GL01475

U.S. EXPORT OF EQUIPMENT AND SERVICES FOR GEOTHERMAL DEVELOPMENT IN THIRD-WORLD COUNTRIES

Project Component	Percent of Total Project Cost	Percentage Spent in U.S.	Percentage Spent in Recipient Country
Exploration	5	3	2
Drilling	35	10	25
Well Testing/Reservoir Engineering	5	3	2
Fluid Production	11	4	7
Plant Design	7	6	1
Equipment Manufacturing	22	9	13
Plant Construction	15	4	11
	100	39	61

POTENTIAL FOR GEOTHERMAL POWER GENERATION IN DEVELOPING COUNTRIES

	potential megawatts
Latin America	
Mexico	5,000
Guatemala	2,000
El Salvador	2,000
Nicaragua	2,000
Costa Rica	2,000
Honduras	
Panama	1,000
Colombia	1,000
Equador	1,000
Peru	1,000
Chile	2,000
Argentina	1,000
Bolivia	500
Venezuela	500
Brazil	100
Caribbean	
Dominican Republic	50
Dominica	100
Monserrat	100
Grenada	100
Nevis-St. Kitts	50
St. Lucia	100
St. Vincent	50
Asia-Pacific	
Philippines	8,000
Indonesia	8,000
Papua New Guinea	3,000
China	500
India	200
Thailand	200
Vietnam	100
Burma	100
Fiji	50
Solomon Islands	50
Tonga	50
Vanuatu	50
Africa	
Kenya	1,700
Djibouti	500
Ethiopia	5,000
Zaire	500
Tanzania	600

Malagasy	300
Sudan	300
Somalia	50
Uganda	500
Rwanda	100
Burundi	50
Zambia	50
Malawi	50
Zimbabwe	50
Mozambique	50
Comoro Islands	20
Eastern Europe and Mediterranian	
Turkey	200
Greece	100
Hungary	300
CIS	2,000
Atlantic	
Azores	100
Ascension	50
	59,050

FACT SHEET

THE EXPORT-IMPORT BANK OF THE U.S.

The Export-Import Bank of the United States (Ex-Im Bank) is an independent U.S. Government agency that helps finance the overseas sales of U.S. goods and services. During its 60 years, Ex-Im Bank has supported more than $290 billion in U.S. exports.

WHAT IS EX-IM BANK'S MISSION?

Ex-Im Bank's mission is to create jobs through exports. It guarantees both working capital loans for U.S. exporters and the repayment of loans by foreign purchasers of U.S. goods and services. Ex-Im also provides credit insurance that protects U.S. exporters against the risks of non-payment by foreign buyers for political or commercial reasons. The Bank does not compete with commercial lenders, but assumes the risks they cannot accept. It always must have a reasonable assurance of repayment.

WHEN CAN EX-IM BANK HELP?

Ex-Im Bank helps provide a level playing field for U.S. exporters by countering the export credit subsidies of other governments. It also provides financing to creditworthy foreign buyers when private financing is unavailable. To qualify for Ex-Im Bank support, the product or service must have at least 50 percent U.S. content and must not affect the U.S. economy adversely.

Ex-Im Bank supports the sales of U.S. exports worldwide. In recent years, its focus has shifted to the developing nations whose economies are growing at twice the rate of the industrial nations.

The Bank will finance the export of any type of goods or services, including commodities, as long as they are not militarily-related. Two of its major goals are to increase the export of environmental goods and services which are in strong demand among the developing nations, and to expand the number of small businesses using Ex-Im programs.

While Ex-Im Bank is not a foreign aid or development agency, its programs often help U.S. exporters participate in development projects. Ex-Im Bank has co-financed projects with the U.S. Agency for International Development (USAID), the World Bank, and regional development banks.

EXPORT-IMPORT BANK OF THE UNITED STATES
811 VERMONT AVENUE, N.W. WASHINGTON, D.C. 20571
(800) 565-EXIM , X3200 (202) 565-3200 FAX: (202) 565-3210

WHAT PROGRAMS DOES EX-IM BANK OFFER?

1. *Working Capital Guarantees* cover 90 percent of the principal and interest on commercial loans to creditworthy small and medium-sized companies that need funds to produce or market U.S. goods or services for export on transactions over $833,333. Transactions under $833,333 . Ex-Im Bank extends greater delegated authority to commerical lenders and asks them to assume increased risks in return. Exporters may apply for a Preliminary Commitment (PC)--a letter from Ex-Im Bank outlining the terms and conditions under which it will provide a guarantee--which can be used to obtain the best financing terms from a private lender. The lender also may apply directly for a final authorization. Guarantees may be for a single transaction or a revolving line of credit. There are no minimum or maximum loan amounts. Guaranteed loans generally have maturities of 12 months and are renewable.

2. *Export Credit Insurance* policies protect against both the political and commercial risks of a foreign buyer defaulting on payment. Policies may be obtained for single or repetitive export sales and for leases. They generally cover 100 percent of the principal for political risks and 90-95 percent for commercial risks, as well as a specified amount of interest. Short-term policies are used to support the sale of consumer goods, raw materials and spare parts on terms of up to 180 days, and bulk agricultural commodities, consumer durables and capital goods on terms of up to 360 days.

   Capital goods may be insured for up to five years, depending upon the contract value, under medium-term policies. Ex-Im Bank's credit insurance allows exporters to finance receivables more easily by assigning the proceeds of the policy to their lender.

3. *Guarantees* of commercial loans to foreign buyers of U.S. goods or services cover 100 percent of principal and interest against both political and commercial risks of nonpayment. Medium-term guarantees cover the sale of capital items such as trucks and construction equipment, scientific apparatus, food processing machinery, medical equipment, or project-related services--including architectural, industrial design, and engineering services. Long-term guarantees are available for major projects, large capital goods and/or project-related services. Ex-Im Bank's Credit Guarantee Facilities also can be used to extend medium-term credit to buyers of U.S. capital goods and services through banks in certain foreign markets.

4. *Loans*, extended directly or through an intermediary, provide foreign buyers with competitive, fixed-rate financing for their purchases from the United States.

   Ex-Im Bank's loans and guarantees cover 85 percent of the contract price (100 percent of the financed portion). The foreign buyer is required to make a 15 percent cash downpayment. The fees charged by Ex-Im Bank for its programs are based on the risk assessment of the foreign buyer or guarantor, the buyer's country, and term of the credit. Ex-Im Bank's fees are competitive with those charged by the export credit agencies of other exporting countries.

When there is no foreign competitor, exporters can obtain an Ex-Im Bank Letter of Interest (LI) to assist in negotiations with a potential foreign buyer. The LI indicates the Bank's willingness to consider a financing offer if sale is completed. An LI can be issued within seven days of a request for financing and remains in effect for six months.

WHERE TO APPLY FOR EX-IM BANK PROGRAMS:

Ex-Im Bank's programs are easily accessible. Any responsible party--the foreign buyer, the U.S. exporter, a lending institution, or a firm representing either the buyer or the exporter--can apply directly to Ex-Im Bank for a PC or LI. Potential borrowers also may obtain assistance in applying for financing at any Ex-Im Bank office or one of the U.S. Export Assistance Centers (USEAC) listed below. USEACs are one-stop centers for the services of the U.S. Department of Commerce, the Ex-Im Bank, the U.S. Small Business Administration and other export-related federal and state agencies.

Baltimore USEAC	(410) 962-9539, (410) 962-4529 Fax
Miami USEAC	(305) 526-7425, (305) 526-7435 Fax
Chicago USEAC	(312) 353-8040, (312) 353-8120 Fax

Further information about Ex-Im Bank programs may be obtained from U.S. embassies or consulates and state governments participating in the Ex-Im Bank City/State Program, or by contacting:

EXPORT-IMPORT BANK OF THE UNITED STATES
811 Vermont Avenue, N.W.
Washington, DC 20571
Telex: (TRT) 197681 EXIM UT

U.S. Toll Free Number:	1-800-565-EXIM
Worldwide Number:	(202) 565-3946
Main Fax Number:	(202) 565-3380
Electronic Bulletin Board:	(202) 565-3835
Business Development Group:	(202) 565-3900
Domestic Business Development:	(202) 565-3932 Fax
International Business Development:	(202) 565-3931 Fax
Seminar Information:	1-800 or (202) 565-EXIM (565-3946)
TDD:	(202) 565-3377

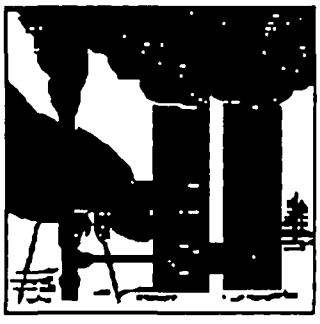
Regional Offices:

New York, NY:	(212) 466-2950, (212) 466-2959 Fax
Miami, FL:	(305) 526-7425, (305) 526-7435 Fax
Chicago, IL:	(312) 353-8081, (312) 353-8098 Fax
Houston, TX:	(713) 589-8182, (713) 589-8184 Fax
Los Angeles (El Segundo), CA:	(310) 322-1152, (310) 322-2041 Fax

PMW
FYI
Dennis

VOL 2, No. 1 APRIL 1992

THE OLD BORE



NEWSLETTER OF THE ALUMNI OF THE GEOTHERMAL INSTITUTE

Geothermal Institute, University of Auckland, Private Bag 92019, Auckland, New Zealand.
Telephone: ++64 9 373 7999 Facsimile: ++64 9 373 7436

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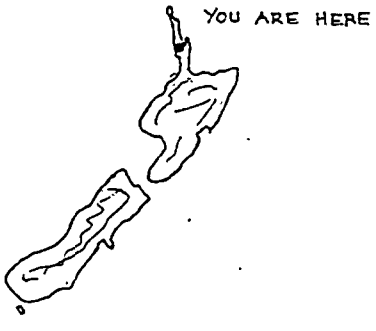
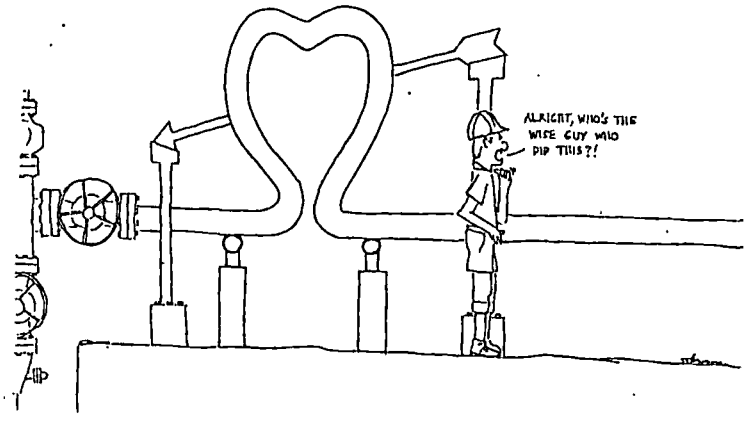




EDITOR'S NOTE

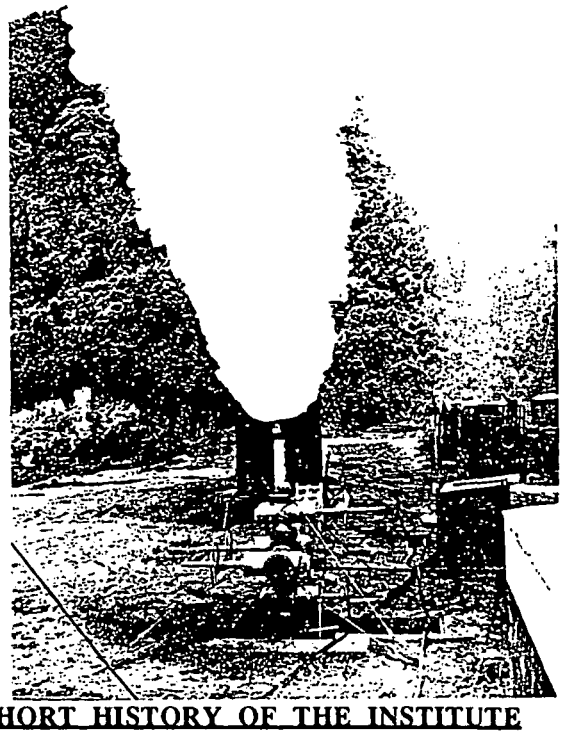
Greetings and Happy New Year!

After 11 years with Electricorp I am delighted to be back at the Geothermal Institute, replacing Dr Robert McKibbin who is now a Senior Lecturer at Massey University.

This is my attempt to revive The Old Bore after 11 years of hibernation (I wonder why?). I sent out 29 letters in Sept '91 to past Diploma graduates (one to each country covering 1979 to 1990) soliciting articles and I got 4 returns. I had no response from graduates between 1980 and 1987. Did you receive my letter? Do you want a newsletter? If you do, I need reporters and you are my reporters. I need to do some soul searching because 'no editor without reporters and no newsletter without editor'.

In my letter, I planned for two issues of The Old Bore per year. Once again, that was only a dream and I will be glad if I can produce annual issues for you in April. Unless this poor editor receives news articles from his unpaid foreign (and local) correspondents for the next edition, The Old Bore will hibernate again. So, before you read further, please note on your diary to write an article for the next issue of The Old Bore. I am waiting.

KC Lee
Sr Lecturer



SHORT HISTORY OF THE INSTITUTE

The Geothermal Institute (GI) was founded on 1.8.78 under the sponsorship of the United Nations Development Programme (UNDP). The GI has offered a one-year intensive course for a Diploma in Geothermal Technology since 1979. Up to 30 students enrol each year, the majority from overseas and sponsored now by the New Zealand Ministry of External Relations and Trade (MERT). Some students continue to Masters or PhD studies after the Diploma Course.

The GI has also offered a short course (3 months, August-October) in Geothermal Reservoir Engineering each year since 1988, and is planning to introduce, in 1993, another short course in Environmental and Hazards Assessment of Geothermal Prospects.

In November each year, at the end of the Diploma Course, a Geothermal Workshop is held and the papers are published in the form of a volume of Proceedings (circulation ~300). The Workshop is a major international event in the geothermal world, with many overseas authors presenting papers.

The future of the GI has always been uncertain. Initially, it was believed that it would exist for no longer than six years. However, in response to continued demand for training, MERT has guaranteed funding for the Institute up to the end of 1993. It is the intention of the GI to market itself not only to attract full-time Diploma students each year, but also to attract earth scientists, engineers and other professionals to attend short courses.

13TH NZ GEOTHERMAL WORKSHOP 1991

The annual NZ Geothermal Workshop was held on 6-8 November. The Workshop also marked the end of the 13th Geothermal Diploma Course (attended by 24 fellows) and the 4th Reservoir Engineering Course (11 fellows).

A total of 48 papers were presented during the Workshop, covering all disciplines of geothermal technology. Of special interest were two groups of papers in Geothermal Resource Management and on the Rotorua Geothermal Field.

Ten papers, summarising recent scientific and technological studies of the Rotorua Field, will be published in a special issue of *'Geothermics'*. The presentation at the Workshop was essentially a refereeing exercise by the NZ geothermal community. Although the Rotorua Field is a type system for NZ, scientific knowledge of it was limited until recently. The Rotorua issue of *Geothermics* will change that. International readers may be interested to learn that another geothermal prospect has been discovered recently beneath Lake Rotorua; the total natural heat output of both systems (i.e. the Rotorua and the Lake Rotorua systems) is probably as high as 400 MWt.

Concepts of Geothermal Resource Management were discussed in three papers. The topic has assumed importance since the introduction of the Resource Management Act by the NZ government this year. All natural resources (except coal and oil) are now covered by one Act of legislation which, in the case of geothermal resources, puts adequate management in the hands of regional councils and the developer; this introduces a certain balance between private and government interests.

The Prize giving ceremony at the conclusion of the Workshop saw the inauguration of the 'Hugh Tokeley Memorial Award', sponsored by DesignPower NZ Ltd. This award, in honour of the late Hugh Tokeley, will be given annually to the best paper presented at the Workshop. Hugh was a member of the Board of Studies of the Geothermal Institute from 1980 to 1988. This year the prize was awarded to Ms Ma. Fe Villadolid (1989 Diploma student) for her excellent paper; "The application of natural tracers in geothermal development: the Bulalo, Philippines, experience". Another prestigious prize, the Mitsubishi Prize, was awarded to Mr Julio Guidos-Pineda (El Salvador) in acknowledgement of his meritorious performance in the 1991 Geothermal Diploma course.

The Proceedings of the Workshop 1991, containing 54 technical papers, are available from the Geothermal Institute, University of Auckland, Private Bag 92019, Auckland.

M.P. Hochstein.

14TH NZ GEOTHERMAL WORKSHOP 1992

***Theme*: Environmental Management of Geothermal Development**

Announcement and Call for Papers

4-6 November 1992
University of Auckland, New Zealand

This year the NZ Geothermal Workshop has a special theme and papers on environmental aspects are particularly welcome. However, contributions on all other geothermal topics are encouraged.

Intending authors should submit a title and an abstract (100 words max.) by 3 July 1992 to the Convenors, Geothermal Institute, University of Auckland, Private Bag 92019, Auckland, NZ. Fax ++64 9 373 7436. All accepted papers will be published in the Workshop Proceedings which are distributed worldwide.

Inquiries should be directed to: Mr Barry Williams, Centre for Continuing Education, University of Auckland, Private Bag 92019, Auckland, New Zealand. Phone ++64 9 373 7999 ext 8903, Fax ++64 9 373 7419.

Conveners
K.C. Lee & S.F. Simmons

RESERVOIR ENGINEERING COURSE 1992

The 1992 Reservoir Engineering Short Course will start on Monday 24th August and conclude after the 14th NZ Geothermal Workshop, 4-6th November 1992. Currently we have six fellowships available but we can have up to ten on the course if private or alternative funding is available. Application forms for the course will be sent to those who have already registered their interest with the Geothermal Institute. Enquiries should be referred to Associate Professor Derek Freeston at the Institute.

NEW ENVIRONMENTAL SHORT COURSE

A new short course in "Environmental and Hazards Assessment of Geothermal Prospects" is planned to begin in 1993, subject to funding from the NZ Government.

Our recent questionnaire survey shows that the demand for the Environmental short course is 17 per year for four years, exceeding that of the Reservoir Engineering short course of 12 per year.

Invitations will be made to those who registered their interest in the returned questionnaire once the course is approved. For those who did not return or receive our survey questionnaire, you may still register your interest by writing to the Geothermal Institute, University of Auckland, Private Bag 92019, Auckland, New Zealand. Fax ++64 9 373 7436.

MITSUBISHI PRIZE

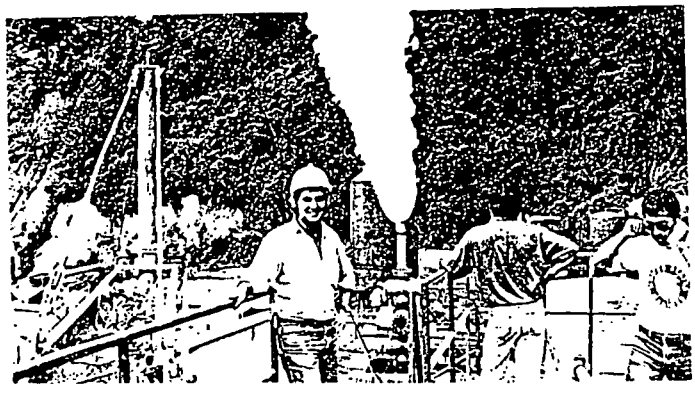
1980	Ricardo MARQUEZ	(Mexico)
1981	Charles HAUKWA	(Kenya)
1982	Teklu HADGU	(Ethiopia)
1983	Gil BATAYOLA	(Philippines)
1984	Mihai SARBULESCU	(Romania)
1985	Francis STA ANA	(Philippines)
1986	George MUGA	(Kenya)
1987	SUROTO	(Indonesia)
1988	Raj Bansh SINGH	(India)
1989	Rommel OBATE	(Philippines)
1990	Wilson CLEMENTE	(Philippines)
1991	Julio GUIDOS-PINEDA	(El Salvador)

DESIGNPOWER PRIZE

1990 Malate, R.C.M. and O'Sullivan, M.J. "Modelling of silica breakthrough in well PN-26, Palinpinon, Philippines".

1991 Villadolid, F.L. "The applications of natural tracers in geothermal development: the Bulalo, Philippines experience".

NEWS FROM GUATEMALA Otto Garcia (1990)



I am very pleased to know that we are going to have a newsletter from the Institute. That sounds like music to my ears, because it is real nice to keep in touch with you and to know something about our classmates.

I started to work almost immediately in the Zunil I project, as a bore geologist logging the first of the three production wells planned for this field. On Jan 5th, 1991 a huge landslide occurred in the field. There was a lot of misinformation. The news talked about an explosion of one of the exploratory wells, and even the birth of a new volcano because the landslide destroyed the wellhead of one of the wells. As you can imagine it was a chaos!!

We continue with the drilling program at this moment. We are drilling the last one and I am so happy to say that the first two wells have been a real success for the geothermal development future in Guatemala.

In the last three months I had two promotions, Drilling manager and now (since October 1991) Exploration Director.

NEWS FROM CHILE Margarita Letelier (1979)

The trouble with geothermal energy in Chile is that since 1983 it is out of the law. The 1983 Mining Law does not consider geothermal neither does the Code of Waters that regulates surface waters. From 1983 to 1990 nothing serious happened to improve the status of geothermal energy in Chile mainly because high officials within the Pinochet's government managed to let geothermal out of the law. Finally last year a project of a Geothermal Law was prepared by the National Commission for Energy. Right now it is ready to be sent to the Congress but we would be lucky if it is approved within 1 year from now. Things have been very slow as you can see.

While I was writing this letter, I called on Mr Hiram Estay from CORFO, my former company when I went to the Geothermal Institute. In 1981 CORFO was forced to close down its Geothermal Committee where I worked. A lot of technical work experience was lost. Right now Mr Estay is gathering what was left in geothermal information at CORFO in order to decide what should be done about it in the future. It is still not known who will do geothermal prospecting in Chile in the future, whether CORFO or private foreign or Chilean companies.

As for me, from 1982 to 1987 I had a non-steady employment record because at that time the Chilean economy changed (its orientation). Geology employment at Institutes, government agencies and universities switched to private exploration and mining companies, where sexism is rampant. In March 87 finally I got a steady job at Cerro Negro Mining Co (Central Chile) as production geologist where I worked until December 88 saving money to start my own knitting business in Valdivia (Southern Chile). I was good at designing and producing but not good at selling. So in August last year I returned to geology but I still have to make up my mind to go to work at a mining camp again. That's why since then I only had some temporary jobs in Santiago or close to it. As for working in geothermal where I could have a better job or career opportunities, I see it very remote. If things are OK for me in geology in the future, I'll stay in it, if not I will try again to have my own business (now I have more experience about it).

Hoping to have soon in the future good news to tell you. My best regards to everybody at the Geothermal Institute.

NEWS FROM NZ Roy Johnstone (1979)

Since finishing work in Ethiopia in early 1984, apart from two geothermal contracts with GENZL in Djibouti and Indonesia, I have been working at the University of Otago, Geology Department.

My interest in things geothermal has been maintained by having a research project on the west coast of the South Island where there are warm springs and fossil geothermal systems on the east side of the Alpine Fault. These fossil systems are the source of the alluvial gold which is scattered along the coastal planes. Rapid uplift along the Alpine Fault has brought hot rock to the surface providing a heat source for the thermal system. Fluid inclusion evidence from the fossil systems suggests that thermal fluids of metamorphic and meteoric origin are active in the region with cooling of the rising metamorphic fluid and interaction of the two fluids causing the observed mineralisation.

On the home front we have had a major change in situation. At the end of 1989 we moved to a 16 ha property west of Dunedin city. It was a new subdivision with no house so I took 3 months off from work and Jan and I built ourselves a house. The construction continues even though we have been in residence for almost two years. We are up on a ridge at about 200 m with fantastic views north over the Taieri Planes to the hills north of the city and to the Rock and Pillar Range towards Central Otago.

With some land Jan is in her element. We are now the proud owners of 30 sheep (unnamed); numerous goats (to eat the gorse and blackberry), McLeary, Doris (a male), Badger, Muffin, Bottle (named after Speights beer), the Beagle Boys, Candy, Other Goat, to name a few; hens like Goldie and Big Egg; a dog called Scud (born during the Gulf War); and Jan has been threatening to add pigs, ducks, guinea fowl, turkeys, horses, llamas; and a few camels to remind us of the wonderful time we had at Lake Langano (Ethiopia). Apart from the above we are also raising three boys, Simon (9), Tim (6) and Aaron (4).

Both Jan and I have very very fond memories of our year at the Institute in 1979 and we are happy that it is still going strong. I am still a firm believer in Geothermal as a very valuable energy source and I am pleased to hear that there is an increase in exploration and development world-wide.

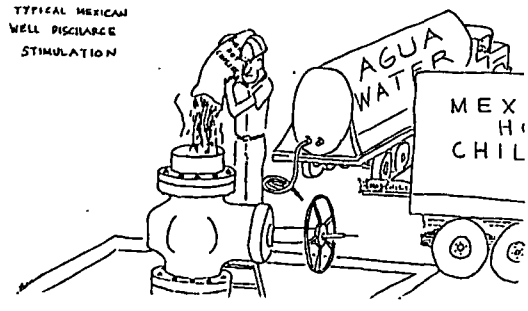
IGA NEWS

The International Geothermal Association (IGA) was incorporated in New Zealand in July 1988 as a scientific, educational and cultural organisation established to operate world-wide. It is a non-political, non-governmental, non-profit organisation, whose aim is to encourage, facilitate and promote co-ordination of activities related to world-wide research, development and application of geothermal resources. The IGA offers: (a) Dissemination of geothermal information by access to IGA database, newsletters, professional journal (reduced subscription to *Geothermics)*, reduced fee to world international geothermal congress, etc. (b) Scientific and technical exchange, e.g. world congress every 5 years (next one 1995 in Italy); (c) Educational and other services, e.g. co-ordination with regional and national geothermal organisations world-wide.

Readers of this newsletter are encouraged to participate in the IGA. National and Regional Associations have and are being formed. The Georgian (Russia), Romanian and Indonesian national associations are already affiliated with IGA, and New Zealand, Japan and a European Association are expected to be established this year.

If you require information on IGA or any of the above national/regional associations, please contact me at the Geothermal Institute, or write direct to: Executive Director, IGA, c/o Lawrence Berkeley Laboratory - ESD, Building 50C, One Cyclotron Road, Berkeley, CA 94720, U.S.A., Fax No. 510 486 4889.

D.H. Freeston



GEOTHERMAL RESOURCES OF SUMATRA

In Jan/Feb 1991 I spent three months in Sumatra (Indonesia). The trip was organized by 'Yogi' Sudarman (Pertamina), an ex-student of the 1981 Diploma class. The aim was to assess all known resources on this 1700 km long island. I had insufficient time and could see only some 1000 km of the 'Sumatra Arc' where all the Tertiary and Quaternary volcanism has occurred. Unfortunately it was the rainy season, so it was no tourist trip! We managed to see about 20 of the 30 presently-known high temperature systems, and I have recently drafted a paper describing the trip in scientific terms. If the referees are kind to me you should see it next year, probably in *Geothermics* (A shortened version of it has been published in the Proceedings of the 1991 NZ Geothermal Workshop).

Only one of the 30 prospects has been explored by deep drilling, the G. Kunyit (Lempur) prospect in Central Sumatra, where two 1-km-deep wells were drilled by a Japanese aid project in about 1983. It encountered a liquid-dominated reservoir at depth, with a bottom hole temperature of about 200°C. It's not a prospect I would have chosen because access is very difficult (it lies in dense jungle still frequented by the Sumatra tiger) and no deep fluids discharge on the lower flanks. It was thought to be a vapour-dominated system, but the wells tell a different story.

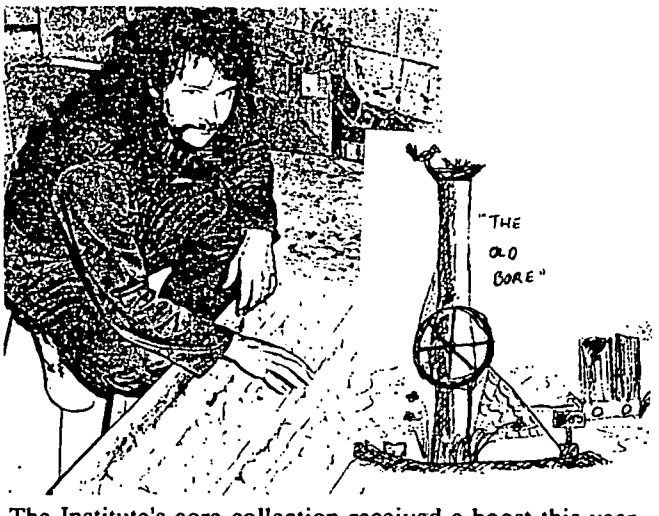
The high temperature systems of Sumatra are in a class of their own: 20 of the 30 systems occur beneath Quaternary stratovolcanoes (including the G. Kunyit prospect); 9 of the 20 systems beneath Quaternary volcanoes are probably associated with shallow crustal 'degassing' magma chambers where magmatic condensates are being discharged in fumarole and solfatara fields. I managed to discover an acid creek on the slopes of the active volcano Sorik Merapi (which is also underlain by a volcanic geothermal system) and this creek discharges the equivalent of 7 t/d of HCl and 10 t/d of SO_2! Obviously, nobody wants to drill a well into a reservoir like that. But there are at least ten other, friendlier reservoirs that probably will be developed in the future.

Several ex-Diploma students accompanied me on the Sumatran trip (Asj'ari Rachman, 1990 class; Agus Mulyono (89), and Lubis Lokot (86). And on the slopes of Sorik Melapi I met Achmad Andan (82), who works for VSI and was conducting a resistivity survey, using techniques learned almost ten years ago in Auckland.

When we returned to Jakarta we had a 2-day Pertamina Workshop at which all the Sumatra prospects we had seen were discussed. Here I met nearly half of our other ex-Diploma students from Indonesia, and the rest I saw during a meeting of the Indonesian Geothermal Association, dominated as it is by the 'Auckland Geothermal Mafia'! It was a pleasant surprise to meet so many of our Indonesian students again, and to hear about the work they do after their training in Auckland.

M.P. Hochstein

THE GI TECHNICIAN WRITES



The Institute's core collection received a boost this year with the addition of 195 boxes of cores and cuttings donated by Works Geothermal Wairakei. Included in the load are cores from Waiotapu, Orakeikorako and Te Kopia geothermal fields. They have been housed in a recently completed facility beneath the University Conference Centre, better known to most as the venue for the annual Geothermal Workshops.

The exercise of storing all of the boxes was, to say the least, "labour intensive". Two tonnes of shelving, donated to the Institute by the Energy and Resources Division of the N.Z. Ministry of Commerce, had to be dismantled, re-located about 15km by truck, carried down a flight of stairs and then re-assembled.

Solomon Woldemichael (1990 Diploma student), a graduate student from Ethiopia, did a fantastic job in single-handedly re-assembling the shelves ...1,728 nuts and bolts to form 144 square metres of shelving !

The boxes were trucked to the Institute and [thankfully!] unloaded by hydraulic hoist. They were then carried, by a group of happy and willing volunteers (ahem), down the stairs to their new accommodation.

We would like to thank everybody involved in the exercise, particularly Works Geothermal for the cores themselves and the Ministry of Commerce for their shelves and assistance. Thanks also to the "Happy Helpers"; may your backs recover quickly !!

Ashley Franklyn

VOLLEYBALL NEWS

Last year's competition between Frankensteins (engineers) and Flintstones (earth scientists) was a draw. The first meeting between these fierce competitors resulted in a 5-1 win in favor of the Flintstones which was later avenged in a trouncing by the Frankensteins; this reporter, being a Flintstone, has unfortunately forgotten the exact score. Other matches included a memorable game between staff and students, which brought the likes of Derek Freeston and Manfred Hochstein face to face with Pim "Spike" Daza and Jorge "Sweeper" Guaimas. Pat Browne failed to show up, and as I recall, the staff barely eeked out one victory with assistance from Mary Weston who led the cheerleading from the stands. KC Lee has run a summer volleyball workshop for staff and we now look forward to future matches.

Stuart Simmons

STAFF MOVEMENTS

A/Prof M.P. Hochstein

I spent part of my 1990-91 study leave in Vienna (Austria), giving a lecture course on "Geothermics" in October 1990 and holding oral examinations in January 1991. It was quite a learning experience for me since, in Europe, Geothermics is mainly concerned with the interpretation of terrestrial heat flow anomalies.

In mid January I went to Indonesia, where Yogi Sudarman arranged for me a visit to the geothermal fields of Sumatra. That trip was probably the highlight of my study leave. The scientific findings of it have been summarized in a short paper: "Geothermal prospects of Sumatra (overview)", presented at the 1991 NZ Geothermal Workshop.

In September/October 1991 I was invited by the US Department of Energy (DOE) to attend a workshop about future geophysical studies of US geothermal prospects. At this workshop in Berkeley I met Charles Haukwa (Kenya), who is undertaking a PhD there in reservoir engineering. Apparently DOE is keen to inject some funds into increasing geothermal exploration activities in the US.

During this visit to the US I also visited UNDP New York and the World Bank in Washington, to renew old contacts. Unfortunately we will never again have the substantial financial support from UNDP which brought so many of you to Auckland, but there is some hope that individual candidates might get support by way of UNDP country funds. Those of you in management positions in China, India and also Indonesia should note that, through your directors, the local UNDP offices may be able to sponsor further geothermal training of your staff at Auckland. Every recommendation you make will help.

World Bank in Washington is now sponsoring several geothermal projects in Kenya and Latin America. Since last year, World Bank loans also contain training components. So, as you can see, it is necessary for the staff here not only to teach geothermal technology, but also to travel overseas to solicit funds for the future training of your staff members, to continue the Institute's 13-year tradition.

I returned to New Zealand via Australia, where at the end of February I attended the first joint meeting of the Australian Geological and Exploration Geophysicist Societies. I presented a paper on "Geophysical anomalies associated with thermally altered rocks", but have not yet had time to write it up. Former graduates will be pleased to hear that, in this paper, I relied to some extent on their studies, i.e. magnetic studies by Suprijadi and Ignacio, seismic and gravity studies by Stuart Henrys, etc. So the work of our students here is 're-cycled' by your teacher!

A/Prof D.H. Freeston

Over the past 18 months I have been privileged to make four overseas trips to attend meetings and conferences and, in particular, to visit ex-students on their 'home ground'. The first of these working trips (and I emphasise the word 'working' because one of my colleagues believed I was on holiday!) was to Central America in October 1990, to present a paper at the International Seminar on Geothermal Prospects in Latin America and the Caribbean (San Salvador, 8-11 October 1990), organised by OLADE and C.E.L. The El Salvadorian experience was exceptional: some members of the 'Kiwi Mafia' (ex-Auckland students) met me at the airport to take me to my hotel: 14 hours later I checked in! A very hard day's work at the beach, swimming pool and cafés, etc., intervened, with a suitable supply of cans! The conference was excellent, and it was great to see ex-Auckland students in positions of responsibility and doing a grand job there. Apart from the conference, I visited the Ahuachapan and Berlin geothermal fields.

While I was in Central America I took the opportunity to visit Guatemala, meeting the geothermal group there and visiting the Zunil prospect. I also visited Nicaragua, where Zacarias Rodriguez (1989) looked after me and showed me some of the geology (!) of the country, and the Momotombo Power Station.

In August 1991, Professor Browne and I were invited to give papers at an International Conference in Bandung, Indonesia. Again, a very rewarding experience for both of us. (This time my colleague could not complain about my holidaying - he was with me!) We did get lost in Bali on the way to Bandung; however, the conference was well organised, and we enjoyed meeting with many of our Indonesian friends. We managed to fit in a short trip to Kamojang.

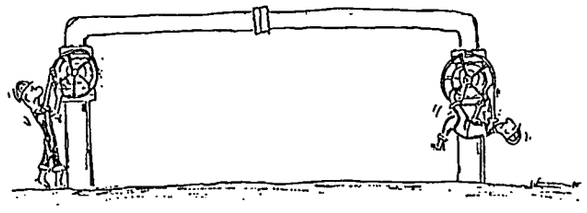
A few weeks later, in October, I went to the GRC meeting in Reno, Nevada, and again met ex-students some of whom were presenting papers there. After this meeting I travelled to Cuernavaca, Mexico, for a Board meeting of the IGA. No visit to Mexico is complete without contacting our resident hostess in Mexico City, Rosa Maria Prol (1985). She is now almost a 'Kiwi', having visited NZ more times than I have been to Mexico.

My final visit of the year was to the Philippines (Dumaguete), to attend an international conference organised by UNDP/PNOC on Geothermal Training. Again, it was good to see ex-Auckland students prominent in the organisation of the conference and presenting material to the international audience. The PNOC hospitality was magnificent, with excellent field trips and organisation, despite the difficulties of having to change the venue at the last minute due to the Ormoc City disaster.

My conclusion from these and other trips made over the years is that seeing ex-students in their work places helps me to better understand their jobs, problems, lifestyles, etc., and also makes me very proud of their achievements. To see them as managers of projects, in control of others, and making technical presentations of a high standard at international meetings, makes me realise that we at the Institute have been privileged to have a fine group of people here over the years who are now making a very real contribution to geothermal developments world-wide.

A/Prof P.R.L. Browne (by Stuart Simmons)

Pat is away on sabbatical leave until May of this year; he is based at the New Mexico Institute of Mining and Technology in Soccorro, New Mexico, USA. In February, Pat travelled to the Philippines, where he was an invited speaker at the PNOC-EDC Geothermal Conference. Pat also was invited to Indonesia with Derek Freeston for a holiday in Bali and to speak at the International Conference in Bandung. When not at the Geothermal Institute, Pat likes to tend his garden, read history books and collect stamps.



Mr K.C. Lee

Armed with the pioneering DipEnTech(Geotherm) in 1980, I went to the real world to put my theories into practice at Wairakei Power Station. For 2.5 years, I fought a war with the cancer of the main steam pipelines of 20 years (about 67 years in human terms for its design life). Well, like most allergies, the doctors can treat the symptoms but not cure them.

Anyway, my apprenticeship at Wairakei gave me the visa to try my hands on Ohaaki. For 5 years this time, I played around with the main steam system, hoping that it would be just as much fun at Wellington H.O. as in the Wairakei football field. Alas! Computers seemed to be fun until one discovered GIGO. Consultants and contractors were the answers to all problems, if one could write specifications that have no loopholes.

While the Ohaaki team of engineers and other professions tried to get Ohaaki off the ground, the government and the management kept busy restructuring and changing the name of the organisation. One medium-size government department became half a dozen or so small companies. Corporatisation, market forces, and profit were the buzz words. Suddenly, I ended up working for an engineering consulting company, DesignPower, and became a consultant (just another buzz word).

Things seemed to move faster and faster. It was like a time machine. Before long, I travelled full circle and landed at square one again in July 1991. This time, I am able to use the secret hide-away staff common room (it is out of bounds to students, you see), where Ashley, Mary and I battle the 10 minute deadline for the daily crossword over cuppa-tea.

My dream came true after just three months at the Institute. I had my first holiday (in their words) attending the Philippine Geothermal and Coal-Burning Technologies Conference held at the University of the Philippines in October 1991. I presented a paper on Environmental and Hazards Assessment of Geothermal Prospects on behalf of A/Prof Hochstein (he gets cold feet at 35,000 ft). It was my first time in the Philippines and I was delighted to meet my good old classmate (Bert Arevalo, looking for a wife again!), and ex GI students (Anita Noor, Bing Vargas, Evelyn Reyes, Wilson Clemente, Cedric Malate, and Manny Ogena; what a bunch of half-baked kiwis?). Then, I caught up with lucky Dr Datuin and met his charming wife. I felt like a lucky son-in-law.

The Conference included a visit to MakBan geothermal field and power station, and Calaca coal-fired power station. I also paid ADB a visit, trying to raise some funds for students to attend courses at the Geothermal Institute. My trip ended with visits to NPC, PNOC, PGI and OEA. Thanks to Mr Ferrer of PNOC who made my final day visits to these organisations so relaxing. I ended up seeing 4 times the number of people I planned to see. Real value for money.

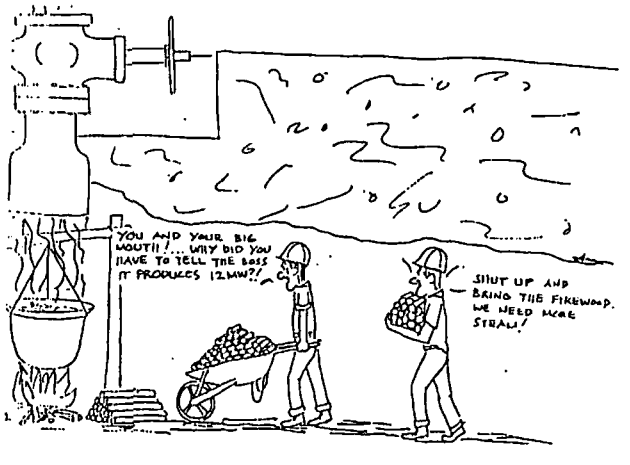
I am now waiting for my next move. *"Be nice to people on your way up because you'll meet them on your way down" - Wilson Mizner.*

Dr S.F. Simmons

After having been a research fellow for 4 years in the Geology Department at the University of Auckland, I became the lecturer in geochemistry after Keith Nicholson returned to Scotland at the end of 1990. My university training is in the field of hydrothermal ore deposits, but I came from USA to New Zealand to study active geothermal systems. My present research involves the evolution of geothermal systems, using fluid inclusions, hydrothermal alteration, fluid chemistry and stable isotopes.

Dr S. Soengkono

After holding a position as a half-time Assistant Lecturer at the Geothermal Institute since 1989 and finishing my PhD in August 1990, I was appointed a full time Temporary Lecturer (Geophysics) on 1 February 1991. I spent my time in 1991 mainly at the Geothermal Institute, lecturing and supervising students in the use of computer facilities at the Institute. I presented papers at the NZ Geophysical Society Symposium (22-23 May) on Magnetic Structure of the western Taupo Volcanic Zone, and at the 13th NZ Geothermal Workshop (6-8 November) on the Magnetic Anomalies of the Rotokawa geothermal field (co-authors M.P. Hochstein and M. Van Dijck).



1991 DIPLOMA STUDENTS

BALMES, Cecilia P. (Philippines)	ES
BUBAN, Alberto C. (Philippines	ES
DAZA, Martin V. (Philippines)	Eng
Award for outstanding academic merit	
GONZALEZ-VARGAS, Carlos F. (Costa Rica)	Eng
GUAIMAS, Jorge A. (Argentina)	Eng
Class Rep	
GUIDOS-PINEDA, Julio A. (El Salvador)	Eng
Mitsubishi prize	
HERMOSO, Danilo P. (Philippines)	ES
Award for outstanding academic merit	
HUNTORO, Toto (Indonesia)	Eng
JACOBO-CASTANEDA, H. Renato (El Salvador)	ES
KALINDIMYA, Miraji M. (Tanzania)	ES
Merit award for progress	
KARINGITHI, Cyrus W. (Kenya)	ES
Class Rep	
KROMODIMEDJO, Bardan (Indonesia)	Eng
MELGAR-LAZO, Hugo (Peru)	Eng
Merit award for progress	
OMENDA, Peter A. (Kenya)	ES
RAE, Andrew (NZ)	ES
SALONGA, Noel D. (Philippines)	ES
Class Rep	
SUN ZHIHONG (China)	Eng
TUDOR, Monica (Romania)	Eng
UTOMO, Indrarto Sedyo (Indonesia)	ES
VENDIOLA, Alexander E. (Philippines)	Eng
YUSUF, Agus (Indonesia)	Eng
ZELEDON-GONZALEZ, J. David (Nicaragua)	Eng
ZENG YI (China)	ES
ZHAO BAOJIN (China)	ES

1991 RESERVOIR ENGINEERING CLASS

Errol ANDERSON	(NZ)
Domingo B BERAQUIT	(Philippines)
Jesus DE LEON VIVAR	(Mexico)
Hermas DAVILA JOSE	(Nicaragua)
Carlos A ESCOBAR BRUNO	(El Salvador)
Danilo MACAWILI	(Philippines)
Horia MITROFAN	(Romania)
Manuel MONTERROSA	(Nicaragua)
Gazi NOTOWIDAGDO	(Indonesia)
Zhong-he PANG	(China)
Magdaleno VIVEROS PIEDRA	(Mexico)

1991 POST-GRADUATE STUDENTS

Master of Engineering:

Chen Song (China) "Feasibility and reservoir studies of the Tianjin Geothermal Field"

Melaku, Markos (Ethiopia) "Plate heat exchanger performance with single and two-phase fluids".

PhD in Engineering:

Dunstall, Michael (NZ) "Downhole Heat Exchanger - Rotorua Geothermal Field"

Huang Yicun (China) "Geothermal supply and reinjection pipe network system simulation"

Pan Hesong (China) "Investigation of the characteristics and performance of doublet systems in the Rotorua geothermal field"

Saptadji, Nenny (Indonesia) "Studies of geyser performance"

Master of Science:

Bovelander, M (NZ) "Distribution and fate of boron in the Naike and Tokaanu thermal areas"

Gibson, Philippa "Retention of boron in soils exposed to geothermal fluids discharged from wells"
Ma Chi (China) "Alteration of lacustrine sediments in the Te Mihi sector of the Wairakei geothermal field"
Newson, Juliet (NZ) "Hydrology of the Waitopu geothermal system"
Woldemichael, S (Ethiopia) "Alteration and isotope geochemistry of a section of the Rotokawa geothermal system"
Yagi, Masahiko "Characteristics of alteration and its effect on oil reservoirs retlated to Miocene volcanism in the Yurihara Field, Northern Honshu, Japan"

PhD in Science:

Bignall, Greg (NZ) "Geology of Orakeikorako and Te Kopia geothermal fields"
Namjou, P (NZ) "Geohydrological studies of refuse sites"
Yang, Z (China) "Computer modelling of unsaturated flow in geothermal reservoirs"
Zhang Lan (China) "Fluid/rock interaction processes in the Shui Koushan area, China"

1992 DIPLOMA STUDENTS

AMAYA V.J.A.	El Salvador (ENG)
ARROCHA, G. Jaime	Panama (ES)
BUDIARDJO, B.	Indonesia (ES)
DHAR, J.K.	India (ES)
DICTUS, B.F.	Indonesia (ENG)
GUEVARA A.G.(Ms)	Nicaragua (ES)
KAGIRI, D.N.	Kenya (ENG)
LIU, Jie	China (ES)
LLENARIZAS, L.	Philippines (ENG)
LUCIANO, L.H.R.	Dominican Republic (ES)
MAGLAQUI, N.	Philippines (ENG)
MANYONGE, Alfred W.	Kenya (ENG)
MARTINEZ F. Marbin	El Salvador (ES)
NTINKWA, S.A.	Tanzania (ES)
PANTILAG, F.	Philippines (ENG)
PENARANDA, J.R.S.	Philippines (ENG)
PUTRANTO, H.D.	Indonesia (ENG)
SOENARYO	Indonesia (ES)
TILOS, Romulo	Philippines (ENG)
VIRAPUN, T.	Thailand (ES)
YOCK, Antonio	Costa Rica (ES)
ZHU Jialing (Ms)	China (ENG)

NUMBER OF DIPLOMA STUDENTS

COUNTRY	79	80	81	82	83	84	85	86	87	88	89	90	91	92	Total
Argentina	1	-	-	-	-	-	-	-	1	1	-	1	1	-	5
Bolivia	-	-	-	-	-	1	-	1	-	-	-	-	-	-	2
Chile	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
China	2	4	3	1	1	2	1	2	3	4	3	4	3	2	35
Colombia	-	-	2	1	1	1	-	-	-	-	-	-	-	-	5
Costa Rica	-	-	-	-	-	-	-	-	1	-	-	-	1	1	3
Djibouti	-	-	-	-	-	1	1	1	-	1	-	1	-	-	5
Dominican R.	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Ecuador	-	-	1	-	-	-	-	-	1	1	-	-	-	-	3
Egypt	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
El Salvador	-	1	-	1	1	2	2	1	1	1	1	2	2	2	17
Ethiopia	1	1	2	3	4	5	2	1	1	1	1	2	-	-	24
Guatemala	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
India	1	2	2	1	1	-	-	-	1	1	1	-	-	1	11
Indonesia	6	2	5	4	7	6	7	9	6	8	6	6	4	4	80
Japan	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Kenya	3	-	1	2	1	-	1	1	1	2	2	1	2	2	19
Mexico	-	2	1	1	-	-	1	1	1	-	1	1	-	-	9
New Zealand	4	7	3	4	5	3	3	2	-	1	1	-	1	-	34
Nicaragua	1	-	-	-	-	-	-	-	-	-	2	1	1	1	6
Nigeria	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
Panama	-	-	-	-	-	-	1	1	1	1	-	-	-	1	5
Papua N.G.	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
Peru	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2
Philippines	2	5	4	4	5	4	6	5	5	6	4	6	6	5	67
Romania	-	-	-	-	-	1	-	-	-	-	-	-	1	-	2
Tanzania	-	2	1	1	1	1	-	-	-	-	-	-	1	1	8
Thailand	-	-	-	1	2	1	2	1	2	1	3	1	-	1	15
Turkey	1	-	2	-	1	-	1	1	2	-	1	-	-	-	9
Vietnam	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2
Total	24	26	27	24	30	28	29	27	27	29	29	30	24	22	376

PHOTOGRAPHS

1. 1991 Reservoir Engineering field trip to Kawerau's Tasman Pulp & Paper Company. From left: Messrs Albert Carter (Tour guide), Domingo Beraquit (Philippines), Carlos Escobar Bruno (El Salvador), Errol Anderson (NZ), Danilo Macawili (Philippines), Gazi Notowidagdo (Indonesia), A/Prof Derek Freeston (Tour Leader), Manuel Monterrosa (El Salvador). *What was in your mind, Carlos? Did you have steak for dinner that night?*

2. 1991 Geothermal Workshop. From left: Messrs Neville Dench (GENZL), Toto Huntoro (Indonesia), Gazi Notowidagdo (Indonesia), Peter Omenda (Kenya). *The Indo-Kenyan connections?*

3. 1991 Geothermal Workshop. From left: Messrs Mike Dunstall (NZ), Masahiko Yagi (Japan), Dr Kelvyn Youngman (NZ). *The geothermal experts or expatriates?*

4. 1991 Geothermal Workshop. From left: Mr Noel Salonga (Philippines), Ms Cecilia Balmes (Philippines). *What a nice couple*

5. 1991 Geothermal Workshop. From left: Messrs Renato Jacobo-Castaneda (El Salvador), Hugo Melgar-Lazo (Peru), Carlos Gonzalez-Vargas (Costa Rica). *The Latin-American smile?*

6. 1991 Reservoir Engineering field trip to Wairakei. From left: Messrs Manuel Monterrosa (El Salvador), Graham Morris (Tour guide), Jesus De Leon Vivar (Mexico), Domingo Beraquit (Philippines), Magdaleno Viveros Piedra (Mexico), Horia Mitrofan (Romania). *Wairakei Bore No. 1!*

7. 1991 Mitsubishi Prize in Geothermal Technology: Mr Julio Guidos-Pineda (El Salvador)(centre) with Mr K. Uemura (Managing Director)(left); and Mr T. Takahashi (Director)(right), Mitsubishi NZ Ltd. *The three kiwis?*

8. 1991 Presentation Ceremony. From left: Mrs Mary Weston (Secretary), Mr Oscar Huijsse (Senior Administration Officer), and Dr Supri Soengkono (Lecturer). *Don't talk with a mouthful, Oscar!*

9. 1991 Presentation Ceremony. From left: A/Prof Patrick Browne, Dr Rosa Prol Ledesma (Mexico), Dr Robert McKibbin (Senior Lecturer, Massey University) *Guess who is the regular VIP?*

10. 1991 Reservoir Engineering field trip to Wairakei. A/Prof Derek Freeston at Well 207 which was used to study two-phase flow, now supplying two-phase fluild to Flash Plant 10. *This was where it all began for Derek.*

11. 1991 Geothermal Workshop Registration Desk: Mr Barry Williams and Ms Marie-Therese Millet. *The familiar faces at the Geothermal Workshop.*

12. 1991 Geothermal Workshop: Messrs Andrew Rae (NZ) and Mr Zeng Yi (China). *Two's company.*

13. 1991 Presentation Ceremony. From left: Messrs Miraji Kalindimya (Tanzania), Alex Vendiola (Philippines), Bardan Kromodimedjo (Indonesia), Toto Huntoro (Indonesia). *It must be very interesting reading, Alex?*

14. 1991 Geothermal Workshop: Mr Keith Lichti (NZ) talking to Mr Sun Zhihong (China). *Is that you, Keith?*

15. 1991 Presentation Ceremony. Mr Danilo Hermoso (Philippines) receiving award for outstanding academic merit from the Director, A/Prof Manfred Hochstein. *The next President of the Philippines?*

16. 1991 Reservoir Engineering field trip. Dr Pang Zhonghe (China) greeting the Maori way, hongi, at the Maori concert at THC Rotorua Hotel. *The lucky man from China.*

17. 1991 Geothermal Workshop: Ms Juliet Newson (NZ) with Ms Monica Tudor (Romania)(right). *My best friend.*

18. 1991 Presentation Ceremony. Mr Jorge Guaimas (Argentina) receiving Certificate of Attendance from Prof Jack Woodward. *Move your head, Oscar.*

19. 1991 Presentation Ceremony. From left: Messrs Markos Melaku (Ethiopia), Pan Hesong (China), and Dr Graeme Scott (NZ). *Who is coming to dinner to-night?*

20. 1991 Presentation Ceremony. Welcoming speech by Prof Ray Meyer, Dean, School of Engineering; and Chairman, Geothermal Institute Board of Studies. *I got it at last, Manfred.*

21. 1991 Geothermal Workshop: From left: Mr & Mrs Abet Buban (Philippines), Mr Pim Daza (Philippines), and Ms Nenny Saptadji (Indonesia). *Where are your beautiful teeth, Pim?*

22. 1991 Philippine Geothermal and Coal-Burning Technologies Conference, University of the Philippines. From left: Messrs Wilson Clemente (1990 Mitsubishi Prize recipient) having lunch break with his colleague, Mr Ron Amores (PGI). *Lunching the Filipino way.*

23. 1991 Philippine Geothermal and Coal-Burning Technologies Conference, University of the Philippines. Mr Percival de las Alas (right, 1990 Reservoir Engineering fellow) with his PGI colleagues. *Who is missing?*

24. 1991 Geothermal Workshop: From left: Messrs Gordon Dawson , Noel Kortwright , and Brian White, all of NZ. *The new face at the Cartshop.*

25. 1991 Geothermal Workshop: From left: A/Prof Mike O'Sullivan, and Ms Bridget Hanley (NZ). *Something very interesting happened on the cruise.*

26. 1991 Geothermal Workshop: Dr Stuart Simmons (staff) chairing Diploma students' presentation. *The President's man.*

27. 1991 Presentation Ceremony. DesignPower Hugh Tokeley Memorial Award recipients. From left: Mr Howard Walker (Acting General Manager, DesignPower), Mrs Tokeley, Ms Ma. Fe Villadolid (Philippines, Award winner), Mr Duncan Brown (DesignPower Geothermal Consultant), Ms Tess Viloria (Philippines, Merit award), Mr Calum Gunn (NZ, Merit award), and Mr Agus Danar (Indonesia, Merit award). *The winning smiles.*

28. 1991 Philippine Geothermal and Coal-Burning Technologies Conference, University of the Philippines. Messrs Hermes Ferrer (PNOC), Manny Ogena (1987 ME graduate), KC Lee , Dr Cedric Malate (1987 PhD graduate). *Fishing the Manny's way.*

29. 1991 Geothermal Workshop: A/Prof Derek Freeston and Mrs Freeston dining on board Harbour Cruise. *You are eating again, Derek?*

30 1991 Geothermal Workshop: Post-graduate students from China chatting over cups of tea. From left: Huang Yicun (PhD), Zhang Lan (PhD), Chen Song (ME), Yang Zhongke (PhD). *Are the tea cups made of china?*

31. 1991 Geothermal Workshop: Masters student, Mr Markos Melaku (Ethiopia). *The perfect model.*

32. 1991 Philippine Geothermal and Coal-Burning Technologies Conference, University of the Philippines. KC Lee meeting ex-students: Ms Anita Noor (Indonesia, centre), and Mr Bert Arevalo (Philippines, right). *The three diplomats.*

33. 1988 NZ Geothermal Workshop field trip: Karsten Pruess (USA), Charles Haukwa (Kenya), Gerardo Hiriart (Mexico), Derek Freeston, Liao Zhi-Jie (P.R.C.), Rosa Prol Ledesma (Mexico), Yogi Sudarman (Indonesia), at Kawerau geothermal field. *The meeting place.*

34. 1984 Diploma class, Prof. Hochstein and Mary Weston being given an overview of the Kawerau geothermal field by Mr Albert Carter (Tasman). *Were you in the 84 class, Mary?*

35. 1983 Diploma class at Kawerau, with Prof. Freeston, Ed Pak (Technician) and James Kanyua, PhD student (foreground). *Where do you think you're going, James?*

36. Prof. Freeston pointing out more pipes and tubes to 1984 Diploma students Arsenio Torrejos (Phillipines), Bambang Soediono (Indonesia), Larry Bayrante (Philippines), Bangun Harahap (Indonesia). *The steam comes up here and goes down there.*

37. Prof. Freeston (in the 1980s, *when he had a bit more hair*) with guide at Orakeikorako geothermal area.

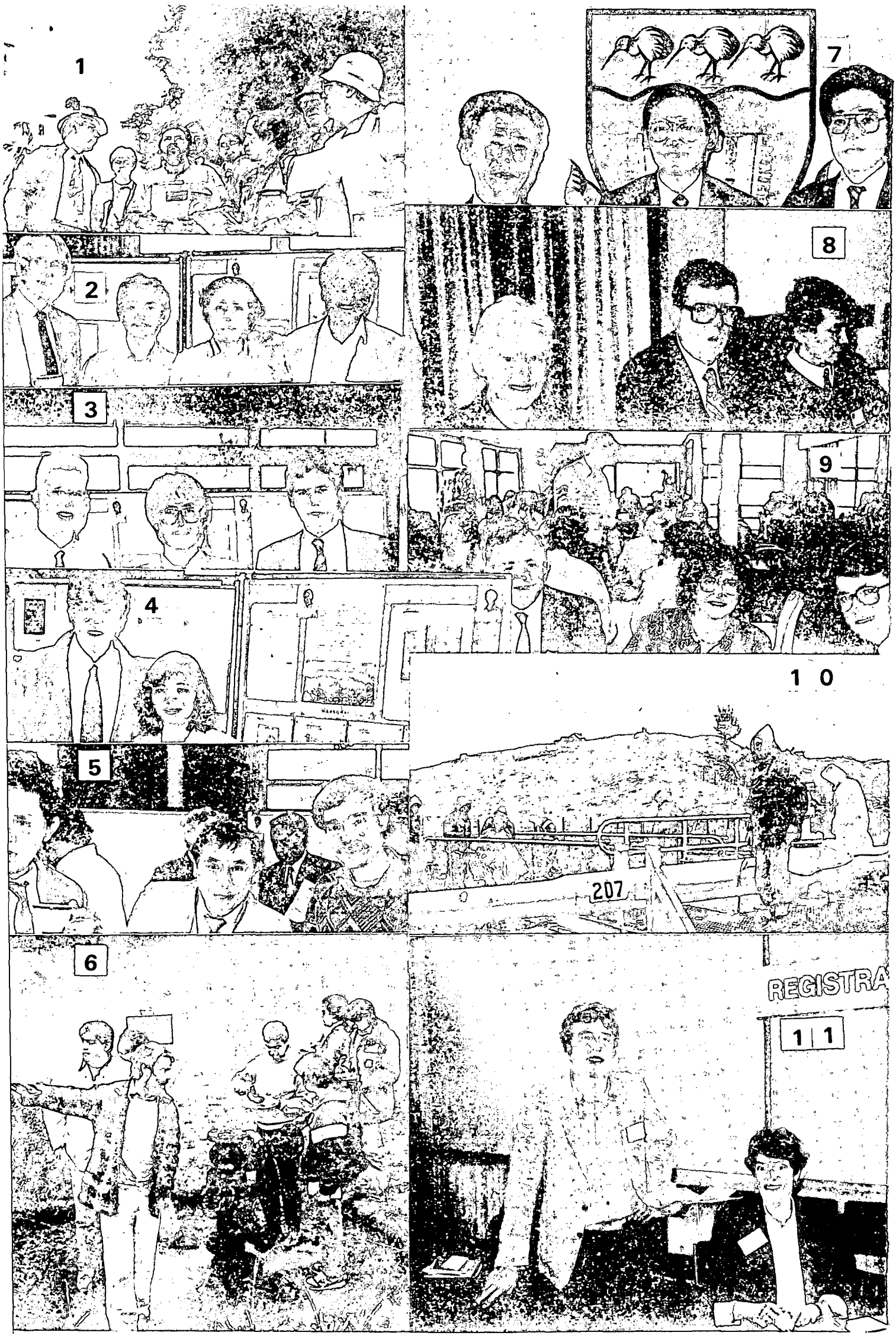
38. Suprijadi and members of the 1988 Diploma class give us an Indonesian song at Prof. Hochstein's BBQ. *What was the name of the song again? Mana dimana, buah hati saya.*

39. The Chinese contingent (1988 Diploma class and Workshop visitors) entertain with a Chinese song at Prof. Hochstein's place. *Is the guitar a Chinese musical instrument?*

40. 1985 class at Craters of the Moon, Wairakei: Ali Khaireh (Djibouti), Pramuan Kohpina (Thailand), Saul Ayala Mendoza (El Salvador), Hamish Pirie (NZ) and Iin Arafin Takhyan (Indonesia). *Giant steps for mankind.*

41. Members of the 1985 Diploma class outside the Victoria Motel, Rotorua. *Carlos in centre stage, as usual.*

42. At the 1984 NZ Geothermal Workshop: Bangun Harahap (Indonesia), Marta Calvache (Colombia), Visit Coothongkul (Thailand), Prof. Hochstein, Prof Freeston, Mihai Sarbulescu (Romania), Carlos Rodriguez (El Salvador) and half of Roberto Condoretti (Bolivia). *The two oldest bores?*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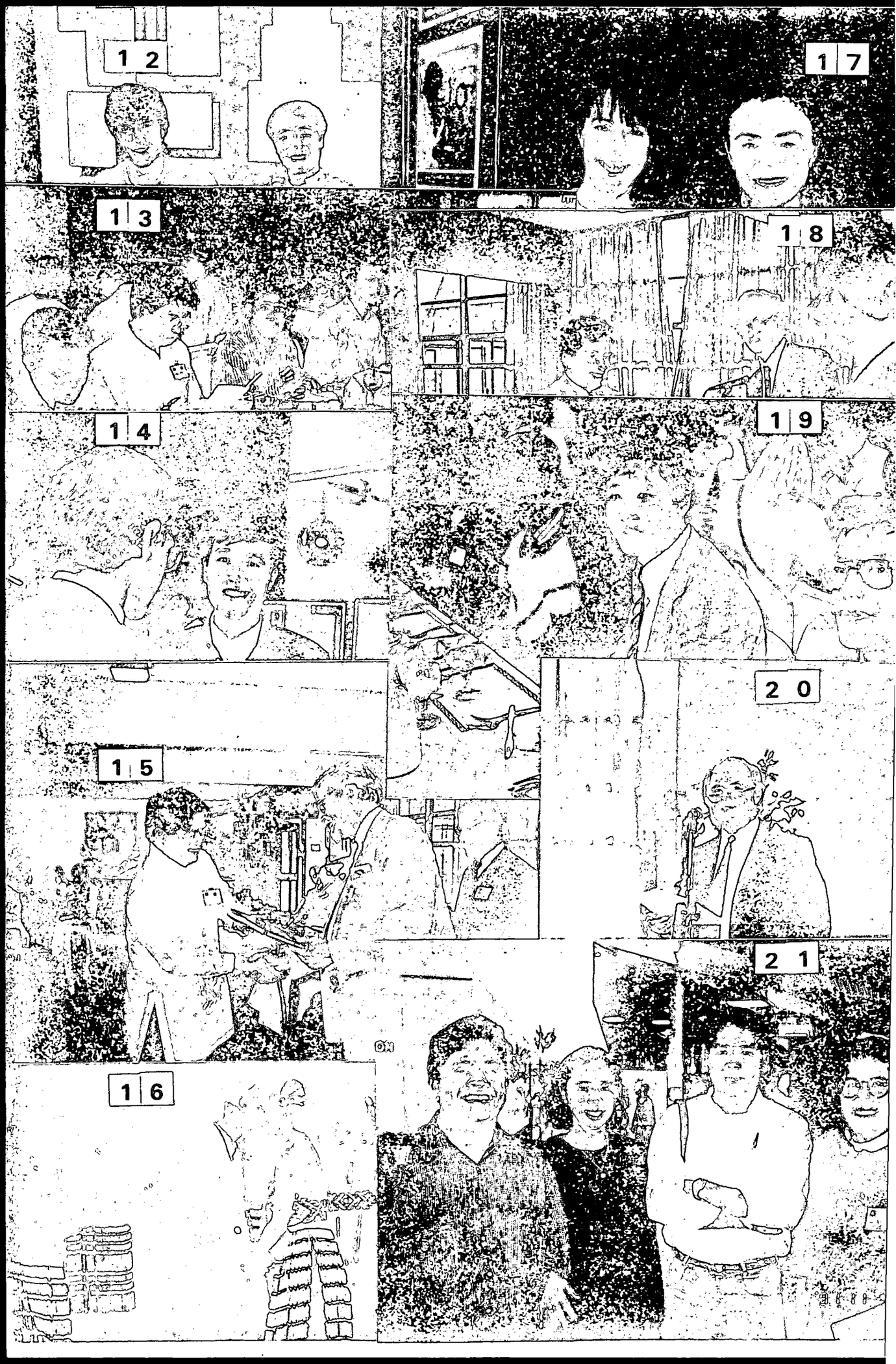
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