

13th EAOG Newsletter, Autumn 2001

1. Newsletter Editor's bit

Dear readers, this is last time I compile the EAOG Newsletter, since I will be taking over as Chairman after the next board meeting in early 2002. I hope you have enjoyed the 9 newsletters I have put together over the last 5 years. Thanks to those of you who have contributed directly to them, and for your (generally appreciative) comments on my efforts. You will – for better or worse – be hearing from me again in my new role, so it is not goodbye but “au revoir”.

In this newsletter you will find a summary of the minutes from the last board meeting in Nancy, information about the EAOG web site, and travel reports from Marie Russell and Manuel Algarra González, as well as some parting thoughts from our dear Chairman. I hope you find it interesting.

Best wishes
Richard Patience.

2. Parting message from the Chairman

And so the day has finally come when I must hang up whatever it is that EAOG Chairmen hang up at the end of their term of office. Actually, I will continue to serve until early in 2002, but as far as the Newsletter is concerned, this is it, my last offering.

I have enjoyed being EAOG Chairman. First and foremost let me thank the organisation and membership for giving me the opportunity to make my mark. It was certainly an honour to follow in the footsteps of my mighty predecessors Pieter Schenck and Geoff Eglinton. I have tried to maintain the traditions and ideals which they helped establish because ultimately it is this that sets EAOG aside from all other organisations. The travelling road-show format of IMOG meetings, each venue with its own peculiarities, is one of these. On the other hand, we have seen the switchover to a more business-orientated running of the organisation with each Board member having a specific duty; voting procedures have been streamlined too. We have expanded our conference activities beyond IMOG, to include, possibly for the first time this year, the co-sponsoring (albeit in name only) of the Goldschmidt Conference. The EAOG Awards programme has flourished, especially the Travel Award which has seen a dramatic increase in the number of young scientists using this \$-vehicle to enable them to spend time in other academic institutions. Membership is at an all time high, so perhaps now is the best time to leave after all.

I shall be passing the baton on to Richard Patience. Richard will make a good chairman I think, because he is dynamic, open to new ideas and is not afraid of speaking his mind (did I say this was an advantage?). It was on consideration of these qualities that he was elected to the post by his Norwegian, Dutch, French, German and British colleagues on the Board. Why raise the issue of nationality? Because Richard himself was acutely aware that he would be the third Britain in a row to get the job, and thought other nationalities should get their chance. Next time. I wish Richard all the best.

In closing I want to extend my warmest congratulations to Archie Douglas, co-opted EAOG Board Member and Scottish philanthropist, who was recently awarded the prestigious Treibs Medal by The Geochemical Society. While one interpretation is that “the Committee must have been at the bottle” (Douglas, personal communication), another is that he actually deserved it. In short, they recognised the immense impact he and his group at Newcastle has had on organic geochemistry in a career which spans more than forty years. Well done, Arch !

3. Minutes of the EAOG Board Meeting

Palais des Congrès, Nancy, September 10th 2001

Board members attending the meeting were Derenne, Douglas, van Graas, Horsfield (Chairman), Michaelis, Patience, Rowland, Telnaes. Maciej Kotarba (University of Krakow) and Artur Stankiewicz (Shell) attended the part of the meeting dedicated to the presentation of the next IMOGE. Friso Veenstra (Elsevier) and Joe Curiale (Organic Geochemistry editor-in-chief) were present until the end of item 4 and James Maxwell (University of Bristol and future co-opted member replacing Douglas) attended the whole meeting.

Item 1 : Welcome

The chairman opened the discussion at 6:40 p.m. He welcomed the board members and the guests.

Item 2 : Minutes

The minutes of the last board meeting were unanimously approved.

Item 3 : Presentation of the next IMOGE in Krakow (M. Kotarba and A. Stankiewicz)

Kotarba thanked the board for giving him the opportunity to organize the next IMOGE in Krakow in September 8-12th, 2003. He also thanked Artur Stankiewicz who suggested a few years ago to have the meeting organized in Poland and Joe Curiale for his encouragement. He showed the logo for the 21st IMOGE which shows the Royal Castle of Krakow. He mentioned that although Warsaw is the official capital of Poland, Krakow is the intellectual and cultural capital. Indeed, 20 universities with more than 80,000 students are present in Krakow among which the oldest European university. Kotarba presented himself and was proud to say that the President of the Republic of Poland will be Honorary president of the next IMOGE. Kotarba will be chairman and Stankiewicz vice-chairman, responsible for the scientific program and committee. The local committee is mainly composed of members from Kotarba's group. Stankiewicz showed slides of the proposed conference venue (Conference and Sport Centre) which comprises a poster hall designed to hold 200 posters and various rooms with capacity ranging from 50 to 250 persons. For a higher capacity, it is planned to convert one or two basketball court(s) into conference room(s). An alternative to this conference venue was mentioned, a conference building which should be built in 2002. Concerning the financial part, the board members asked the organizers to maintain the fees at the level of Nancy and stressed the importance of sponsorship. The organizers already have the financial report of the Istanbul meeting for guidance and that of Nancy will be provided later. Price ranges for hotels located in the vicinity of the conference

centre were given as well as that of student dormitories. The places chosen for the ice-breaker party (Royal Castle at Wawel Hill), the opening ceremony (Slowacki Theatre) and the conference dinner (old salt mine, 15 km from Krakow) were described along with the pre- and post-conference trips (raft trip in the Pieniny Mounts and cable car climbing to Kasprowy Wierch for the former and Eastern Carpatians for the latter). The accompanying person program is not yet prepared and will be presented to the board at the next board meeting in January 2002. Krakow access was presented : the international airport of Krakow has direct connections with most European capitals and with Chicago. Moreover, Krakow is 2.5 hours from Warsaw by train. The board members asked the organizers to give to the website officer a CD Rom with all the above information for the EAOG website.

Item 4 : Elsevier-related matters

On-line access : Patience reminded the board members of a report he wrote earlier this year which included his discussions with Friso Veenstra. The latter proposed free access for all EAOG members for 2002, starting November 1st, 2001 with 1 year of archives. The board members requested an increase in the length of this duration and Veenstra promised to ask his management if it were possible to increase it to two years. van Graas mentioned that AAPG offers either hard copy or on-line access with a back-up CD. In other respects, several members have already access to full papers through Science Direct. However, we don't know how many members have this access. It has been decided to ask members who want to benefit from the Elsevier offer to send their e-mail address to the new website officer or to fill out the corresponding page on the EAOG website. An announcement will be made during the meeting just before the Pieter Schenck ceremony.

Application for membership and provision of membership list : The new website officer will be asked as a first task to modify the application form and to provide Elsevier with a list of e-mail addresses. The application form refers to the EAOG articles which were published in vol. 20 and it was suggested to publish them again either in a forthcoming journal issue and/or on the website. However, it was mentioned that the articles have been amended at the Maastricht meeting. The board secretary will thus check in the minutes what has been amended and this point will be discussed at the next board meeting.

Elsevier was asked to give membership lists in Excel files to the membership officer. Rowland noted that the current membership is similar to last years (564 at the end of 2000 and 561 presently), but it may increase later this year and will increase next year as a result of the new members from the Nancy meeting.

Distribution of the journal : Veenstra was informed of several problems in OG distribution. However, they appear to be rather scarce (Curiale only received about ten complaints this year) and it was suggested to create a space in the website for receiving these complaints.

Archie Douglas' successor : Douglas has decided to stop his job of co-editor-in-chief in mid-2002. James Maxwell has agreed to take over from Douglas. The board members thanked Douglas for the work he has done.

Electronic submission : The board members agreed that electronic submission and reviewing should start and recommended discussions between the editors and Elsevier to study the

processes involved. The example of several other journals (EST, GCA) was cited. A proposal for electronic submission and reviewing should be presented at the January board meeting.

Item 5 : New board members

Despite the publication of a call for candidates in January (in the journal, website and org-geochem mailbase) and further extension of the deadline, no candidature applications were received by the Secretary. The board members thus decided to nominate two candidates, Anthony Lewis (Plymouth) and Francisco Gonzalez-Vila (Sevilla).

The term of Horsfield as chairman ends in 2002. After detailed discussions via e-mail following on from the last board meeting in January 2000, Patience was chosen as chairman-elect. He will thus take over from Horsfield after the next board meeting in early 2002.

Since the work of the website officer and of the membership officer are more and more closely related, it was decided to combine the two positions. However, two new members have been nominated, hence no additional member is needed to take the communication officer job. This will result in the decrease of the board size by one.

The general assembly will be asked to approve the above changes in board composition and the nomination of the new EAOG board members. Members will also be informed of the new chairman.

Item 6 : Awards (Michaelis)

Three candidates were nominated for the Pieter Schenck Award after having postponed the deadline. The committee, composed of Roger Summons, Jacques Connan, Pierre Albrecht and Walter Michaelis, selected Kliti Grice. It has been said that the criterion on the age limit of 35 years will have to be clearly defined at the next board meeting.

Concerning the travel awards, Michaelis showed the number of applications, acceptances and rejections in the last ten years. In 2000, 4 awards were given out of 9 applications. Only one application was received prior to the first deadline (March 31st) which was granted. However, Michaelis mentioned that the quality of the proposals was sometimes low and the committee is complaining. The supervisors and/or heads of host laboratories will therefore be asked to have a look on the proposals before they are sent. The announcement in Organic Geochemistry will have to be changed to indicate that there are 2 deadlines per year.

Item 7 : Journal report (Douglas)

Douglas reported that all issues for 2001 have been received to date (Jan-Aug) and that the September issue is to be dispatched this week. He also showed that publication proceeds smoothly with an average delay of two months between acceptance and publication for 2000 and 2001. The total number of papers received in 2000 was 159 of which 99 accepted, 37 rejected, 6 withdrawn and 17 in progress. For this year (Jan-Aug), 93 papers received, 28 accepted, 21 rejected, 1 withdrawn and 43 in progress. 2 Special issues have been already published in vol 32 and 12 are expected for 2002/2003. The impact factor of Organic Geochemistry rose from 1.29 to

1.39 in 2000 while those of GCA and EST are at ca.2.5 and 3 respectively. An index of authors, keywords, articles and special issues is available at <http://www.elsevier.com/locate/orggeochem>.

Item 8 : Financial report (van Graas)

Van Graas showed the evolution with two year-steps of the incomes and expenses. It shows a high variability of the incomes depending on whether the IMOG made profits or not. As agreed on the previous board meeting, the planned accounts for the coming few years show a gradual reduction of our assets (not counting on income from the IMOG meetings). On the long term (> 6-8 years) this will cause problems, so we should keep this in mind when choosing the locations of the future meetings (good options for sponsoring). It has been decided to consider a possible increase of the membership fees after the next board meeting.

Before closing the meeting, the chairman thanked Rowland and Telnaes who have been serving for 8 years on the board. As there was no other business, the chairman closed the meeting at 9:45 p.m.

Paris, September 17th, 2001.
(Sylvie Derenne, secretary)

4. EAOG Website

The EAOG website came under new management in December 2000 and this brief message is to introduce myself as the incumbent (I hesitate to use the awful term, webmaster, although it's probably expected).

Having spent a while getting to grips with both the style of the site and the way it works, I have now updated the content. I hope there are no dead or out of date links but, please, if you find anything awry contact me (c.a.lewis@plymouth.ac.uk) and I will leap into action and attempt to rectify the situation.

I have some ideas on how to extend the site; however, I would like to take this opportunity to ask if you, the target audience, have any thoughts on possible improvements or additions. Whatever your suggestions, large or small, please contact me.

Finally, and for those of you who may not know, the URL (in plain language, that's the address) of the EAOG homepage is: <http://www.eaog.org/index.html> ... bookmark it or add it to your favourites now!

I look forward to a deluge of messages.

Your dutiful Webmaster,

C. Anthony Lewis
(calewis@plymouth.ac.uk)

5. Travel reports

A. Dr. Marie Russell, Oceanography Labs, University of Liverpool, Liverpool L69 3BX, U.K. (Present address: Dept of Geography, The University of Durham, South Road, Durham DH1 3LE, U.K.)

I received an EAOG Travel grant to visit the International Atomic Energy Agency (IAEA) – Marine Environment Laboratory in Monaco to study and apply compound specific isotope ratio mass spectrometry to selected samples from the eastern continental shelf of the Faeroes-Shetland Channel. Due to various unforeseen circumstances I did not travel to Monaco until March 2000, but despite the delay I had a fruitful and enjoyable visit to the IAEA Marine Laboratory and I thank both the EAOG and the IAEA for the opportunity to pursue the proposed work. Special thanks are due to Dr. Imma Tolosa of the IAEA for her help during, and since, the study. Thanks are also due to the staff of the IAEA who made my visit both successful and enjoyable.

Background

The proposal for this work arose from a study of the biogeochemistry of the benthic boundary layer of the eastern continental slope of the Faeroes-Shetland Channel. In this study an important enrichment of fresh organic matter in surficial sediments was distinguished. This enrichment appears to be related to the boundary between overlying North Atlantic Water flowing in a north-easterly direction, and underlying cold water that forms in the Norwegian Sea and flows to the south-west. The enrichment of fresh material is decoupled from terrestrial material, which is instead concentrated further down-slope. This demonstrates the off-shelf transport of the latter and the different hydrodynamic behaviour of rapidly settling fresh material and more degraded terrestrial organic matter.

The de-convolution of transport pathways on the shelf/slope remains one of the key goals of this (and other) research. It is of particular importance in the environmental assessment of anthropogenic activity, principally hydrocarbon exploitation, at the north-eastern margin of the Atlantic Ocean. As part of the above work, an unusual series of high molecular weight (C₃₃ to C₃₇) mid-chain ketones (Fig. 1) was identified at one of the slope sites. This particular site has previously been drilled, and appears to be contaminated (high PAH, Ba etc.). Similar suites of ketones have previously been identified in archaeological cooking pot shards and have been ascribed to a high temperature origin from triglycerides (Evershed *et al.*, 1995; Raven *et al.*, 1997).

Proposal

The high concentrations of these compounds in the Faeroes-Shetland Channel site, where there has been some drilling, lead us to speculate that the compounds were not naturally-derived, but may result from drilling activities, since common additives to drilling muds are often derived from vegetable oils, one of the most common being rape seed oil. There is a possibility that the ketones identified in the surficial sediments at the contaminated site were formed during drilling,

and may therefore provide a valuable, specific marker for the dispersal of drilling fines. On the other hand, the compounds may have an unknown biological origin.

It would be expected that the lipid components of the vegetable oil would have isotopic compositions distinct from those of the autochthonous lipids produced in the water column. Therefore the work proposed to be carried out at the IAEA Marine Environment Laboratory was to shed some light on the origin of these mid-chain ketones by determining their carbon stable isotopic compositions and comparing them with those of the ubiquitous long chain alkenones (primary production water column source) that are also present in the samples.

Results

The isotopic compositions of the alkenones and sterols ($^{13}\text{C} = -24$ to -26 per mil) are consistent with an algal origin. However, the isotopic composition of the mid-chain ketones (-18.9 per mil) is significantly enriched compared to that of the alkenones and sterols, suggesting a different source. Although the presence of these compounds may be exceptional, their origin is of interest since they may turn out to be potential markers for the dispersal of fines from drilling cuttings. Alternatively they may have an as yet unknown biological source.

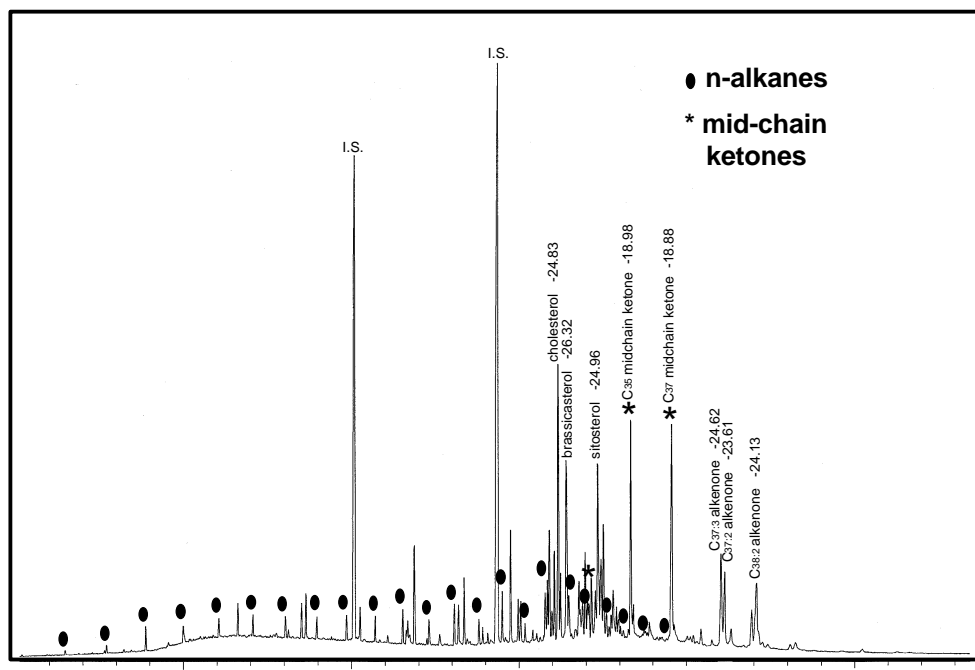
Additional work on samples of drilling mud additives is ongoing and may provide further insight to this problem.

The results from this study will be presented at the 1st French Meeting on Stable Isotopes, to be held in Nancy in December 2000.

References

- Evershed R.P., Stott A.W., Dudd S.N., Charters S. and Leyden A., 1995**, Formation of long-chain ketones in ancient pottery vessels by pyrolysis of acyl lipids. *Tetrahedron Letters* **36**, No. 8, 8875-8878.
- Raven A.M., van Bergen P.F., Stott A.W., Dudd S.N. and Evershed R.P., 1997**, Formation of long-chain ketones in archaeological pottery vessels by pyrolysis of acyl lipids. *Journal of Analytical and Applied Pyrolysis* **40-41**, 267-285.

Figure 1



2) During breaks in analysis (due to sample work up etc) an additional short study was made of the isotopic composition of the isomers of the C₂₀ isoprenoid alkylthiophenes contained in solvent extracts from a short stratigraphic section of the Lorca Basin, SE Spain. In addition the isotopic composition of C₂₅ highly branched isoprenoid alkylthiophenes (HBIT) was also measured.

The structural isomers of C₂₀ isoprenoid alkylthiophenes can be grouped into two types – those with sulphur incorporated in a mid-chain position and those with incorporation at the end of the chain. End-chain alkylthiophenes are thought to be derived from the incorporation of sulphur into phytol derived phytadienes, i.e. from the phytol side chain of chlorophyll *a*, and thus to represent an input from photosynthetic organisms. A predominance of these isomers represents a normal marine environment. The mid-chain alkylthiophenes are thought to derive from sulphur incorporation into polyenes derived predominantly from geranyl geraniol, the availability of which is restricted to anoxic environments where Archaeobacteria and green and purple sulphur bacteria contribute significantly to the biomass, e.g. in hypersaline environments.

The ¹³δC values for the end-chain isomers range between –18 to –19 per mil for the normal marine sediments and between –22 and –25 per mil for the hypersaline sediments. The mid-chain isomers have a ¹³δC value of –19 to –22 per mil for the normal marine and –26 to –27 per mil for the organic rich shales (hypersaline). The values for the carbonates are –15 and –23 per mil.

These values suggest that the mid-chain and end-chain isomers may indeed have different biological precursors but the story does not appear to be clear cut, particularly when the isotopic composition of other compounds present in the extracts are taken into account.

The results from this study were presented at the 1st French Meeting on Stable Isotopes, held in Nancy in December 2000.

B. Exchange Grant Report of Dr. Manuel Algarra González in Laboratoire de Physico Toxicochimie des Milieux Naturels (LPTC), Université de Bordeaux I.

“Solid Phase Enhanced Direct Spectrofluorimetric Determination of Aromatic Compounds in Natural Waters”

Resume

Continuing the line of research fixed in Laboratoire de Physico-Toxicochimie in University of Bordeaux I under the supervision of **Dr. Lamotte**, was carried out the proposal of an analytical method to determinate *Polychlorinated Biphenyl Compounds* (PCB's) and *Polycyclic Aromatic Hydrocarbons* (PAH's) in natural waters using solid phase extraction coupled with fluorescence spectroscopy.

A commercial extraction disk (ENVI™ C18 purchased from Supelco) as solid phase was used to investigate the optimal experimental procedure that include kinetic of adsorption process, pH, ionic strength, and influence of humic substances and presence of PAHs in the measurements. Detection limits are determinate in <ng/L level. In addition, the feasibility of applying the proposed method to determinate PCB's and PAH's in real samples.

Scientific aspects carried out

Because of the widespread environmental occurrence of PCB's and their well-documented toxicity among animal and human population, there is a continuous interest in the development of reliable, practical, sensitive and cheap methods for their analysis in natural media.

Previously a bibliography study to establish the lines of our purposes were done and the most of papers found that the most of the methods developed so far for the detection and determination of PCB's and PAH's usually include an extraction step (liquid-liquid or adsorption on a solid phase) followed by a chromatographic analysis. All these methods require sophisticated instruments and several steps, which are known to introduce substantial loss of the analytes and errors in the analytical results, other kind of analytes can suffer chemical transformation, moreover, both extraction methods, require the use of organic solvent whose utilization is more and more subject to law limitation.

During the last 10 years however there have been some attempts to perform direct spectroscopic detection directly on an appropriate solid phase after adsorption. The interest in such a technique

lies on the fact that it is a solvent-less method and it allows to avoid both elution of the solid phase and chromatographic steps by performing a direct spectroscopic analysis of analytes mentioned before. In the present work we have evaluated a solid phase extraction method of PCB's and PAH's in water, based on extraction with a fiberglass C₁₈ inverse phase coupled with a fluorescence detection and quantification directly on the phase. It was observed that only solid phase microextraction (SPME) is using actually as analytical method where is not necessary to use solvents to extract analytes from the waters' samples. In the case of solid phase extraction, recent works have shown that it is possible to avoid elution of the solid phase and chromatographic steps by performing a direct spectroscopic analysis of PCB's and PAH's pollutants from the aqueous medium directly on an appropriate solid phase after extraction.

Our first task was to set the experimental procedure in order to optimise the reproducibility and sensitivity of the method. This work included:

- (i) the design of a sample holder adapted to the sample compartment of the fluorometer.
- (ii) the design of a special device for adsorption which comprised a 200 ml vial with a cover where are set both a motor for stirring and the sample holder.

Wall adsorption problems were avoided by using only stainless steel for all the material in contact with the water samples.

Kinetic adsorption and calibration curves were determined for eleven PCB's (**IUPAC n° 3, 15, 37, 52, 77, 101, 118, 126, 138, 153 and 169**) which were determined to be readily adsorbed on the C₁₈ phase from pure water and from water in the presence of humic substances (10 mg L⁻¹).

Detection limits (**LOD**) were determinate in the range 0.2-2 ng ml⁻¹ for the investigated PCB, that is a value close to the concentration found in river waters in contact with highly contaminated sediments. Linear dynamic ranges (**LDR**) were determined with respect to immersion time in order to optimise the method in the condition where equilibrium between the liquid solution and the solid phase is far to be reached. They were estimated to be in the range 0.2-25 ng mL⁻¹ (ppb) for most analytes. Convenient immersion times were found to be around 30 min. The effect of various physical parameters and interferences were also investigated leading to the following conclusions:

- (i) In pure water, pH and ionic strength were found to have no effect.
- (ii) At concentration normally found in polluted water, PAH's were found not to interfere with PCBs. The only problem is with low molecular PAHs whose fluorescence spectra may overlap PCBs spectra.
- (iii) Humic substance were found to compete with the adsorbing phase by sequestering partly the PCBs molecules. *Stern-Volmer* constants were evaluated (mean value $K \approx 1.1 \times 10^3 \text{ mg}^{-1}$

ml). In practice, compared to pure water, in water containing about 10 mg l⁻¹ of humic acids, a reduction of about 60% of the intensity was observed. Preliminary experiments have showed that this decrease can be reduced at high pH but more measurement must be done to confirm this effect.

Instrumentation

Measurements were made with a commercial fluorometer (HITACHI F 4500). To define the best sensitivity UV/VIS spectroscopy was employed to detect the excitation wavelength of every analyte and blanks in the same way when fluorescence measurements were done, blanks were checked. Quantum yields of analytes were determined by Parker-Reeves method (using biphenyl as reference in cyclohexane), **Table 1**. Linear dynamic ranges were determined with respect to immersion time in order to optimise the method. Although far from equilibrium, convenient immersion times are found to be around 30 min.

Table 1. Photophysical and analytical figures of merit of the investigated PCBs and PAH's

PCB's congeners	$F_f^a \times 10^{-2}$	Log K_{ow}	Calib. slope	LOD (ppb)
PCB3 (4-chloro.)	2.4 ± 0.2	4.7	872.7	0.07
PCB15 (4,4'-dichloro.)	2.5 ± 0.2	5.1	144.8	0.40
PCB37 (3,4,4'-trichloro.)	0.95 ± 0.05	5.5	224.2	0.30
PCB52 (2,2',5,5'-tetrachloro.)	0.40 ± 0.08*	5.9	nd	nd
PCB77 (3,3',4,4'-tetrachloro)	4.5 ± 0.2	5.9	140	0.50
PCB101 (2,2',4,5,5'-pentachloro)	« 0.1	6.3	nd	nd
PCB118 (2,3',4,4'-5-pentachloro.)	0.35 ± 0.05	6.3	58	1.0
PCB126 (3,3',4,4'5-pentachloro)	0.81±0.05	6.3	73.6	0.8
PCB138 (2,2',3,4,4',5'-hexachloro.)	« 0.1	6.7	nd	nd
PCB153 (2,2',4,4',5,5'-hexachloro.)	0.30±0.05*	6.7	nd	nd
PCB169 (3,3',4,4',5,5'-hexachloro.)	0.97±0.05	6.7	301.5	0.20

* : Possibility for the presence of impurity

Conclusions

In the present work we have shown that our method can be used for a global determination of PCB's and for identification of PAH's. So the method appears suitable to determine the presence of this class of pollutants in natural waters and may serve as an alert method to detect these compounds in groundwater contaminated by soil or sediments. Its main advantage is its simplicity.

In the case of PCB's, owing to the low concentration usually found in most environmental waters, usually well below the ng mL⁻¹ range (**Table 1**), its sensitivity needs to be substantially improved before being applied to moderately polluted ground water. Such a goal could be attained by trying different types of phases and developing more efficient and sensitive methods for fluorometric detection. Two other possibilities for improving the sensitivity of the method

would be first to eliminate the interference with humic substances and second to dechlorinate the PCBs molecule in order to detect only biphenyl whose fluorescence quantum yield is much higher. Others experiments are in progress with more polar analytes like as chlorophenols derivatives, persistent pollutants like as PCB's in environmental media and carcinogenic effects in humans, experiments with this kind of analytes in C₁₈ were carried out, but no good results were obtained, for that the present work will continue in University of Málaga to improve the analytical method and extend its applicability

In the case of PAH's, the LOD has been determined to be lower than 0.1 ppb for the most fluorescent compounds. This result shows that the method can be applied to detect PAH's pollution in a variety of contaminated natural waters. As an example, some measurement has been performed on sea water samples contaminated by oil spill. In that case a clear fluorescence signal indicating the presence of PAHs due to oil contamination have been observed

Málaga 4th July 2001

Manuel Algarra González