Geoscience Canada

TL + ESR 6th International Specialist Seminar on Thermoluminescence and Electron Spin Resonance Dating

Bonnie Blackwell

Volume 17, Number 3, September 1990

URI: https://id.erudit.org/iderudit/geocan17_3con04

See table of contents

Publisher(s)

The Geological Association of Canada

ISSN

0315-0941 (print)
1911-4850 (digital)

Explore this journal

Cite this article

Blackwell, B. (1990). TL + ESR 6th International Specialist Seminar on Thermoluminescence and Electron Spin Resonance Dating. *Geoscience Canada*, *17*(3), 197–199.

Porat *et al.*), U series (Ford and Lundberg), and ^{14}C (Shoshani; Stuckenrath; Aravena *et al.*; Mayle and Cwynar). Several other interesting topics were presented, including drumlin formation (Patterson), p-forms (Stenson and Tinkler), neotectonics (Thomas *et al.*; Bobrowsky and Clague), placers (Milner), collapsing ice sheets (Johnson), aboriginal adaptations to change (Webb), marl $\delta^{18}O$ (Edwards and Dyrkton), ecological density models (Shoshani), isotope dendroclimatology (Buhay *et al.*), a paleoecological data base (Jette), bog formation (McAndrews and Ovenden), geophysical prospecting for archeological sites (Hunter and Nobes) and resource mapping (Schneider and Greenhouse). All the posters were high-calibre presentations scientifically. Furthermore, only two posters looked like they had been done on the plane to the conference. Poster presenters must be congratulated for the efforts they put into their presentation.

Two more field trips followed the meeting. The Waterloo regional geomorphology trip was repeated. A good group took a Lake Ontario cruise and visited the Canada Centre for Inland Waters research facility at Burlington, luckily on the only really nice day all week.

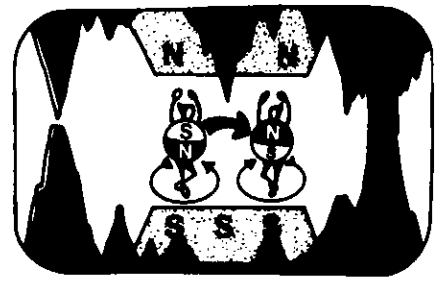
Also, three short courses were given following the meeting. David Nobes, John Greenhouse, and G. Schneider taught a course in geophysical applications in Quaternary sciences which included one day of field experience followed by a day of lectures and computing. Several experts taught the short course on biological techniques in paleoenvironmental interpretation. The short course on Quaternary dating techniques brought ten experts in TL, ESR, U series, ^{14}C, and amino acid racemization together to discuss the methodology, problems, and sampling. Extra copies of the notes for this course sold out almost immediately, requiring a second printing during the conference. Comments from course participants praised the content and organization. Course notes for all courses can be purchased by the public. The conference and short course organizers are to be congratulated for successfully delivering such an ambitious number of courses.

As with any conference there were minor technical and organizational problems, not to mention miserable weather complete with a small tornado. This year, microphones enabled us to hear the speakers better than in most conferences, although some were still hard to hear. It was also a delight that this year the talks only fell behind schedule on the last day, partially due to the presentation of the Johnson Medal. The session chairmen who stringently enforced the time limits, yet did not strangle the discussions, are to be congratulated, as are the organizers.

The idea of having a designated time for the poster sessions which did not conflict with any talks ensured that many people visited the posters, but unfortunately, the area with the posters became very crowded. Future conference organizers must solve this problem, without relegating the posters to one (or, worse yet, many) hidden rooms. With the number of submissions to meetings constantly increasing, it may become necessary to split the conference into concurrent sessions, to accommodate the number of people wanting to talk. A side issue to this problem is that not all presenters are equally good at oral presentations. Most of us have fallen asleep at one time or another during a boring talk in which the speaker droned on and on. One solution here might be to review not only the scientific content of the paper, but also the ability of the speaker to present his/her message. People who do not communicate as well orally would still be able to present in a poster session. This would ensure stimulating talks, but still allow everyone to present their data.

Given that probably the most frustrating thing about the meeting was having to choose from the great variety of interesting post-conference activities, I think the Waterloo AMQUA/CANQUA conference was a great success. Certainly, it was the biggest CANQUA meeting ever. As the first joint meeting, we all hope it is only the first of many. It's also the first time CANQUA has tried offering short courses, but I'm sure, not the last. The local organizing committee did a superb job. People wishing copies of either the conference abstracts, field trip guidebook, or any of the short course notes can obtain them from Barry Warner, Department of Earth Sciences, University of Waterloo, Waterloo, Ontario N2L 3G1. The next CANQUA meeting is scheduled for Fredericton, New Brunswick, in 1991.

Accepted 3 July 1990.



TL + ESR 6th International Specialist Seminar on Thermoluminescence and Electron Spin Resonance Dating

Bonnie Blackwell
Department of Geology
McMaster University
Hamilton, Ontario L8S 4M1

On 2-6 July 1990, more than 150 participants from around the world, including six Canadian scientists, attended the sixth international symposium on thermoluminescence (TL) and electron spin resonance (ESR) dating at Clermont-Ferrand, France, hosted by l'Université Blaise-Pascal. This conference was extremely well organized, with a wealth of excellent presentations in the problems and applications of TL and ESR. Participants were split between government and university research personnel.

The conference kicked off with a dinner on Sunday night at which many old friends had an opportunity to catch up on recent events. Early Monday morning, the scientific sessions started with welcomes from Dr. Jean Fain, the conference chairman, Dr. M. Montret, head of the Laboratoire de Physique Corpusculaire, and Dr. Renal, the INQUA representative for France.

In the opening address, Steve McKeever developed his theory to explain why the "hard to bleach" TL component cannot be completely removed. Reuven Chen *et al.* reviewed the problem of the predose effect. In discussing the characteristics of the red TL curve from quartz, Jean Fain et al. detailed their theory based on local interaction effects. For the problems of fading, charge transfer, and bleaching, Bill Hornyak with A. Franklin suggested that isothermal decay does not demonstrate which of three mathematical model applies. Paul Levy, however, indicated that the nature of the glow curve would elucidate the trap kinetics. A lively discussion of the problem followed, but did not resolve the difference of opinion.

In an excellent paper about the problems of TL dating burnt flint, Hélène Valladas

noted that no crushing-induced signal occurs, but transparency can cause bleaching in the outer few millimetres. Anomalous fading is not a problem after 3.5 ka, while the dose rate effect is ±2%. For many sites, TL burnt flint dates agree well with ^{14}C dates from the newly published calibration curve (Bard *et al.*, 1990). Using the growth curve method for TL, Isao Takashima with S. Honda found the maximum limit to be 3 Ma. Lars Bøtter-Jenssen *et al.* described their automated irradiator used for both TL and OSL (optically stimulated luminescence) analysis. Santa Chawla with A.K. Singhvi suggested using the quartz TL sensitivity itself to estimate the accumulated dose (AD), but found that sunlight and laboratory bleaching were not equally effective. Peter Muller *et al.* explained that low sensitivity, thermal instability, and anomalous fading prevent TL dating of archeological glass. In deep sea cores, Giuliana Cini Castagnoli with G. Bonino reported incredibly good correspondence between TL signal sensitivity and $CaCO_3$ content, which could be related to Milankovich cycles.

A champagne reception at the mayor's office followed in which the mayor welcomed the delegates and thanked the local committee for bringing the conference to Clermont-Ferrand.

On Tuesday, the sessions began with an excellent review of the problems and successes in ESR dating application by Rainer Grün. In the ensuing discussion, it was suggested that all laboratories should use an internal synthetic ruby standard, and that all should participate in the upcoming interlaboratory calibration program. It will include source calibration, in addition to dating several standards, some of which will be preirradiated. Barabas *et al.* found that the g = 2.0006 signal is the best signal for dating all marine carbonates, but not all terrestrial carbonates. For molluscs, they found that analysis in the Q band gave the most reliable results. In the coral intercalibration project, Rainer Grün with Ulrich Radtke suggested that artificial irradiation produced a secondary signal. In the discussion, alternate hypotheses included two sets of traps, multiple overlapping signals, and saturating exponential traps.

For ESR in quartz, Christophe Falguères *et al.* reported that the OHC and Ti signals annealed at 110°C, while the Al begins to anneal at 180°C. Tatsuro Fukuchi explained that annealing behavior does not follow first- or second-order kinetics, and that the mean-life (τ) for the signals is a function of the age of the sample itself. For the peroxy centres at g = 2.008 and 2.003, Bill Rink with A.L. Odom demonstrated that α recoil of heavy particles formed new signals at a rate of 1.2×10^{8} a^{-1}. For the E_1 centre in fused silica, Albrecht Wieser *et al.* found several signals, one of which had a growth curve with a slope of 1.114, suggesting possible supralinearity. Ruth Lyons with B.J. Brennan determined the κ value (α efficiency) in stalagmites by measuring the γ-induced and α-induced AD's for splits of the same sample. They found a weak correlation between κ and U concentration. If the OHC signal is not present in heated chert, Naomi Porat *et al.* could separate the E' signal from the heating induced C radical signal with a computer simulation technique. They also reported on the problems encountered in attempting to date heated quartz hearth sand. Using their new 2-D ESR scan apparatus, Masahiro Furasawa *et al.* showed the zonation in a zircon crystal.

Tuesday ended with a quick trip to the top of the Puy de Dome, where Pascal first demonstrated that atmospheric pressure depended on altitude. This volcanic cone was TL dated at 8 ka. From there, we had a spectacular view of Clermont-Ferrand and area. A small museum at the top displayed some local archeological finds, including those from the Roman Temple to Apollo.

On Wednesday, Martin Aitken reviewed the theory of OSL (also known as photoluminescence, laser stimulated luminescence) techniques, which include infrared stimulated luminescence (IRSL). He noted that mixed peaks, retrapping, and thermal transfer of electrons allow recuperation of the signal, requiring exponential fits for the glow curves. For OSL in feldspars and quartz, Galina Hütt used the full spectrum from green to infrared with no preheat treatment. Discussion centred on the problem of bleaching in fluvial and glacial environments. After 4 days annealing at 75°C, Shengua Li with A. Wintle found no fading of the OSL signal in feldspars. They determined the K-feldspar signal was more stable at > 200°C than that in loess. For IRSL in recent silt, Martin Aitkin with J. Xie had the greatest success with the fine silt fraction, but found estimating the water content to be problematic. For feldspars, Nigel Spooner reported significant fading for both IRSL and green OSL signals, especially in labradorite and sanidine. In the discussion, it was stated that the IR signal is unstable, and that it is necessary to wait for thermal equilibrium to be reestablished before measuring samples. For OSL in quartz, Eddy Rhodes reported that signals in all samples recuperate, including zircons and loess. Stephen Stokes found a 0.5-1.0 gray residual OSL signal in modern quartz. He used the absence of the IR peak to ensure no feldspar contamination. Ian Bailiff with N.J.R. Poolton found that IRSL has a lower residual signal than TL, and that the signal appears more thermally stable in labradorite than in quartz. Using 514nm laser light on quartz, Doreen Stoneham with S. Stokes found that the 325°C OSL peak sensitivity is related to the 110°C TL peak. Martin Aitken explained his theories on three different types of recuperation.

In reviewing recent TL dates for sediment, Anne Wintle noted that, while TL dates agree with ^{14}C dates back until ~10 ka, most older TL dates appear to underestimate the actual ages. Furthermore, the measured age depends partially on the filter used. Using the regeneration method for eolian sand, Vagn Mejdahl did find some agreement between the TL ages and other methods. Ludwig Zöller with G.A. Wagner reported loess regeneration dates for several sites, including Schwalbenberg, Toenchesberg, Ehringsdorf-Weimar, and Steinheim, that agree with dates by other methods, although some underestimation occurred. Manfred Frenchen's dates for Toenchesberg and Airendorf, however, did not agree with Zöller's results. He found that the maximum age determinable with TL for loess was 100 ka.

Claus Ditlefsen with C. Kronborg reported on a simulation experiment during which K-feldspars were immersed in water. They found significant bleaching in K-feldspars after 20 hours in turbid water. Bleaching was a function of turbidity, suspension strength, mineralogy, and grain size. For dune sand, Alan Franklin *et al.* determined that at least 4 hours of bleaching were needed to produce any significant decrease in the 375°C TL peak intensity. Using feldspars from sand units, Helen Rendell TL dated the Stockport Till at 20-30 ka and the Chelford interstadial sand at 90-110 ka. In TL dating the Chinese loess sequences, Martin Aitkin with M. Xin found a consistent 62% underestimation compared to the ^{18}O stage ages.

On Thursday afternoon, most people enjoyed a field trip to see several volcanic tuff sections which were dated by Jean Fain's group at the Université Blaise-Pascal. Although the weather did not co-operate, most people were suitably impressed by the thickness of the volcanic sequence developed over the last 100 ka. One flow originating in the Puy de Vache can be traced for 40 km down a valley, where it dammed several lakes. Although a proper field trip guidebook and a decent map for everyone would have made the trip more educational, the geological guides did explain the features succinctly in both French and English. The trip ended with a banquet at a medieval castle in St. Saturnin where we were entertained by local musicians who specialize in medieval folk dances and songs. After lubrication by the local vintages, most people joined in the dancing. Unfortunately, the success of the evening did affect attendance at the Friday morning sessions.

For an elephant tooth from Isernia la Pineta, found beneath a magnetically reversed 730 ka tuff, Jean-Jacques Bahain *et al.* obtained ESR dates of 150 to 270 ka. Comparing ESR ages of an *Equus* molar with U series dated travertines at La Chaise-de-Vouthon, Bonnie Blackwell *et al.* found significant underestimation which was attributed to suppression of the ESR signal by trace elements. Henry Schwarcz *et al.* found that well-crystallized teeth, as demonstrated

with IR and XRD spectrometry, give better ESR results. They also reported on recent successes in dating gar *(Lepisosteus)* scale enameloid. Using linear fits, Ren-You Liang with P.H. Huang *et al.* ESR dated teeth from the Beijing Man-bearing layer at Zhoukoudian at 580 ka. For recent New Zealand bone, John Dennison with B.M. Peake found that the presence of Fe did not affect peak height measurement. Determining the sensitivity of the overmodulated $g = 2.0012$ peak in molluscs, Anotoly Molodkov dated shells from several open marine sites. He suggested using Th concentrations to monitor U uptake. Motoji Ikeya with Ikeda *et al.* found that the $g = 2.006$ peak anneals at 200°C and that the $g = 2.0035$ and 2.0007 peaks were nonorganic. In the general discussion, the existence of the $g = 2.0007$ peak in shells, and the number of components in the $g = 2.0012$ peak were discussed.

For Cretaceous sediments in the Otway Group, Peter Ypma with M.B.M. Hochman found that quartz TL signal heights are a better indicator of average maturity than vitrianite reflectance. For TL signals in calcite, M.R. Khanlary with Peter Townsend reported peaks from powders were fewer and broader than those from single crystals due to disassociation of Mg during grinding. In X-irradiated albite, Yoram Kirsh with R. Chen determined the activation energies and pre-exponential factor for the blue phosphorescence. For TL in quartz, G. Kitis with Stefan Charalambous found that the α-irradiated signal was consistently more intense than the β-induced signal. For higher doses, moreover, the dose response varied with the irradiation temperature.

Pierre Guibert with M. Schvoerer described their technique for γ emission spectroscopy on artifacts using paraffin casts. Problems in assessing U disequilibrium currently hamper the method, but K and Th results are in excellent agreement with other analytical techniques. For ore dosimetry, Y. Liritzis with R.B. Galloway found as much as 10-20% backscattering during β measurement, while in γ measurements, the self-adsorption is critical. I. Rossini *et al.* reported on initial determinations of the standard Soil 7 using neutron activation analysis.

Posters were formally presented in two sessions during the conference, but were displayed for the whole week. The posters covered a range of interesting topics. Posters attempted to resolve problems in estimating α particle attenuation (Brennan *et al.*), in TL analysis (Andersson *et al.*; Bluszcz; Kierstead and Levy; Silverman *et al.*; Lippe and Goedicke; Chapoulie *et al.*; Duller; Forman and Ennis; Mercier; Frechen *et al.*; Goedicke; Kitis *et al.*; Vana and Gratzl; Miallier *et al.*), in TL dosimetry (Blenko), in estimating ceramic firing temperatures with TL (Türetken and Mahmoud), in OSL analysis (Hütt and Poliakov; Jungner and Huntley; Ishii *et al.*; Diaz *et al.*; Milanovich-Reichhalter and Vana; Smith and Rhodes; Huntley and Haskell; Haskell and Huntley), and in ESR analysis (Lyons *et al.*; Bidiamambu *et al.*; Walther *et al.*). New equipment demonstrations included a multi-sample analysis system for TL and OSL (Galloway), a portable TL detector (Ichihara *et al.*), and a portable ESR detector (Ikeya *et al.*).

Many posters demonstrated the utility of TL for dating beach sand (Balescu *et al.*; Yokoyama *et al.*; Balescu and Lamothe), eolian sand (Singhvi *et al.*), till (LaMothe and Marcheterre), alluvial sediment (Prószyńska *et al.*; Ervanne *et al.*; Parks and Rendell; Price *et al.*), kame sediment (Hütt and Jungner), loess (Zhou and Wintle; Questiaux; Bluszcz; Bluschbeck *et al.*; Dijkmans and Wintle; Packman and Grün), speleothems (Hercman), burnt hearth stones (Bertrand and LaMothe), fault movement (Hiraga *et al.*), volcanics (Nagatomo *et al.*; Pilleyre *et al.*), shells (Ninagawa *et al.*), and ceramics (Lorenz and Wagner; Michael; Ohta; Mortlock and Skinsness-Scollard). Japanese tephra were also dated by OSL (Kanemaki *et al.*). Posters reported ESR dates for bone (Oduwole and Sales), teeth (Jin *et al.*; Liang *et al.*; Özer *et al.*), molluscs (Özer *et al.*; Skinner and Weicker; Shimokawa *et al.*), deep sea sediment (Mudelsee *et al.*), Australian silcretes and gypcretes (Y. Chen *et al.*), phosphorites (Y. Chen *et al.*), fault gouge (Grün and Fenton), and volcanics (Buhay *et al.*; Imai and Shimokawa; Toyoda and Ikeya).

Unlike most conferences, there were few technical and organizational problems. Only two talks and three posters were cancelled, and these slots were filled by other papers. The biggest problem was the lack of a second slide projector. While timing for the talks was scrupulously enforced by a series of excellent session chairmen, they ensured adequate time for discussion following each paper. Having a designated time for the poster sessions which did not conflict with any talks ensured that many people visited the posters and, fortunately, adequate space made it possible to see them easily.

The daily group luncheon, an excellent French four-course meal, promoted lively discussion between participants, and saved everyone the hassle of trying to find a restaurant each day. Unfortunately, there was often little spare time to run errands at lunch, which did contribute to a growing absentee rate for each successive session. The only real complaint most participants had was that there was too much food, and the wine tended to put many to sleep in the afternoon sessions.

This conference, however, was a long one. By Friday, most people were a little frazzled, which, combined with the Thursday night entertainment, meant that Friday sessions were poorly attended. With the number of submissions to this conference constantly increasing, it may become necessary to split the conference into concurrent sessions to accommodate the number of people wanting to talk. Such a problem is difficult to solve since everyone is theoretically interested in all the papers.

The local organizing committee did a superb job. People wishing copies of the conference abstracts, should contact Jean Fain, Laboratoire de Physique Corpusculaire de l'Université Blaise-Pascal, Aubière F-63177, France. Most of the papers will be published in upcoming issues of *Nuclear Tracks and Radiation Measurements* or *Quaternary Science Reviews*. The next ESR conference is scheduled for Washington, DC, in October, 1992, while the 7th International TL + ESR conference will occur in 1993, either in Austria or Durham, England.

Reference

Bard, E., Hamelin, B., Fairbanks, R.G. and Zindler, A., 1990, Calibration of the ^{14}C timescale over the past 30,000 years using mass spectrometric U-Th ages from Barbados corals: Nature, v. 345, p. 405-410.

Accepted 16 August 1990.