25% were therefore written by staff, Diploma students, and graduates (allowing for joint authorship between the groups). Staff of the GI also published c. 150 refereed papers (and sections in books) in international journals (until 2002). Another c. 40 papers of GI staff and students appeared in the Proceedings of overseas geothermal conferences such as the Stanford Geothermal Reservoir Workshop, the (US) Geothermal Resources Council conferences, and more recently the geothermal workshops in the Philippines and Indonesia. Most of these workshops and the Geothermal World Congress conferences (every 5 years) were attended by at least one staff member who usually presented a paper; this helped to spread our research results. Staff also wrote a large number of technical reports for international and bilateral aid agencies, for local bodies, and consulting reports. The annually published 'Research Reports' series of the University of Auckland lists a total of c. 70 technical reports written by GI staff since 1979. Much effort also went into the writing teaching manuals for each of the 8 lecture courses since appropriate texts were not available.

Several awards were given every year to our geothermal students. The most prestigious was the 'Mitsubishi Prize in Geothermal Technology' which was sponsored jointly by three different Mitsubishi companies. The Prize was awarded from 1981 to 2000 to the most meritorious Diploma students on the basis of their academic performance and professionalism; it provided a trip to Japan to inspect geothermal developments there. A list of the 20 students who obtained the Prize is shown in Table 1. Other prizes were awarded annually at the end of each Course to the best earth science and engineering students. These were provided during the last 10 years by IGNS and Century Res. Ltd. (formerly Works Geothermal) respectively. Prizes were also presented to students at the end of the NZ Geothermal Workshop by the New Zealand geothermal industry (for example, GENZL, Sinclair Knight Merz Ltd (former KRTA), Design Power, and Ormat Pacific Ltd.) and the Geothermal Institute.

Another important award was the annual Mitsubishi Fellowship which allowed academic staff and professionals from overseas universities and companies to join the Institute and to undertake some teaching and research in their own discipline, usually during one term; the Fellowship was awarded between 1981 and 2001. It could be split and was sometimes awarded to deserving graduate students. The Mitsubishi Fellows at the Geothermal Institute are also listed in Table 1. A few visitors came to us with other fellowships. All visiting fellows contributed significantly to our teaching and research.

5. IMPACT OF THE DIPLOMA COURSE

Data are available which allow some comparison of the student populations at Pisa, Kyushu, and Reykjavik during the duration of the Auckland courses (Dickinson and Fanelli, 1995; Fridleifsson, 2000; Ushijima, 2002). Teaching and training schedules indicate three types of geothermal courses which were open to candidates from developing countries:

1. overview type courses at Pisa (average c. 9 months) and Kyushu (2 or 4 months),

2. specialized teaching at Reykjavik (6 months) and Auckland (3 months course), and

3. one year post graduate Diploma course at Auckland with integrated and linked teaching of overview and specialized topics.

The composition of student population at the four international training centres is shown in Fig.3. Of the total of 1764 candidates who received geothermal tuition between 1979 and 2002, 711 (c. 40%) attended the courses in Pisa

and Kyushu, 655 (37%) the 1-yr Diploma Course in Auckland, and 398 (22%) the specialized teaching courses at Reykjavik and Auckland. At least 5% of all candidates attended more than one course; a total of 224 (out of 1764) students during that period were from developed countries. The number of students (774) who attended the two Auckland courses make up c. 44% of all candidates at the four international geothermal schools.

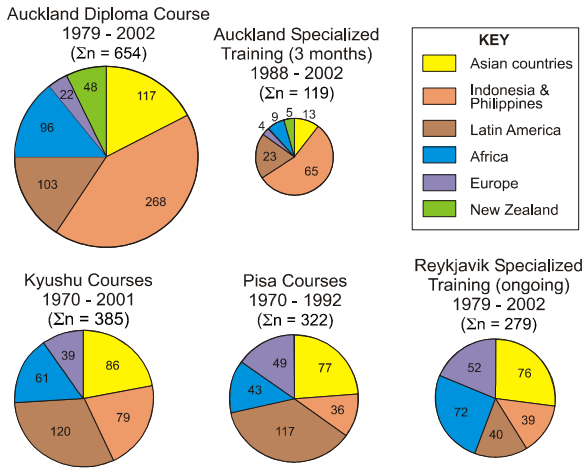

Figure 3: Student Population at International Geothermal Training Courses (1970-2002).

6. SUMMARY

Geothermal Technology was taught at the Geothermal Institute, University of Auckland, from 1979 to 2002. The annual Diploma course was attended by 655 candidates (595 from developing countries); c. 400 fellows and c. 100 fellows were sponsored by fellowships provided by the NZ Government and the UNDP respectively. Specialized professional training was given to 119 candidates (105 from developing countries) from 1988 to 2002; c. 90 candidates received fellowships from the NZ aid programmes. Maintaining the sponsorship for the Geothermal Institute over 25 years was a major NZ aid contribution (of the order of 20 Mill. $ NZ).

A change in NZ aid policy to projects to eliminate poverty, mainly in the Pacific region, and administered by the new NZ Aid agency, led to closure of the Diploma- and specialized training courses at the end of 2002. At that time there was still a significant demand by developing countries for geothermal training at Auckland, especially for the specialized courses, as documented by the numerous applications which had been received. Protests by the international geothermal community (IGA News, Nr.50, 2002) to MFAT did nothing to change its decision. It appears now that aid administrators of developed countries are not willing to sponsor such training if it involves support of teaching institutions. This argument was used by the UNDP Programme when it withdrew its support from the Auckland course in 1989; it probably also explains the closure of the course at Pisa and more recently that at Kyushu.

However, staff of the Geothermal Institute, alumni, graduates, and students are proud of their achievements covering a quarter of a century. Their work has, and will, have lasting impact, especially in countries where GI fellows have become an integral part of the geothermal community. Geothermal research is also continuing at the University of Auckland, namely at the Geology Department and the School of Engineering, – and many fellows from developing countries are involved in geothermal research.

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Table 1: Holders of the MITSUBISHI Fellowship and the MITSUBISHI Prize

Year	MITSUBISHI Fellowship Holders (incl. teaching fellows)		MITSUBISHI Prize (Diploma students)	
2001	Dr. Feeydoun Chazban (Iran)	(ES)		
2000	Dr. Cedric Malate (Philippines)	(Eng)	Armando Arciaga	(Philippines)
1999	Dr. Fauzi Sulaiman (Indonesia)	(Eng)	Ontowiryo Alamsyah	(Indonesia)
1998	(appointments delayed by 1 yr)		Imam Baru Raharjo	(Indonesia)
1997	A/Prof. Ryuichi Itoi (Japan)	(Eng)	Ali Mundakir	(Indonesia)
1996	Prof. Ladzi Rybach (Switzerland)	(ES)	Salvius Pantangke	(Indonesia)
	Dr. Al H.Truesdell (US)**	(ES)		
1995	Prof. John Lund (US)	(Eng)	Rosella Dulce	(Philippines)
1994	Prof. Kiril Popowski (Macedonia)	(Eng)	Peter Aloo	(Kenya)
1993	Prof. Grant Heiken (US)	(ES)	Glenn Golla	(Philippines)
	Nessy Nezhadkhoujeh (NZ)*	(Eng)		
1992	Dr. Don E.Michels (US)	(Eng)	Nathaniel Malaqui	(Philippines)
1991	Prof. David I.Norman (US)	(ES)	Julio Guidos Pineda	(El Salvador)
	Klaus Regenauer-Lieb (Germany)*	(ES)		
1990	Dr.Colin Harvey (NZ)	(ES)	Wilson Clemente	(Philippines)
	Huang Yicun (PR China)*	(Eng)		
1989	Prof. Bill Chen (US)	(Eng)	Rommel Obate	(Philippines)
	Dr.Rosa Prol-Ledesma (Mexico)**	(ES)		
1988	Prof.Rolf Gutdeutsc h (Austria)**	(ES)	Raj Bansh Singh	(India)
	Marcel van Dijck (NZ)*	(ES)		
	Graeme Scott (NZ)*	(ES)		
1987	Dr.Hjalti Franzson (Iceland)	(Eng)	Suroto	(Indonesia)
	Dr.Doddy Abdassah (Indonesia)	(Eng)		
1986	Dr.Sachio Ehara (Japan)	(ES)	George Muga	(Kenya)
	Prof. Edward Appleyard (Canada)	(ES)		
1985	Dr.Jean-Michel Coudert (France)	(Eng)	Francis Sta.Ana	(Philippines)
	James Kanyua (Kenya)*	(Eng)		
1984	Basil Stilwell (NZ)	(Eng)	Mihai Sarbulescu	(Romania)
	Graeme Scott (NZ)*`	(ES)		
1983	Kelvin Youngman (NZ)*	(ES)	Gil Batayola	(Philippines)
	Graeme Scott (NZ)*	(ES)		
1982	Dr. Einar Eliasson (Iceland)	(Eng)	Teklu Hadgu	(Ethiopia)
1981	Dr. Al H. Truesdell (US)	(ES)	Ricardo Marquez	(Mexico)

* Master- or PhD student (GI) ** Other fellowships