

*On
Track*

**The Newsletter of the International Fission-Track Community
February 2002, Volume 12, Number 1, Issue 23**

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Editor's Notes

Taking over as Editor of On Track from Raymond Jonckheere is rather like being given the keys to a brand new Mercedes when you do not know how to drive, at least that's the way I feel. I am sure everyone would agree that Raymond has been a meticulous editor and taken On Track to an even higher standard. Raymond has been particularly successful in cadgeoling people from all sectors of the track community into writing articles. As I now realise this is not so easy. Although, with every best intention, people say they will contribute an article, when the deadline comes around nothing materialises. This is nobodies fault. The exponential growth in administration combined with research proposal and conference abstract deadlines,

papers to review and teaching leave us little time for research, apart from anything else.

Regarding conferences, this year seems particularly busy. In April there is the EGS meeting in Nice, then in June, we have a four-day meeting of European fission trackers in Cadiz. In August, at Davos in Switzerland there is the annual Goldschmidt meeting, which this year incorporates ICOG. All of these will have sessions or symposia directly relevant to our research but how many of us can afford the time and money to go to every one?

In this issue of On Track you will find a report of last Novembers short EFTAN (European FT network) meeting held in the Black Forest, Germany. Chaired by Günther Wagner, this forum provided the opportunity for European researchers to explore collaborative links and express some of their methodological concerns. A general point that came out of this meeting was a need for better communication amongst the FT community, through an e-mail-based network (more details about this are provided in short tracks). It was also felt that we should establish a library of laboratory profiles containing very basic information such as where people are working. As a follow on from this last point, it was felt that a European sample and results database would encourage collaboration and aid joint research proposals. More details on each of these initiatives can be found on pages 4 of this issue.

The compilation of laboratory profiles and sample/ results database are initially intended for European consumption, but there is no reason why other researchers cannot join in. I welcome any feedback on this issue and perhaps in due course views could be exchanged via the e-mail discussion group.

Continuing down a eurocentric road, over the last few years we have seen a proliferation of new fission track laboratories a positive sign of the methods ubiquitous value to Earth Sciences. A consequence of this are frequent requests for dosimeter glass and age standard reference material with a degree of uncertainty as to what is available and who to ask. Given this situation, on page 10, I have pooled together as much relevant information as I could find. There may be omissions so please let me know.

There is only one scientific(sic) article in this issue kindly written by Kit Johnson in his own unique style (translation supplied). Kits article/story reinforces the need to carefully plan our sampling strategies. Under certain conditions a poorly considered sampling program can undermine interpretation in a similar way to ignoring variable grain composition.

Finally, I would like to remind you that the registration and payment deadline for the Cadiz FT meeting is fast approaching (15th February) so please find time to register. See page 7 for more details.

Short Tracks

Dave Coyle is now the proud president of his own company! Effective Software Inc. was formed in late 2001, and focusses on bringing customised technology solutions to businesses and non-profit organisations. Daves new company can be accessed on the web at www.effective-software.com.

Although moving further away from tracks, Dave clearly still has a soft spot for all things fission given his new e-mail address; tracker@coylebilt.com Good luck in your new venture.

NEW FT DISCUSSION GROUP

A FORUM FOR DISCUSSION AND DISSEMINATION OF INFORMATION relating to the fission-track method.

Some of you may already be aware that in December last year a new email discussion group for the fission track community was set up to facilitate world-wide exchange of knowledge on technical and analytical aspects of the method, to advertise posts and studentships and make relevant conference announcements.

The name of the group is FISSION-TRACK@jiscmail.ac.uk and if you want to be involved and participate all you have to do is send an email to jiscmail@jiscmail.ac.uk with a blank subject box and then in the body of the message write: join FISSION-TRACK *your name* Alternatively you can sign up by going to <http://www.jiscmail.ac.uk/lists/FISSION-TRACK.html>

Many of you are already aware of the way this type of forum works, but for those of you who are not familiar we recommend visiting the home page of JISC

<http://www.jiscmail.ac.uk/docs/jiscmail-guides.htm>

Please note that replies are sent to everyone on the list. Do not use attachments when sending mail as some members will be using modem connections to download.

If you wish to leave the list at any point, send an email to jiscmail@jiscmail.ac.uk with the message:

Leave FISSION-TRACK

Or alternatively, go to the website and follow the instructions to leave the list.

And finally, please note the guidelines for acceptable use are covered in the following document

<http://www.jiscmail.ac.uk/docs/policy.htm>

NEW (U-Th)/He LAB

THE NEW HELIUM LINE at UCL built by Patterson Instruments is now completed. The new facility consists of a single vacuum resistance furnace for extracting helium from apatite crystals, fully automated gas handling and preparation, and a dedicated on-line quadrupole mass spectrometer for determination of $^4\text{He}/^3\text{He}$ ratios.

Over 100 Gas standards have been analysed during the commissioning of the new system. On a day-by-day basis $^4\text{He}/^3\text{He}$ ratios of spiked gas standards typically reproduce at 0.05 to 0.1 % (1 sigma), and ^4He hot blanks from the furnace are running at <0.03 ncc ^4He .

At the time of writing three samples of Durango Apatite have been successfully outgassed and analysed for their ^4He contents. It is planned that the determination of U and Th in these initial samples will be completed in several weeks allowing the first (U-Th)/ ^4He ages from the UCL to be calculated.

Des Pattersons next project is in Tübingen where he will build a helium line for István Dunkl's group.

MEETINGS

EUROPEAN FISSION TRACK WORKSHOP, CADIZ, SPAIN 4-7 JUNE 2002.

This workshop follows three consecutive meetings that began in Italy in 1997. The aim is to provide a forum for European fission track scientists to meet and discuss methods and applications.

EUROPEAN GEOPHYSICAL SOCIETY MEETING - EGS NICE 2002

The XXVIIth General Assembly of the European Geophysical Society will be held in Nice, France, 22 - 26 April 2002.

GOLDSCHMIDT 2002 incorporating ICOG. The 12th annual VM Goldschmidt conference will be held in Davos, Switzerland, 18-23rd August 2002. There will be symposia on erosion, noble gas geochronology and new dating techniques.

OBITUARY

On the morning of the thirteenth September, 2001, we, the members of Japanese Fission Track Research Group (JFTRG), received an e-mail which informed us of the sudden death of Prof. Takaaki Matsuda, Kumamoto University. He had suffered a heart attack while playing tennis the previous evening. Despite doctors efforts to save him he never regained consciousness.

Born on the 8th July 1949, and only 52 years old when he died Prof. Takaaki Matsuda received his degree in Geology from Kyoto University in 1983, and began a career as an assistant professor at the Himeji Institute of Technology. He was soon promoted to an associate professor and then professor. In April 2001 Prof. Takaaki Matsuda moved to Kumamoto University where he was expected to lead the University as a professor through the difficult and revolutionary changes now taking place across the Japanese education and research system.

Prof. Takaaki Matsuda's research involved comprehensive geochronological studies of Japanese Tertiary igneous rocks and he contributed to understanding the geological evolution of the Japanese Islands. He played a major role on a project to reconstruct the opening of the Japan Sea joining a research group whose members were more famous for their wild but hearty behaviour and drinking, rather than their brilliant research. A tough mountaineer he was always keen to collect samples from difficult terrain, walking very fast along steep and rough trails as if they were flat pavement. His research interests were not restricted to Japan and included; the rift valley in Kenya, Sikhote Alin in the Russian Far East and China, and as a member of JARE-42 (Japanese Antarctic Research Expedition-42) he had just started research on Antarctica. For the FT community in Japan Prof. Takaaki Matsuda had volunteered to be president of JFTRG for 2 terms, making great efforts to promote geochronology in Japan. He always enjoyed contributing to the international FT conferences as far as his schedule permitted, and was especially disappointed that he could not join the last conference in Lorne because the Japanese academic calendar forbade professors to leave the university, even for a short term.

The JFTRG sincerely acknowledge Prof. Takaaki Matsuda's achievements, and wish him an everlasting and peaceful sleep. To mourn his death, the Department of Earth Sciences, Kumamoto University, constructed a web site although they are sorry that it is written in Japanese. It would be nice if you find time to visit this site and write a message when you have something in mind <http://www.sci.kumamoto-u.ac.jp/cgibin/TMbbs.cgi>.

A Photo Gallery is also available <http://www.sci.kumamoto-u.ac.jp/earthsci/tmatsuda/MatsudaPhoto.html>.

Japanese Fission Track Research Group
President, Teruyuki Honda (until March, 2002) and Hisatoshi Ito (from April, 2002)

AN ELECTRONIC DATABASE FOR EUROPEAN FT DATA.

Jocelyn Barbarand

Since the 1970's when Wagner and co-workers made the first FT analyses on samples from the Alps, there has been a huge increase in the number of fission track studies across Europe with much of the data remaining unpublished or buried in student theses. At the European FT network (EFTAN) meeting in Lautenbach last November, it was decided to establish a database of results from these different European studies to facilitate further studies and as an impetus for co-operative research. The data may also be used to compile large-scale summary maps that show sample locations and ages as well as denudation and thermal histories. The database will provide an important resource to support collaborative research proposals between scientists and as well as an aid to future research projects. It will eventually be web-based and accessible to all participants. First, though we need the data.

Participation is open to any scientist that has FT data from Europe. As a first step, we need to compile the data from published and unpublished sources and so we need people to submit their data. For this we require the following basic information:

Lab Name
Contact
Area of study (geographical area, geological unit, country)
Mineral used
Number of samples
Method used, i.e. EDM or POP
Length Data Y/N
If data are published - References

The aim is to compile this preliminary information as a summary map that shows which parts of Europe have FT data. The map will be presented at the Cadiz FT meeting in June 2002, where we will discuss in more detail how we want to proceed with the database in terms of content and format.

For this first stage, only data received by the 1st April 2002 will be incorporated into the first maps. So please spend a few moments to compile your list and send it to me, Jocelyn Barbarand, (barbaran@geol.u-psud.fr). If you want more information or have any questions please do not hesitate to contact me.

Books/Special Issues

The special volume arising from the Lorne 2000 conference, edited by Barry Kohn and Paul Green is expected to appear around March. The Tectonophysics Special Issue is entitled; ***Low temperature Thermochronology: From Tectonics To Landscape Evolution***, and will contain the following papers;

[Barry Kohn]

No.	Author(s)	Title
	B.P. Kohn and P.F. Green	Preface
1	A.J.W. Gleadow, B.P. Kohn, R.W. Brown, P.B. O'Sullivan and A. Raza	Fission track thermotectonic imaging of the Australian continent
2	D.A. Foster and A. Raza	Low-temperature thermochronological record of exhumation of the Bitterroot metamorphic core complex, northern Cordilleran orogen
3	E. Hejl, H. Riedl and H. Weingartner	Post-plutonic unroofing and morphogenesis of the Attic-Cycladic complex (Aegea, Greece)
4	F. Lisker	Review of fission track studies in northern Victoria Land: Passive margin evolution versus uplift of the Transantarctic Mountains
5	M.J. Raab, R.W. Brown, K. Gallagher, A. Carter and K. Weber	Late Cretaceous reactivation of deep crustal shear zones in northern Namibia: constraints from apatite fission track analysis
6	K. Hansen and C.K. Brooks	The evolution of the East to Southeast Greenland margin as revealed from fission track studies
7	J. Juez-Larré and P.A.M. Andriessen	Post Late Paleozoic tectonism in the southern Catalan Coastal Ranges (NE Spain), assessed by apatite fission track analysis
8	P. F. Green	Early Tertiary paleo-thermal effects in northern England: reconciling results from apatite fission track analysis with geological evidence
9	J. De Grave and P. Van den haute	Apatite fission-track thermochronology of the Altai Mountains, Lake Teletskoye region, South Siberia : preliminary results
10	C. H. de Bruijne and P. A. M. Andriessen	Far-field Effects of Alpine Plate Tectonism in the Iberian Microplate Recorded by Fault Related Denudation in the Spanish Central System
11	G. E. Batt and M. T. Brandon	Lateral thinking: 2D - Interpretation of thermochronology in convergent orogenic settings
12	J.I. Garver and P.J.J. Kamp	Exhumation of the zircon colour annealing zone in orogenic belts: A case study of detrital zircon from the Southern Alps, New Zealand
13	K.G. Osadetz, B. P. Kohn, S. Feinstein and P.B. O'Sullivan	Williston basin thermal history from apatite fission track thermochronology - implications for petroleum systems and geodynamic history
14	P.R. Tingate and I.R. Duddy	The thermal history of the eastern Officer Basin (South Australia): evidence from apatite fission track analysis and organic maturity data
15	M. A. House, B. P. Kohn, K. A. Farley and A. Raza	Evaluating thermal history models for the Otway Basin, southeastern Australia, using (U-Th)/He and fission-track data from borehole apatites
16	P. W. Reiners, K. A. Farley and H.J. Hickes	He diffusion and (U-Th)/He thermochronometry of zircon: Initial results from Fish Canyon Tuff and Gold Butte, Nevada
17	M. R. Brix, B. Stöckhert, E. Seidel, T. Theye and S. N. Thomson	Thermobarometric data from a fossil zircon partial annealing zone in high pressure - low temperature rocks of eastern and central Crete, Greece
18	R.A. Spikings, D.A. Foster, B.P. Kohn and G.S. Lister	Post orogenic (<1500 Ma) thermal history of the Palao-Mesoproterozoic Mt. Isa province, NE Australia

EFTAN NETWORK

A brief report on the November meeting at Lautenbach in the Black Forest, Germany.

A short meeting of the EFTAN network was held at Lautenbach in the Black Forest, Germany between 22. 11. 2001 – 23. 11. 2001 chaired by Günther Wagner. The meeting was well attended and most European labs (and Mexico) were represented by the twenty seven participants. The aim of this brief meeting was to facilitate communication between the different European groups, agree on the venue for the next International Fission Track Conference in 2004, to explore funding opportunities for collaborative research, and discuss more technical aspects of FT methodology.

The meeting began formally at 8.00 pm on Thursday evening with Günther welcoming everybody and outlining the history of the network and the program for the next day. Each of the participants then introduced themselves in their own language before briefly outlining their FT research interests. Towards the end of the evening, as the beer and schnapps did their work our discussions discovered more tangents than Pythagoras: István told a story about washing machine motors, toothpaste and women's socks (I think it was all to do with polishing apatite grain mounts), whilst the three wise old men reminisced about the early days of FT dating (Günther was the first person to start FT studies in Europe, in April 1964). Time for bed...

The next day began with Maurice Pagel outlining some of the possibilities for EU-funded projects that combine FT data from across NW Europe. He also introduced us to a CNRS-funded project that started in 2001. This project has funding for 2002, including some provision for co-workers outside of France. More information about these projects will be presented later on this year including at the next European FT-meeting in Cadiz. As a first step participants decided it would be useful to establish a European FT database of samples analysed by EFTAN members. It was also noted that other non-European labs may have data from Europe and they would be encouraged to participate. Jocelyn Barbarand and Maurice Pagel were willing to set-up the database and more details about this can be found on page 4.



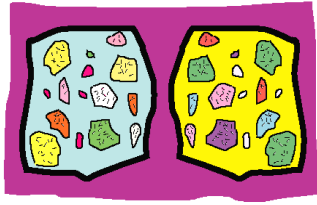
A variety of technical issues were briefly discussed including a need for track length standards (Tony Hurford), methodological problems associated with use of appropriate age standards, track length measurement, etching and absolute calibration (Raymond Jonckheere), the meaning of dispersion in the Chi-test (Balazs Székely), and shortage of suitable reactors (István Dunkl).

A suggestion was put forward that it would be useful if each of the European labs draft a brief Laboratory profile consisting of Group name and address, contacts, names of Group members, sources of support (university, state research funding, industry etc.) and ongoing research projects. So far only a few laboratories have sent their profiles and for the moment these are given at the end of On Track. In the future if enough laboratories participate it may be worthwhile compiling this list as a separate downloadable pdf file from the Editors On Track web address.

Some discussion was held about the European location of the next International FT conference to be held in 2004. It was agreed to accept Paul Andriessens offer to hold it in Amsterdam at a date yet to be arranged. The meeting concluded around 5 p.m. on Friday.

Günther Wagner and Ulrich Glasmacher are thanked for their warm hospitality and encouragement during discussion.

[Andy Carter]



CADIZ 2002

FISSION-TRACK ANALYSIS: THEORY AND APPLICATIONS

El Puerto de Santa María

Cádiz, Spain

June 4-7, 2002

Organization of the Cadiz meeting is now well underway. As most of you know, abstract submission was extended until February 1st, but the registration deadline remains February 15th. Please, do not forget to send me a copy of the bank draft when you make your payment. You can either fax it to: int-34-956-06040, send it by post or via email to; ftcadiz2002@uca.es

Two invited speakers have agreed to give keynote talks: Tony Hurford from UCL has agreed to talk about sources of variation in age and track length measurement, and Ulrich Glasmacher from MPI will talk about the Alpha Recoil Track Technique.

Diane Seward will give a "talk on the bus" during the field trip to the Ronda Massif in which she will present some fission track data on this massif.

A short meeting of the EFTAN (European Fission Track Network) will also be held in Cadiz, and Jocelyn Barbarand will update us on the progress of a European fission track sample/project database.

Once all of the abstracts have been received, I will prepare a second circular detailing the conference program including sessions and roundtable discussions.

It is intended that there will be a special issue of Tectonophysics from papers presented at the meeting but this is contingent upon there being an adequate number of suitable papers. At the moment six people have told me of their intention to submit a paper. If you want to make a contribution to this special issue then please contact me (Luis Barbero email: ftcadiz2002.uca.es) with a preliminary title and list of authors which I can forward on to the Editor-in-Chief.

Please remember that you are responsible for organizing your own accommodation. A limited number of rooms have been pre-booked in the Hotel Monasterio (meeting venue), and in the Hotel Los Cántaros and Hotel Santa María, both in the city center. When making your reservation indicate that you are attending the Fission Track meeting. I strongly recommend that you visit <http://interhotel.com> where you can book your rooms online. Please, note that El Puerto de Santa María is a busy tourist area and if you do not book your rooms in advance it can be very difficult to find somewhere.

Reactor Watch

In On Track issue 21, Ed Sobel presented a tabulation of reactor facts which has proven to be of immense use to trackers. The continuing economic and political pressures on research reactor facilities concern us all and no doubt you have had the odd sleepless night wondering which site may close next. In Europe the demise of RISØ has left many exposed to the problems and bureaucracy associated with international transport of radioactive materials. As far as I can gather, most trackers seem to be using either HIFAR at Lucas Heights or, TRIGA at Oregon. Although there is no evidence that either facility is going to close (although last years election in Australia could have seen Hifar closed if an alternative government were voted in) it would seem prudent to have a list of suitable backup reactors. Therefore in each future issue of On Track we will include updated versions of Ed Sobels reactor fact sheet and include any news relating to facility staff, upgrades, downtimes etc.

If you hear of any new developments concerning reactors or are aware of reactors that may be suitable please contact the Editor of On Track to ensure the latest developments can be reported back to the Fission Track community.

It is worth reminding ourselves (based on Ed Sobels comments) what constitutes a suitable reactor facility for Fission Track analysis:

What is a well-thermalised reactor? In order to avoid epithermal ^{235}U or fast ^{238}U and ^{232}Th fission, which will bias an FT age, samples must be exposed primarily to a flux of thermal neutrons. The actual thermalisation required depends on the Th/U-ratio in the sample. According to Wagner and Van der Haute (1992), the thermal/epithermal flux ratio should be >50 and preferably >100 . For absolute dating, it should be >200 . The thermal/fast flux ratio should be >7.5 and preferably >80 . A thermal/epithermal value of 100 corresponds to a cadmium ratio of 6.4 for Au and of 50 for Co.

Can I work with a facility that has a gradient? Gradients can be problematic. Standard glass dosimeters located at the top and bottom (and sometimes in the middle) of a sample stack is desirable to monitor and correct for any axial gradient. This assumes a linear gradient, which may not be the case. Some reactors have shown evidence for lateral gradients. We should always endeavour to count our dosimeter micas as traverses across the whole area to detect any lateral variation associated

with a lateral flux gradient. If we do find one we are in trouble as correction is much more problematic. One solution is to ask the reactor people to either rotate the tube continually or by 180 degree halfway through the irradiation time. Again this assumes stable and flux conditions.

If I change reactor does this influence my zeta?

The question of how an irradiation influences zeta has been addressed by Hurford (1998). Comparing a robust database of zeta values determined by a single analyst from 4 well-thermalised irradiation facilities, the values were seen to vary by $\pm 2\%$. Unfortunately, of these 4 reactors, only Lucas Heights is still available. However, providing it is a well-thermalised, it should be possible to change reactor without being greatly concerned about the effect on your zeta value. Nevertheless it would be wise to gather a new set of zetas for comparison. Note that because the SRM glasses have an unusual isotopic ratio, they are more sensitive to the degree of thermalisation than the Corning glasses.

HOT NEWS

Prior to the Australian election there was some concern that a change of government may herald closure of the ageing reactor facility at Lucas Heights. Re-election of the Howard government seems to have removed this concern and plans for building a new facility to replace the Hifar reactor are now underway. Phillip Morgan has moved to a reactor operators position at Lucas Heights and so will no longer be responsible for handling FT samples.

Ed Sobel and Kirsten Graefe are currently investigating a research reactor in Berlin. They have conducted a series of experiments to determine the level of axial and lateral gradients. Preliminary results were not encouraging due to significant gradients. However, the gradients may be due to failure of the sample holder rotation mechanism. Further experiments are underway to resolve this.

István Dunkl is exploring the suitability of a reactor in Hungary. Although well thermalised it appears that the main problem is that it is overpowered for our needs such that sample exposure time too short. Istvan is having negotiations too see if it will be possible to run the reactor for specific days at a lower fluence.

REACTOR INFORMATION	<u>LUCAS HEIGHTS</u> HIFAR X7 position	<u>OREGON</u> TRIGA Mark-II thermal column [inner face]	<u>THETIS</u> positions 6,7,8,15,16
CHARACTERISTICS			
Thermal fluence:	3 - 5.7 x 10 ¹²	1.0 x 10 ¹¹	1.0 - 3.0 x 10 ¹¹
Epithermal fluence:		5.0 x 10 ⁰⁸ [c]	0.6 - 4.3 x 10 ⁰⁹
Fast fluence:		5.0 x 10 ⁰⁸	0.8 - 5.0 x 10 ⁰⁹
Thermal /fast:		145 [b]	60 - 120
Thermal/epithermal:		200	70 - 160
Cd ratio for Au:	~125, ~98	14	
Cd ratio for Co:			
Radial gradient:		3%/cm	6% / cm
Axial gradient:	~ 5 %/cm		1% / cm
Foreigners ?	Yes	Yes	Yes
Price [nationals]	A\$350 /can [?]	\$ 200 (zr)	175 Euro /7h
Price [foreigners]	A\$350 /can plus shipping	\$ 400 (ap) plus shipping	175 Euro /7h incl. ship. [g]
Packing:	Ti cans [a] [supplied]	polyethylene	
Can size [mm] :	20 x 50	23 x 90	19 x 70
[diam. x length]	(total glass in each can must not exceed 15 grams)	price for 2 cans	
Website	www.ainse.edu.au/		
E-mail Contact:	David.hurwood@ansto.gov.au		

REACTOR INFORMATION	<u>VIENNA</u> TRIGA Mark-II	<u>PAVIA</u> TRIGA Mark-II Lazy Susan Rot. spec. rack	<u>PAVIA</u> TRIGA Mark-II Thermal Column	<u>KYOTO</u> KUR
CHARACTERISTICS				
Thermal fluence:	1.0 x 10 ¹³	1.0 x 10 ¹²	3.8 x 10 ⁰⁹	4.0 x 10 ¹¹
Epithermal fluence:	[d]			6.0 x 10 ⁰⁸
Fast fluence:		9.0 10 ¹¹		8.0 x 10 ⁰⁷
Thermal /fast:		1.1		5000
Thermal/epithermal:				700
Cd ratio for Au:		6.5	31	~200 [f]
Cd ratio for Co:		48		
Radial gradient:				
Axial gradient:				
Foreigners ?	Yes	Yes	Yes [e]	No
Price [nationals]	Free	On demand		
Price [foreigners]	Variable, ± \$80 /can	On demand		No commercial use
Packing:	plast. up to 80 h oth.: Al+quartz	plastic, Al can, glass, etc.	plastic, Al can, glass, etc.	plastic capsule
Can size [mm] :	35 x 100	22.5 x 50	22.5 x 50	
[diam. x length]				
Website				
E-mail Contact:				

TABLE 1: comparison of reactor parameters. Notes: [a] Mass of sodium containing glass must not exceed 15 g per can; total mass of can + contents must not exceed 55 g. Some users report problems with broken samples; [b] Extrapolated from 6" from face using 10%/cm gradient; [c] Measured 6" from face; [d] Epithermal neutron flux is high; induced Th-fission can be a problem; [e] thermal column is presently unavailable for FT-irradiations; [f] Cd-ratio is pers. com. [1988] Prof. M. Koyama to T. Tagami; [g] except by specialised transport.

Standards

Standards are always out of date. That is what makes them standards
(from *Forty Years On* by Alan Bennet)

No I am not referring to moral principles but rather the availability of uranium glass and age standard material. With new labs continuing to appear I thought it a subject worth reviewing. What is the current the position on age standards and dosimeter glasses and where can I get them?

GLASSES

Historically laboratories adopted the NIST (NBS) uranium glasses as dosimeters with most users favouring the SRM 610-617 range. Of these SRM 612 was widely used as it contained 37 ppm U. In the late 1970's Jan Schreurs at Corning manufactured alternative uranium glasses starting with U1-U7 followed by CN1, CN2 and CN5. The reason for an alternative to SRM glasses stemmed from the realisation that 60 odd trace elements in the SRM glasses could cause problems. For example the boron and rare earth content was sufficient to attenuate the neutron flux by up to 1%. The thorium content and depleted ^{235}U could cause problems if using a poorly thermalised facility. In addition it was unclear if the uranium distribution was suitably homogenous. These and other aspects are reviewed by Hurford (1998) and De Corte et al., (1998). Importantly comparison between CN and SRM glasses revealed the CN glasses to be consistently better monitors. Thus from the mid 1980's onwards most labs converted to the CN glasses. Initially these were distributed by Jan Schreurs at Corning, but later he retired and kindly arranged for the remaining supply to be passed on to the FT community via London who distributed to labs in the northern hemisphere and Melbourne who looked after the southern hemisphere. Since most labs use apatite and are located in the northern hemisphere the London supply of CN5 glass has now run out. Melbourne has some CN5 left and for the time being will distribute it to anyone who requests it.

Bearing in mind that the CN glass supply is rapidly diminishing and will not be replaced it is worth considering the new glasses being distributed by the International Institute for Reference Materials (IRMM). These glasses are described in De Corte et al., (1998) and are designed as Nuclear Reference Material. The first batch of 15 ppm U IRMM-540 glass is already sold out but two new sets have been prepared at 15 and 55 ppm U, and data on these new glasses are reported in Radiation Measurements (2001, vol. 34, p.419-422). These glasses will eventually replace the CN series.

To summarise;

CN1 (39.8 ppm U) and CN2 (36.5 ppm U) glass used for zircon can be obtained from either London or Melbourne

CN5 glass (12.2 ppm U) used for apatite can be obtained only from Melbourne.

IRMM-540 glass (15 and 55 ppm) from Belgium.

Contacts:

Tony Hurford t.hurford@ucl.ac.uk or, Andy Carter a.carter@ucl.ac.uk

Barry Kohn b.kohn@unimelb.edu.au

IRMM-540 glasses can be obtained from Dr. Christopher Ingelbrecht;

chris.ingelbrecht@irmm.jrc.be

There are also IRMM web pages that provide a catalogues of the reference materials and their specifications. <http://www.irmm.jrc.be>

[Thanks go to Peter Van den haute for this information].

AGE STANDARDS

In 1989 Tony Hurford listed on behalf of the IUGS Subcommittee on Geochronology the age standards considered most suitable to use in system calibration. These were;

Apatite: Fish Canyon Tuff
Durango
Zircon: Fish Canyon Tuff
Buluk Member tuff
Tardree Rhyolite
Sphene: Mount Dromedary Banatite

Other standards were noted to exist but were not included in the IUGS list because they were either technically difficult to prepare and/or use, or, had not been rigorously dated by other methods.

It was noted in 1988 that more age standards are needed, and in the last On Track we were introduced by Meinert Rahn to the latest candidate. Meinert has circulated some of this apatite and hopefully he will report back the results in a future On Track.

FISH CANYON Currently most of the larger fission track groups have their own supply of Fish Canyon Tuff (reference age 27.8 ± 0.2 Ma) and most will probably have some spare to share. I remember collecting some myself together with Manfred Brix from the Bochum group. It was after the fission track conference in Philadelphia in 1992, and we arranged to meet Chuck Naeser back in his Denver lab to be given the precise location details. He must have had a busy post conference week because when we got to the location other labs

had clearly been there - we found a nice freshly hammered outcrop that was startling to resemble a small cave because so much had recently been removed. Over the years Chuck must have spent a lot of time on Fish Canyon, initially preparing and circulating mineral separates, later receiving visitors and providing location details. On behalf of everyone, thanks Chuck.

Recently there have been several papers revising the age of the Fish Canyon Tuff based on new U-Pb ages. The most notable by Schmitz and Bowring (2001) provide good evidence for increasing the age to 28.48 ± 0.03 Ma from the argon based ages which range from 27.5 to 28.05 Ma. Evidence was provided to show that the difference between the U-Pb and argon based ages was not due to significant magma residence time but instead due to the decay constant and ages standards used in argon. All of this sounds bad news. However these small corrections have little impact on zeta when our comparatively large analytical errors are taken into consideration.

DURANGO. This is perhaps the most widely used apatite standard with a reference age of 31.4 ± 3 Ma (e.g. Green, 1985). It is widely available as most mineral dealers have it in their stock. Most specimens are found as gem quality, centimetre long, green euhedral crystals. It comes from the Cerro de Mercado (iron mountain) mining area in Durango, Mexico. Fission track labs either purchase their samples from mineral dealers or in some cases (no names) rob their department mineral collection. A word of caution if using mineral dealers. In On Track 2 issue 5, 1992 Richard Weiland reported that a dealer in the states had mistakenly labelled another apatite (probably from Bancroft Ontario) as durango. This apatite although similar in many respects to Durango was slightly deeper green in colour. Only after chemical analysis did this become apparent. I have not heard of this happening anywhere else but it could happen again so beware.

BULUK MEMBER TUFF This zircon age standard, reference age 16.2 ± 0.6 Ma was described by Hurford and Watkins (1985). The only supply is held in London and is freely available on request. The zircons are reasonably large, zoning free and have a fairly long > 24-36 hr etch time.

TARDREE RHYOLITE This zircon collected from the Tertiary igneous province of northern Ireland. The reference age is 58.7 ± 1.1 Ma based on K-Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ dating. The zircons are highly zoned but in general large countable areas are found in most grains. Although far from perfect this sample is similar in quality to many real samples. Currently no mineral separate is available. London has some rock but as yet it has not been processed.

BISHOP TUFF zircon has been used as an interlab standard. The reference age of 0.73 ± 0.024 Ma (Hurford and Hammerschmidt 1985) indicates

a long etch time. Currently, I am not aware of anyone using this sample routinely, nor of any supply for widespread distribution. Any offers?

MOUNT DROMEDARY BANATITE has been used as an interlab standard in Melbourne for many years and mineral separates have also been widely distributed to other labs. The sphene is a great standard and the apatite is also good. The zircon which contains on average 300-250 ppm U is also OK but less widely used.

Contacts:

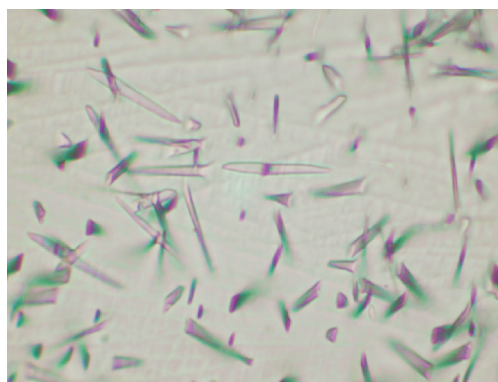
Fish Canyon - Supplies widely available from most FT labs as a last resort contact London.

Mt Dromedary - Melbourne, contact Barry Kohn; b.kohn@unimelb.edu.au

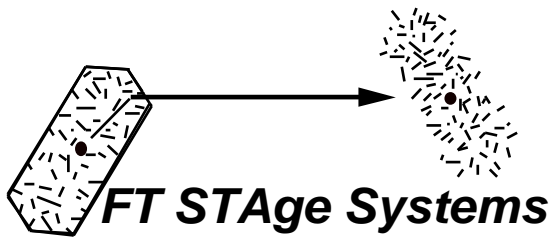
Buluk Tuff - London, contact Andy Carter or Tony Hurford; a.carter@ucl.ac.uk or t.hurford@ucl.ac.uk

REFERENCES

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Fission Track Laboratories Using the System (year installed; *adapted to a non-Kinetek stage)

- Stanford University, Stanford, California (1991)
- University of California, Santa Barbara, California (1992)
- ARCO Exploration and Production Technology, Plano, Texas (1992).
Moved to University of Minnesota, Minneapolis, Minnesota, in 1999.
- Universität Bremen, Bremen, Germany (1993)
- E.T.H., Zürich, Switzerland (1993*)
- Kent State University, Kent, Ohio (1993)
- University of Wyoming, Laramie, Wyoming (1993)
- University of Arizona, Tucson, Arizona (1993).
Moved to Syracuse University, Syracuse, New York, in 2000.
- Max-Planck-Institut, Heidelberg, Germany (1993*)
- Union College, Schenectady, New York (1994)
- Monash University, Melbourne, Australia (1994*).
Moved to University of Melbourne in 1999.
- La Trobe University, Melbourne, Australia (two systems, 1994*).
Moved to University of Melbourne in 1999.
- University of Pennsylvania, Philadelphia, Pennsylvania (1995)
- Universität Tübingen, Tübingen, Germany (1995)
- Universidad Central de Venezuela, Caracas, Venezuela (1995)
- Brigham Young University, Provo, Utah (1995)
- Central Research Institute of the Electric Power, Chiba, Japan (1995)
- Universität Salzburg, Salzburg, Austria (1996)
- University of Southern California, Los Angeles, California (1996)
- E.T.H., Zürich, Switzerland (second system, 1996*)
- Geologisk Centralinstitut, Copenhagen, Denmark (1996*)
- University of Waikato, Hamilton, New Zealand (1996*)
- Università di Bologna, Bologna, Italy (1997)
- Centro di Studio di Geologia dell'Appennino e delle Catene Perimediterra-
nee, Florence, Italy (1997)
- University of Wyoming, Laramie, Wyoming (second system, 1997)
- Universität Potsdam, Potsdam, Germany (1997)
- Seoul National University, Seoul, Korea (1998)
- E.T.H., Zürich, Switzerland (third system, 1998)
- Universität Basel, Basel, Switzerland (1998)
- University of Florida, Gainesville, Florida (1998)
- Universite Paris-XI, Paris, France (1998)
- Universität Graz, Graz, Austria (1998)
- Göteborgs Universitet, Göteborg, Sweden (1999)
- Universidad de Cádiz, Cádiz, Spain (1999)
- Universite Montpellier II, Montpellier, France (1999)
- Kurukshehra University, Kurukshehra, India (1999)
- Universität Tübingen, Tübingen, Germany, (second system, 1999)
- California State University, Fullerton, California (2000)
- Geoforschungszentrum, Potsdam, Germany (2000)
- Polish Academy of Sciences, Krakow, Poland (2000)
- University of Glasgow, Glasgow, Scotland (two systems, 2001)
- Yale University, New Haven, Connecticut (2001)
- Université Joseph Fourier, Grenoble, France (2001)

Further Information:

An early version of the system is described in a paper in Nuclear Tracks and Radiation Measurements, vol. 21, p. 575-580, Oct. 1993 (1992 Philadelphia Fission Track Workshop volume). For detailed information please contact: Dr. Trevor Dumitru, 4100 Campana Drive, Palo Alto, California 94306, U.S.A., telephone (auto-switching voice and fax line): 1-650-725-6155.

Profiling *sans jam-jar*¹

Fiction(?) by Kit Johnson

Earth Sciences and Engineering
Imperial College of Science, Technology and Medicine
Exhibition Road, London, SW7 2BT, UK



The phone rang and I picked it up. "Hello John," a voice said "I've got you a new motor²". It was my car dealer. "Err, that's nice" I replied "but I...." "No listen" he said. "I know it's early for your field season and all that, but this little jam-jar is a beauty. Up and down those mountain roads like a yo-yo. And the hand brake works this time. Promise. You'll love it." "Yes, but.....Harry³, I'm not planning on using a car for field work this summer. Or any other year for that matter. So I think I'll give it a miss. Thanks for phoning anyway" I was about to replace the receiver, but Harry wasn't a man to be put off easily. "Oi! John! No! Hold on a minute." he bellowed. "Just think about it for a moment. How the hell are you going to get to those rock samples of yours, sitting out there in the field waiting for you to drive up and belt them with an hammer, eh? You tell me that." He had a point, I couldn't deny that. "I'm going to walk to them." I said rather weakly.

¹ Car (cockney rhyming slang)

² Car

³ 'Harry' as in Palmer (or 'Michael' as in Caine etc. etc.)

"Walk!" There was a choking sound, and I wondered for a moment if he was suffering a coronary.

"Don't you ever use that word in my company again young man⁴. I'm a car dealer not a shoe salesman". "Sorry Harry. Slow jogging perhaps." I volunteered. "Alright, alright. Tell me this then. Who's going to carry your samples out of the field then eh? Tell me that."

He had a very good point, I reflected.

There was certainly no denying that one.

"Err.....I'd get somebody else to carry them out." I offered.

Silence.

"Nice thinking son." he said.

He liked that, I could tell.

"Alright" he said. "I'm trying to get me head round this one. You are going to do fieldwork. Not using a car, but using your feet instead. Just tell me why."

"Well Harry, its like this." I began.

"We've known for a long time that apatite fission track ages often vary systematically with sample elevation. When samples are collected in mountainous relief they yield older ages at higher elevations and younger ages at correspondingly lower elevations. The same is true for samples from boreholes, and for the same reasons. In general it seems reasonable to suppose that at a given locality, samples from deeper in the crust are never cooler than shallower samples, whether they are located in a borehole, or are now exposed up a valley side. Cooler samples will begin to retain fission tracks over geological timescales before hotter, deeper ones, thus giving rise to the positive correlation between age and elevation".

"Is that so." sniffed Harry.

"Yes" I ploughed on. "And quite a few people have made use of this relationship to say something about the timing of onset of accelerated denudation and the rate at which it proceeds. They call samples collected in this format 'vertical profiles'."

"That would be that Fitzy⁵ bloke, wouldn't it? Harry interjected, demonstrating a surprising knowledge of the literature.

"And a few more too who I can't be bothered to mention." I admitted.

"So what's this got to do with walking then?" Harry demanded.

"Hang-on old son⁶," I replied. "I'm getting to that. The thing is, if we've chosen our samples carefully, in a vertical profile format, we can treat them as coming from a coherent crustal section. Because we orientate our samples in space, so-to-speak, using structural or sedimentological criteria we can potentially make use of this spatial information when extracting the thermal history information contained within the fission track data. Basically we argue that

⁴ someone old enough to be your father

⁵ Probably Paul Fitzgerald.

⁶ someone too old to be your son

it's reasonable to assume that all of the samples experienced the same thermal history. But, and this is the important bit, each will have been at a temperature which is offset from its neighbours by a relatively fixed but unknown amount. This amount will be determined by the heat-flow and the distribution of rock thermal conductivities in the crustal column from which the samples were taken. Previously we would have modelled the samples independently and then, if appropriate, tried to fit a paleogeotherm to the data. Now, the temperature offset is actually one of the parameters that we try to estimate, along with the time and temperature pairs that define the collective thermal history."

"Yeah? And? I've not heard nuffin about walking yet." Harry said in a sullen voice.

"Don't be like that." I said. "I'll get round to the walking thing in a moment. Have a look at this diagram first."

I rolled the diagram up and stuffed it down the mouthpiece of the phone. I could hear Harry tearing it as he pulled it out of his receiver.

"Bugger," he said. "Oh no, its alright."

A moment of silence ensued.

"What's it all mean?" he finally said

"Well," I began. "It shows seven sedimentary samples that I collected in a vertical profile. They each had their thermal history information extracted independently of one another. Although there is a very good fit between the predicted FT parameters and those that were measured, there is a good deal of disagreement between the model predictions for the timing of cooling. This is indicated by the t-T point in the coloured area."

I heard "uuuurrrh" from the other end of the phone, but wasn't sure whether this indicated agreement, or the possibility that Harry had nodded off.

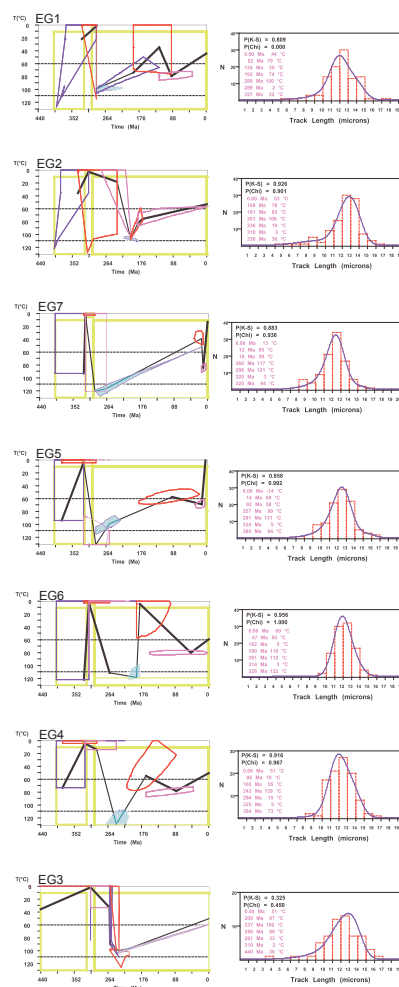
"The coloured area itself indicates the uncertainty associated with that t:T point, which is fairly large in many cases." I continued. "And even that is often truncated on the figures at adjacent t:T points. So the uncertainty in individual timings is really quite large, as well as variable. Now have a look at this second diagram."

I rolled this one up into a ball and popped it into the mouthpiece. Harry fumbled it and I heard it fall to the floor. When he'd retrieved it he flattened it out and began studying it. A curious smell wafted from the phones' mouthpiece. Harry was thinking⁷ 'what's this got to do with walking?'

"Just compare this with the last diagram Harry." I said, trying to move things along.

"In this one we've modelled the data from all seven samples jointly and come up with a thermal history that has a common form for all, but satisfies the observations for each of the samples. True, the fit between the observed and predicted parameters is not as good, but that's a desirable feature of the

procedure we would argue. It helps to minimise over-interpretation of the data, particularly when we are dealing with sediments that contain variable provenance related information. It sort of improves the signal to noise ratio, if you know what I mean."



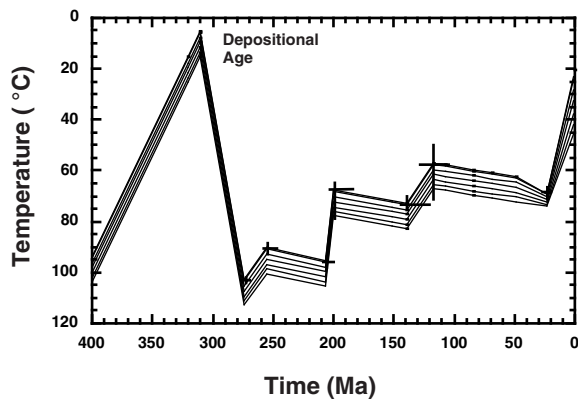
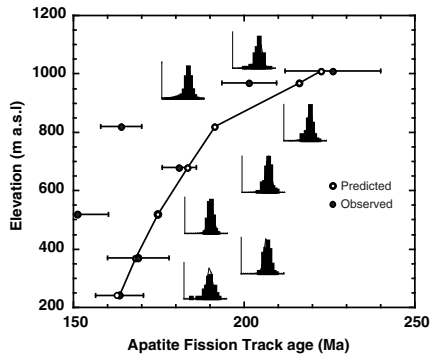
"Now have a look at the resolution that we've obtained, particularly for the timing of cooling episodes. Those little crosses indicate the 95% confidence intervals for each t:T point. Bit of an improvement eh?"

"Mmmm..uurrr"

"And of course" I continued, unsure whether Harry was buying any of this, "we can also estimate paleo-heat flow using the estimated temperature offset, section thickness, and measured thermal conductivity data. No more assuming a thermal gradient for estimating the thickness of eroded section." I said, allowing a note of triumphalism to enter my voice.⁸ There was a pause.

⁷ What does Harry's brain smell like? Think used bank notes. Small denominations. Now breathe deeply.

⁸ All this is of course annealing model dependent, but who worries about annealing models these days?



I knew I should have pressed on, but for some reason I didn't take my opportunity. Before I could say another thing, Harry seemed to have put two and two together and concluded they did indeed make four.

"What's this 'we'?" He demanded.

"Errr", I hesitated.

"That Gaggsy⁹ put you up to this didn't he?" he said accusingly. "That man is a toilet¹⁰. He should be locked up"

"Steady on Harry" I said. "He speaks very highly of you".

"Yeah, well" Harry replied. "He drives a Volvo. Rubbish foreign stuff. We like Fords in this neck-of-the-woods¹¹. Sierras, Mondeos, that sort of thing".

I was going to point out that Ford's were American but thought better of it. He wouldn't have believed me anyway.

"So? Was it Gaggsy?" he continued.

"No, no" I replied "Well..... eerrrrr..... yes..... sort of. He did the err... tricky bits".

"Thought so."

⁹ Probably Kerry Gallagher.

¹⁰ a cockney expression used to convey feelings of admiration and respect for other members of the human race (I made this bit up).

¹¹ locality

Harry sounded vindicated. "He doesn't know concrete from calcrete¹², but he thinks he can tell fission trackers not to buy my motors. And selling them shoes no doubt. I'm not having it!"

"But it's not like that Harry."

I was beginning to feel exasperated.

"It just makes more sense to collect samples from valley or mountain sides in a structured fashion so you can model the data jointly, rather than collect them from wherever the roads take you and model them individually. I know you find it upsetting Harry, even offensive, but we do have to leave the motor behind, pull on those boots, and get out into the field."

I realized that I'd started sweating. Maybe, I reflected, I wasn't the best advocate for hill climbing after all.

I could hear Harry re-organising his thoughts

"This new motor" he said "has a three litre engine."

Harry was trying a different strategy.

"Oh?" I replied.

"And alloy wheels,"

Pause.

"And it's red.....you like red don't you?" he added.

I did like red.

"And lots of widgets,"

"Mmm"

"And an enormous overhead dangle blaster camshaft"

"Really?"

"....that's chromed."

It was just getting too much for me.

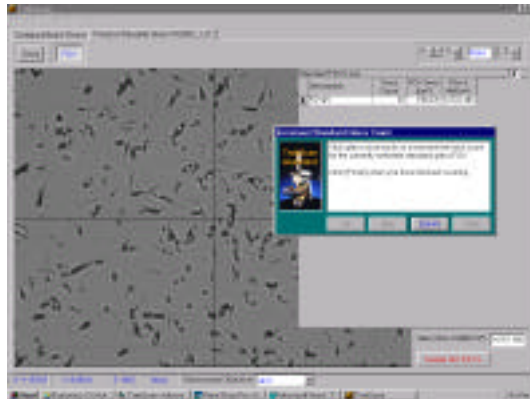
"Oh, go on then Harry. Sod the profiles, how much is it

¹² Who does?

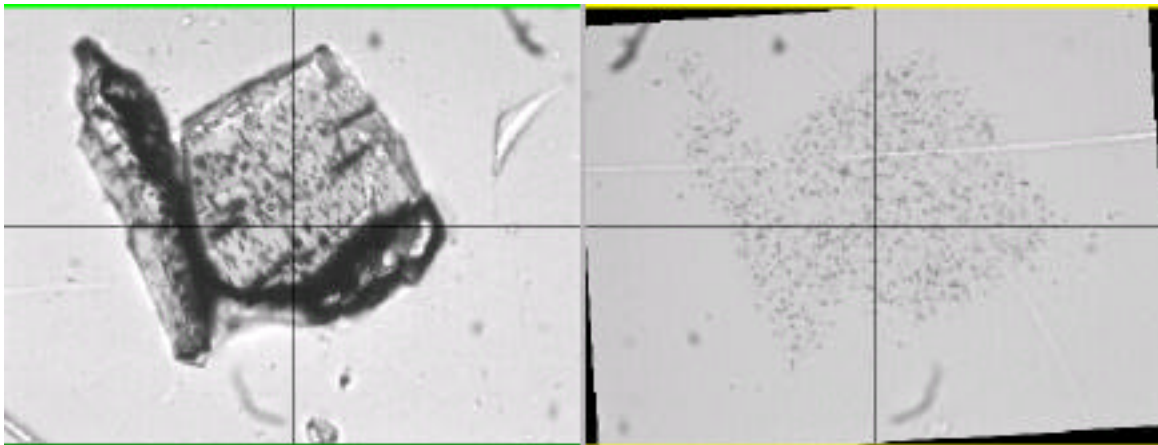


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EUROPEAN LABORATORY PROFILES

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Frank Hansen (technician)

SUPPORT

Two permanent positions from the Ruhr-University (MRB, FH) grants from DFG (German Science Foundation, SNT) and DAAD (German Academic Exchange Service, AAM)

RESEARCH PROJECTS

cooling and denudation histories:
Eastern Alps (Austroalpine basement south of the Tauern Window)
Western Alps (Ivrea Zone and Seconda Zona Diorito Kinzigitica)
Crete (Phyllite-Quartzite Unit, Uppermost Unit)
Harz and Thuringian Forest (Hercynian basement and sediments)
Caribbean (Cuba, Isla Margarita)
Southern Chile (Patagonian Andes, Chile Triple Junction, Liquiñe-Ofqui Fault)
Cyclades Islands (Syros, Tinos)
Provenance studies:
Harz foreland (Cretaceous sediments)
Crete (Flysch units)
Chile (Pre-Jurassic metamorphic basement of the Patagonian Andes)
Natural zircon annealing:
Vlotho Massif (N Germany; near an inferred magmatic intrusion)
Maas Valley (France, Belgium; around a metamorphic anomaly)
Zircon and sphene P/T annealing experiments

thermochronology of the Northwest German Basin

BOLOGNA FISSION-TRACK LABORATORY

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Dr. Vincenzo Picotti (Geologist)
Dr. Massimiliano Zattin (Geologist, FT analyst)
Giuditta Fellin (FT analyst, Ph.D. student)

SUPPORT

Two permanent positions from the University of Bologna (GGZ, VP)
Grants from MURST (Italian Ministry for University), CNR (National Research Council) and ENI-AGIP oil company

RESEARCH PROJECTS

Exhumation of Western Alps (Aosta valley)
The Veneto foreland as sedimentary record of the Alpine exhumation: a combined fission-track and petrographic study
Long-term and short-term exhumation of Northern Apennines
Thermal evolution of Southern Apennines (integration of FT analysis with other temperature indicators)
Brittle tectonics and exhumation of Northern Corsica

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SUPPORT

National Environmental Research Council (NERC),
EU, TotalFinaElf, Eurotrack

PROJECTS

Methodology

Sources of variation in FT data
System calibration
Controls on annealing
Integration of FT analysis with (U-Th)/He dating
Thermal history reconstruction

Application

Provenance studies in N. Atlantic basins
Denudation history of N. Atlantic region
Metamorphic and exhumation history of NW Himalaya
Provenance studies of Himalayan foreland basins

ORSAY FISSION TRACK LABORATORY

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GROUP MEMBERS

Maurice Pagel (Professor)
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SUPPORT

One permanent position from the Paris-Sud university

RESEARCH PROJECTS

Methodology

Apatite fission track annealing
Role of the composition on the apatite fission-track annealing : chlorine, rare earth elements, cell parameters
Use of cathodoluminescence to characterise the composition of apatite crystals

Applications

Reconstruction of the South-East basin margin thermal history : Ardèche, south-east Massif Central (Cévennes), south Massif Central (Causses basin)
Deformation of the Western european plate (Massif Central, Brittany)
U distribution cartography

MUSEUM FÜR MINERALOGIE UND GEOLOGIE

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Christian Tonk
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SUPPORT

Deutsche Forschungsgemeinschaft

RESEARCH PROJECTS

Thermal history of the Saxonian basement (from Fission-Track Data).
In co-operation with the Heidelberger Akademie der Wissenschaften and University of Leipzig.

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- Thermochronology, deformation and low grade metamorphism of the Tethyan Himalaya (Nepal)
- Thermochronology of the Pelagonian crystalline basement (Macedonia & Greece)
- Provenance and thermal history of the Cretaceous sediments in Apuseni Mts. (Romania)
- Apatite FT thermochronology and metamorphic evolution of the crystalline basement westernmost western Carpathians (Slovakia)

Projects in preparation

- Thermochronology and relief evolution of the south Peruvian Andes
- Relief evolution in Corsica
- 10. Exhumation of the Slavonian core mountains and sediment provenance (Croatia)

GROUP MEMBERS

Researcher-lecturer: István Dunkl

Post-docs: Cornelia Spiegel, Balázs Székely

PhD and master students: Martina Schwab, Petra Angelmaier, Thomas Most, Volker Schuller, Renato Pagliuca, Martin Danisik

Technicians: Dagmar Kost, Gerlinde Höckh, Dorothea Müllbayer-Renner

Finished PhD (alumni) since the last EFTAN meeting: Jürgen Elias, Kirsten Gräfe, Achim Brügel, Britta Trautwein, John Reinecker, Franz Moser

SUPPORT

Deutsche Forschungsgemeinschaft

RESEARCH PROJECTS

- FT age-provenance analyses with combination of advanced heavy mineralogy and (isotope)geochemistry on detrital phases
- exhumation studies of blocks within the Alpine-Carpathian-Pannonian-Dinaric area
- relief evolution with combination of DEM analyses
- software development - a new population-decomposition software will be available soon (PopShare)

- Provenance analysis of Alpine Flysch, Molasse and recent river sediments
- Exhumation history and modeling of the central part of the Eastern Alps (in connection with the TRANSALP seismic project)
- Structural and thermal evolution of the northeastern Pamirs (Kirgisia and Tadjikistan)
- Thermal history of the basement of the Pannonian basin
- Apatite FT thermochronology of the Dolomites
- Exhumation history of the Bohemian massif (Moravicum and Moldanubicum)
- Organic maturation and AFTA analysis of the Paleogene sediments of the northern Pannonian basin

Fission-Track Papers

The following is a list of recent and soon-to-be published fission track papers that were submitted by the authors for inclusion in this issue of *On Track*. The list is extensive but far from complete. It may however serve as a starting point for compiling a 'complete' list of fission-track papers. We would all agree that such a list has practical use as a reference to what is happening in fission-tracks or in your study area. This cannot be achieved without everyone's active co-operation. So, if you have or know of a paper that you would like to see listed in this section, please send the complete reference or a photocopy of the first page to the editor. We are also interested in non-fission-track papers that may be of interest to the fission-track community.

1999

- Balestrieri M.L., Bigazzi G. and Ghezzi C. [1999]. The Transantarctic Mountains: a natural laboratory for apatite fission-track analysis. Results from Italian Antarctic expeditions. *Radiation. Measurements*, Vol. 31, 623-626.
- Batt G.E., Kohn B.P., Braun J., McDougall I. and Ireland T. R. [1999]. New insight into the dynamic development of the Southern Alps, New Zealand, from detailed thermochronological investigation of the Mataketake Range pegmatites. In: *Exhumation Processes: Normal Faulting, Ductile Flow and Erosion* (U. Ring, M.T. Brandon, G.S. Lister and S.D. Willett, eds.). Geological Society, London, Special Publications, 154, 261-282.
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- Bernet M., Zattin M., Garver J.I. and Brandon M.T. [1999]. Exhumation of the European Alps revealed through fission-track ages of detrital zircons. *Memorie di Scienze Geologiche* (in English), 51.
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- Carter A. [1999]. Present status and future avenues of source region discrimination and characterization using fission track analysis, *Sedimentary Geology*, Volume 124, Issues 1-4, 31-45.
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- Cassola Molina E. and Ussami N. [1999]. The geoid in southeastern Brazil and adjacent regions: new constraints on density distribution and thermal state of the lithosphere. *Journal of Geodynamics*, Volume 28, Issues 4-5, 357-374.
- Davidson G. and Miller J.A. [1999]. Towards automated 3D analysis of fission tracks in external mica detectors. *Computers and Geosciences*, Volume 25, Issue 2, 171-178.
- Donelick R.A., Ketcham R.A. and Carlson W.D. [1999]. Variability of apatite fission-track annealing kinetics: II. Crystallographic orientation effects. *American Mineralogist*, Volume 84, Issue 9, 1224-1234.
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- Foster D.A. and John B.E. [1999]. Quantifying tectonic exhumation in an extensional orogen with thermochronology: examples from the southern Basin and Range Province. In: *Exhumation Processes: Normal Faulting, Ductile Flow and Erosion* (U. Ring, M.T. Brandon, G.S. Lister and S. D. Willett, eds.). Geological Society of London, Special Publication, 154, 343-364.

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Afterthoughts



Latest Fishon (*track*) Group?

[Mike Krochma

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The next issue of On Track is scheduled for late June 2002 and we are looking for contributions. On Track welcomes contributions of virtually any kind, including scientific articles, news, gossip, job openings, descriptions of new lab techniques, reviews of useful products, ravings about what the other labs are doing wrong, meeting announcements, cartoons and descriptions of what you are doing in your research.

If you would like to contribute, please send the final document no later than **June 1, 2002**. If you intend to submit a substantial article, please let the editor know as soon as possible.

On Track includes a list of recent and forthcoming fission-track papers. If you know of a paper that was published recently or is in press and should appear in the list, please let me know so that it can be added to the list. Also, if you happen to change location due to a change in jobs or finishing off the thesis and graduating, please inform the editor.

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