

## 6th Newsletter of the EAOG

### A. Newsletter Secretary's bit

Hello again fellow geochemists. Well, there's so much in this Newsletter VI that it was almost worth the wait. Most of it is serious, but there are one or two silly bits as well. There were so many humorous contributions that some of them had to be held over for another time, otherwise the EAOG and yours truly might have got a reputation for not being serious enough. In this edition, there are reports from the Chairman, Secretary and Membership Secretary, as well as news of two scientific meetings, a PhD summary from Pakistan and a scientific treatise on the possible origins of the Athabasca tar sands. I hope you enjoy it, and all comments/contributions are gratefully received.

As you all know, we have a conference in Maastricht in September, and the Scientific Committee met in March to choose the programme. The venue was the "Schlosspark Rahe" Hotel near Aachen, which sounded very grand (Schlosspark meaning Castle Park or similar) and conjured up images of country retreats, golf courses etc. The reality was somewhat different, since it turned out to be a hotel-cum-sanatorium in a residential district. The average age of the residents was probably around 85, and their golf handicap was no doubt considerably higher. Nevertheless, the facilities were more than adequate and the price of the accommodation very reasonable. After 2 days with too little sleep and a very bad headache, smoke was seen above the hotel to indicate that the committee had come up with the selections for the Orals and the Posters. All the contributors will know this by now, since Brian Horsfield has written to you. We, the committee, hope that the conference delegates will find it a balanced and enjoyable meeting - we certainly strived very hard to devise a scientific programme which will appeal to all, regardless of where you are coming from.

Richard Patience

### B. Chairman's Remarks

Maastricht will soon be upon us (18th International Meeting on Organic Geochemistry, 22-26 September, 1997) so I thought I might use this opportunity to reflect on how EAOG has evolved since the last International Meeting, held just two years ago in San Sebastian/Donostia.

The overall goal of the association, as defined in its Articles (dated 19 83), has not changed. This is to promote organic geochemistry in its broadest sense by encouraging collaboration between its scientists and those from other disciplines. This remains our challenge for now and the foreseeable future. The most important decisions we have to make are therefore (1) how we go about doing this, and (2) how the machinery of EAOG should be structured in order to effect change.

The EAOG Board is now more task-oriented. In addition to Chairman, Secretary and Treasurer there is a membership officer (Steve Rowland) whose job is to haul in new members from the established scientific community and the ranks of students and postdocs. There is also an awards officer (Alain Huc), whose

task is promote the prestigious awards we offer and to head a select committee which decides who should receive the awards. A Newsletter is an important mouthpiece of any organisation, and Richard Patience attacks the daunting task of editor with vigour and enthusiasm (gosh, thanks - ed.). The EAOG Website has made its long awaited appearance, thanks to the coordination of Nils Telnaes (and the mighty efforts of Stuart Petch, NRG), and can be reached at <http://nrg.ncl.ac.uk/eaog/index.html>. The EAOG -Elsevier partnership continues to operate smoothly thanks to the efforts of Archie Douglas. All of these combine to improve and personalise EAOG's links with you and with the world at large.

EAOG is now more accessible to its members. Voting by mail has already proved a great success, and a healthy debate has been initiated on where and when we should convene our International Meetings (see Secretary's contribution to this Newsletter).

Organic geochemistry as a discipline is attracting many young and talented scientists into its ranks. Visit the informal BOGS and NOGS (British and Norwegian Organic Geochemical Societies, respectively) gatherings to see for yourself. We would like to think that EAOG is continuing to play an important part in their training. Long dormant, the EAOG Travel Award has really taken off, attesting to a keen interest by young scientists to visit other institutions at someone else's expense! Registration fees for Maastricht have been kept very low thanks to generous sponsorship - a "mere" 200DM buys all lunches, the conference dinner, all scientific materials (proceedings volume, CD-Rom of abstracts) and a year's free subscription to Organic Geochemistry.

EAOG membership is growing. The organisation has strong European roots, boasts an international membership and pursues a global agenda. We shall all continue to seek opportunities that promote organic geochemistry. I hope you will continue to take an active interest in the development of EAOG.

See you in The Netherlands in September!

Brian Horsfield

### C. Secretary's Report

You may not expect this plea in this part of the newsletter, but the circulars of the International Meeting are so full of information that parts are easily overlooked: Manuscripts for the Proceedings of the International Meeting are due at the meeting in September. So, take them with you remembering that our association is as strong as the science in our journal Organic Geochemistry! Also, keep in mind that there will be no book of extended abstracts this time that can be referenced, as we had it in Donostia-San Sebastian. We all still admire the efforts of Joan Grimalt and his team to produce such an excellent volume, but the workload for them, the Scientific Committee and the referees involved was tremendous. Apart from this aspect and the chance that such a volume may never be published again, we also give innovative freedom to each Chairman of the International Meetings. Brian's philosophy for Maastricht involves late abstract submission guaranteeing up-to-date science at the meeting and rapid publication of manuscripts submitted during the meeting in a Proceedings volume (part of the

journal Organic Geochemistry as usual) for the benefits of the authors and our association. So again: Do not forget to prepare your manuscripts in time and take them to Maastricht!

Looking already beyond Maastricht, all the information provided so far by our Turkish colleagues promises an exciting meeting in Istanbul 1999. More information will certainly be distributed at the Maastricht meeting in September. But the EAOG Board already now is looking into the next century and asks for volunteers to organise future meetings. Please, express your interest as soon as possible! It would be exciting to have an idea about the meetings in most of the next decade already in Maastricht.

Earlier this year you received a letter from Elsevier with a ballot form which requested your vote on the following two changes in EAOG business: i) Reduction of the number of Board members from eleven to nine (including the co-opted non-voting Editor-in-Chief of our journal Organic Geochemistry) and ii) Future election of Board members by all EAOG members who have paid their dues by mail (not only by those attending the General Assembly at the International Meetings). Although I had hoped for more response, 166 ballot forms returned (out of 388 sent) make up a reasonable 43% turnout. Unfortunately, 31 members sent the vote without their address either in the envelope (as requested) or on the outside of it. So, these votes had to be rated invalid. The remaining 135 votes were distributed as follows:

Reduction of Board members to nine:	132 Agree (98%)	3 Disagree (2%)
Board member election by ballot:	132 Agree (98%)	3 Disagree (2%).

With the ballot form, you also received a call for candidates for new board members for the term starting in September 1997. This was done under the assumption that the majority of EAOG members would approve the changes suggested by the Board, as they duly did. For the two open positions there are three candidates, and around the time you read this, you should have received a second ballot form asking you to vote on the new Board members.

Finally, on the ballot form all EAOG members were asked to express their opinion about having future International Meetings outside Europe. There is, for example, an attractive offer by Bob Alexander to hold the International Meeting in Perth. Remember, as the Chairman said in Newsletter V, we are a European Association but not an Association of Europeans, so the sizeable group of Australian organic geochemists, in particular, travels around the world to meetings in Europe and America and rarely has the chance to gather their colleagues in their home country. The transport problem may be an obstacle at first glance, but there may be ways around it like group flights from major airports in Europe and other places, and there may be benefits like inexpensive local arrangements. The opinions on this topic are - not unexpectedly - quite diverse as shown by the results on the ballot form:

International Meetings outside Europe:

55 (41%) Agree

33 (24%) Agree if group flights can be organised

47 (35%) Disagree

Below is a compilation of all the comments regarding this item:

Positive

-Major cities in U.S. and Canada; Caribbean resorts; Cancun/Mexico City; Rio de Janeiro (Brazil); Caracas (Venezuela) Canada, South Pacific (i.e. Australia or New Zealand) ...

-Agree, but only occasionally, say 1 in 5 years.

-I favour the Australian option.

-Must be in countries where EAOG has several members like USA, Australia, Brazil, Canada etc.

-Australia sounds like a great place so located that most everyone will be challenged to get there, but it would be worth it.

-Australia!

-Group flights would be nice. I would like to see a conference in both Australia and North America.

-Tahiti, Fiji, Bahamas.

-Australia, Israel, joint meeting with ALAGO in South America!

-Australia is a good suggestion.

-Why not change the name of EAOG to Association of Organic Geochemists to reflect international membership, and holding meetings outside Europe?

-Rio de Janeiro, Brazil.

-It would be extremely important if EAOG meeting could be held at least once in every five years in North America (USA or Canada). This may be arranged in collaboration with the Geochemistry Group of the American Chemical Society. This would be helpful for North American EAOG members to participate in the EAOG meeting.

-At first stick to Europe/Africa/Middle East, but definitely not in USA to avoid clashes with existing meetings.

-International meeting outside Europe is a good idea, as long as you choose cities which have direct flight connections from Europe.

-I am Australian and we would be pleased to host the conference.

-Location should be chosen with close and careful consideration of cost to all members, not only those located in Europe.

-Why not also consider name change to International Association of Organic Geochemists?

-In regions where market on applications (environmental, climatic: extreme northern and southern hemisphere, or exploration for energy sources: e.g. South-East Asia) is focusing.

-Australia would be a good first choice because there is a thriving organic geochemistry community here. USA not such a good choice, as already have large ACS and Gordon Conferences.

-Given the existence of the Gordon Conference in North America and the Latin Organic Geochemistry Conference in South America, I suggest not to include those two continents in consideration of a future conference. An international conference in collaboration, e.g., with the IPA (Indonesian Petroleum Association) might be a possibility.

-The association has many members outside of Europe and I believe a meeting in Australia is a good idea considering the contribution of Australian geochemists to the science.

-Perth, Istanbul, Wellington, Honolulu.

-Australia would be a great place to hold the conference.

-Numbers of delegates from the different countries should be taken into account when "major cities" are selected. In this sense, e.g., Oslo could be a "major city" since there normally are quite a number of Norwegians attending.

Negative

-Enough conferences held in the US (ACS, Gordon, GSA).

-Other international geoscience organisations have held this debate recently, e.g. AAPG, and decided to retain their original remit. So I believe should EAOG.

-We need to encourage the attendance of students. Air fares may restrict this if we go outside Europe.

-As a European association EAOG has imposed itself as an international actor.

- We should keep our European basis. Meeting outside Europe can eventually be organised but not on a regular basis. They should be exceptional. Meeting in Europe allows a large audience of students from European countries to attend. Even if group flights are organised the European participation and benefits will be substantially reduced.

-I strongly disagree that the decision concerning meetings outside Europe should be taken by the board and not through a ballot.

-Australia is too far, too expensive .... The USA could be a better option and half way for Australians and East Asians.

-There are many geochemistry meetings outside of Europe. I feel that this is a great opportunity for many European based geochemists to get to see European geochemists who typically do not come to meetings in the US.

-Financing student participation would become even more difficult.

-I understand Australia has been mentioned. Even if cheaper flights could be organised, it would be too expensive for students. I firmly believe student attendance must be encouraged at EAOG meetings. Turkey is OK as it is virtually "Europe". There are already plenty of meetings in the U.S. covering "organic geochemistry" and subject areas within it.

-Disagree because it is a European Association of Organic Geochemists. Otherwise the EAOG Board should think about founding an "International Association of Organic Geochemists".

-European Association of Organic Geochemists. If meetings are held outside Europe, then the association is no longer "European" by definition.

-There are already international meetings in the U.S. It would be too bad to remove EAOG meetings from Europe because less Europeans were able to attend. Maybe we all should try Australia (I am an American, by the way).

-EAOG must assist organic geochemists from other countries to organise meetings, but I think EAOG should maintain its main activity in Europe.

-The Gordon Conference provides an adequate meeting platform in alternate years. Either the association is European or it is international and membership of the Board shall become international. I prefer to keep it European.

-Perhaps a move to cities outside of Europe should be accompanied by a name change to IAOG - International Association of Organic Geochemists with Board positions open to all nationalities (and places of residence).

-We have already enough reasons to travel world-wide for professional needs and to attend conventions outside of Europe... So to save time, I prefer to have the EAOG conventions in Europe. -We're the European Association of Organic Geochemists, so we should hold the conferences in Europe. Cost of getting to meetings may not be a big issue for oil company personnel etc. but we should make sure we also have interests of the European students at heart.

-EAOG should keep its well established formula of 1 meeting in a European city every 2 years. By all means co-sponsor meetings elsewhere but these should not compete with, or distract from, the EAOG meeting.

-Why should we compete with AAPG or Gordon Conferences?

-It is very expensive.

-This is a comment about access to this conference, which is already expensive for students. They have to be encouraged to attend and increased travel costs in a time of reduced grants etc. will not do this.

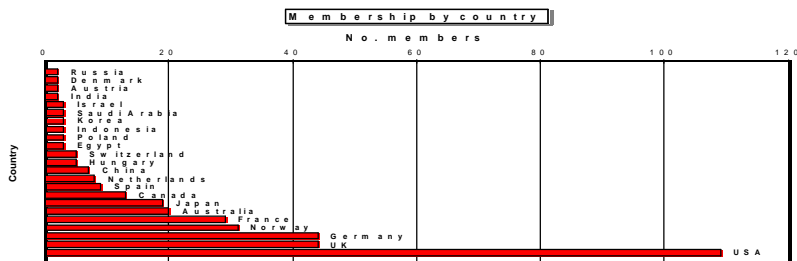
-In art. 8 of the EAOG Articles it is said that "the meeting ... shall be within Europe". This could perhaps be read as restricted to the General Meeting but I remember quite well that this was meant to cover the biannual International Meeting on Organic Geochemistry during which the General Meeting has to be held. Whether or not a scientific meeting outside Europe would be against the present rules, I should personally disagree with such a proposal. Costs would be much higher for European participants. The attractive aspect of the present format is that also young scientists (PhD students) may attend. The same holds for young American scientists in the USA for American meetings, Australians in Australia etc. Of course, all these meetings have an international character and may be and have been attended by participants from abroad. The European meetings have a positive biannual tradition for over 30 years now; to me it seems unfavourable to change this pattern. They have played an important role in the exchange of scientific results and I do not see a special argument for changes in this respect. Moreover, I doubt whether the financial position of EAOG permits such a step; the financial risks would be much higher.

Juergen Rullkoetter

#### D. Report from the Membership Officer

Membership is buoyant and healthy! I effectively took up the post at the San Sebastian meeting and my first task was to compile a user-friendly database of EAOG membership. My secretary, Debbie Petherick and one of our faculty administrators, Peter Blatchford, struggled manfully (and womanfully) to compile an accurate version on Microsoft Access, from which the following emerge: In September 1995 we had about 346 members, but this was a large overestimate since it included many student 'members' who actually received no benefits from membership (e.g. no copies of this wonderful mag) and who paid no fees. So at the next board meeting in Maastricht it was agreed to abolish this superfluous category (of course students would still be eligible for discounted conference rates etc). After the San Sebastian meeting I wrote to all conference attendees who were not EAOG members encouraging them to join. As a result of these and other factors, EAOG membership at the end of December 1996 was a (real) 386 (see Figure)!

Steve Rowland



## E. Call for Papers

### 1. Fate of nitrogen-containing macromolecules in the biosphere and geosphere

214th American Chemical Society Fall Meeting, LAS VEGAS, 7 -11 SEPTEMBER 1997  
(The Newsletter Secretary apologises for the late publishing of this Newsletter, which means that the deadline for receipt of Abstracts for this meeting has now passed.)

The aim of this symposium is to bring together a broad spectrum of biological scientists, biochemists, geochemists and geologists who study nitrogen containing macromolecules in marine and terrestrial organisms, their contribution to sedimentary organic matter, and their preservation/degradation in the biosphere and geosphere.

Abstracts are invited in the following topic areas:

- Natural sources of N-containing polymers (i.e. proteins, chitin, pigments etc.) in the biosphere, their significance in life cycles, and their stability and preservation in the initial stages of biodegradation (soils, peat) - in co-operation with Dr Pim F. van Bergen.
- Fate of the N-containing biopolymers in sedimentary organic matter (peat, coal, kerogens), their transformation during diagenesis into geopolymers - in co-operation with Dr Pim F. van Bergen.
- Stable isotope measurements on nitrogen -containing molecules, such as amino acids, D-glucosamine etc., and their application in paleoclimatic and paleoenvironmental studies.
- Advances in analytical techniques (e.g., GC/MS, HPLC, solids NMR) for recognising N-containing moieties in biological, archaeological and geological materials.

Send three copies of a 150 word abstract on original ACS forms to the symposium organiser by April 14, 1997.

Additional information can be obtained from the symposium organiser:

Dr B. Artur Stankiewicz, Biogeochemistry Research Centre, Department of Geology, University of Bristol, Queen's Rd., Wills Memorial Building, Bristol BS8 1RJ, UK.

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### 2. The Biogeochemistry of Aromatic Hydrocarbons

American Chemical Society Division of Geochemistry, ACS Spring Meeting, March 29 - April 2, 1998, DALLAS, TX, USA

The occurrence of potentially toxic polycyclic aromatic hydrocarbons (PAHs) in modern sediments, soils and waters has rapidly become a major environmental concern during the past three decades. However, at present, we must recognise that many questions remain unanswered about the origin and fate of PAHs. For example, their formation through anthropogenic as well as natural processes brings up the problem of 'natural backgrounds'. And since half lives of most PAHs are less than a year, why do they persist in modern environments? This symposium will be the opportunity to discuss PAHs issues among scientists working on various modern media such as sediments,

soils and waters. We strongly encourage contributions on the following subjects :

- PAHs in recent sediments, soils and waters
- Bioavailability and toxicity of PAHs in sediments and soils
- Natural and anthropogenic sources of PAHs
- Transport, biodegradation and stabilisation of PAHs
- Bound PAHs in macromolecules, humic substances...
- Novel analytical tools : isotopes ( $^{13}\text{C}$ ,  $^{14}\text{C}$ ), NMR, MS...

Welcome to Dallas! Bienvenue à Dallas! Please feel free to contact us for further information :

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F. Thesis summary

ORGANIC GROUP SEPARATION AND CHARACTERIZATION OF PETROLEUM SOURCE ROCK  
EXTRACTS AND CRUDE OILS BY CHROMATOGRAPHIC AND SPECTROSCOPIC METHODS

DOCTOR OF PHILOSOPHY IN CHEMISTRY

Submitted by MUHAMMAD PERVAZ

DEPARTMENT OF CHEMISTRY QUAID-I-AZAM UNIVERSITY ISLAMABAD, PAKISTAN 1996

The present work has been carried out in co-operation between Quaid-i-Azam  
University, Islamabad, Pakistan and Technical University of Aachen (RWTH),

Germany through financial support of German Academic Exchange Service (DAAD). In the Atlas of Northern Tunisia stratiform lead and zinc sulphide mineralization occurs in laminated black shales of the Cenomanian -Turonian Bahloul Formation and as Bou Grine orebody along a fault system through Cretaceous series. The age, mechanism of mineralization and source of organic matter is still controversial. The precipitation of base metals as sulphides in sediments requires organic matter as hydrogen source both in thermochemical (Abiological) and bacterial (Biological) sulphate reduction. Bahloul Formation is an excellent example to study this phenomenon.

Three series of 97 samples were investigated using a range of geochemical techniques: Determination of total carbon (TC), total organic carbon (TOC), total sulphur (TS) by Leco Carbon-Sulphur Analyser; Rock-Eval pyrolysis; solvent extraction of bitumen; separation of organic groups (hydrocarbons) by column chromatography (CC); gas chromatography (GC) of aliphatic and aromatic fractions; derivatisation of NSO fractions and gas chromatography; gas chromatography-mass spectrometry of selected samples. Representative core samples from the orebody and third series were also investigated by Organic Petrography (reflectance/fluorescence microscopy). Inorganic geochemical analyses by X-Ray Fluorescence (XRF) for major and trace elements and isotopic determinations by mass spectrometer (C & O of carbonate, C isotopes of extract and kerogen) were made for representative samples from three series.

Analytical data obtained from organic geochemical, inorganic geochemical analyses, isotopic determinations and microscopic measurements/observations were interpreted and plotted to establish different relationships and correlations to investigate the following: richness, quality and maturity of organic matter; origin and source of organic matter; organic matter typing in sediments of Bahloul Formation and Bou Grine orebody; depositional environment of the organic matter; hydrocarbon (petroleum) potential of Bahloul Formation; the abnormal biodegradation (aromatic hydrocarbons degraded prior to aliphatic hydrocarbons); alteration in mineral composition; mechanism of mineralization with reference to organic matter; correlation of biodegradation and mineralization.

Good correlations have been found among the data coming from different analytical techniques. It can be concluded that organic matter in the Bahloul Formation is derived from marine plankton deposited under reducing conditions, and is dominantly oil prone (comparable to Toarcian shale of Paris Basin, Kerogen Type II). The source rock at the onset of oil generation has excellent quality and potential for liquid hydrocarbons. The underlying Triassic diapirs were apparently the source of base metals and sulphate whereas the Bahloul Formation contributed the hydrocarbons for the bacterial degradation. Sulphate was reduced at the expense of organic matter. The biomarkers (steranes and hopanes) also support the microbial activity. The fluid was expelled from deeper levels of the basin channeled through diapirs and its associated fault system. The intensity of degradation is a function of metal content which further support the role of organic matter in the mineralization process. The degree of Pb/Zn mineralization correlates with the degree of organic matter oxidation/biodegradation. Carbon isotopic ratios determined on organic matter argue for the conversion of organic carbon into carbonates (secondary carbonate formation). Investigations at the molecular level provide evidence for biological process of final metal enrichment

(bacterial sulphate reduction). The organic geochemical and stable isotope studies testify that the part of the bitumen is not formed in Bahloul Formation. It may be originated from some other source rock and adsorbed (migrated) into the Bahloul Formation.

#### F. Silliness

Origin of the Athabasca Tar Sands  
by Lloyd R. Snowdon (with a little help from my friends)

The Athabasca Tar Sands (ATS) in north eastern Alberta have been estimated to contain a minimum of one trillion (10<sup>12</sup>) barrels of bitumen. To put this in perspective, it is at least ten times the size of all known conventional crude oil deposits in the world. Various hypotheses as to the origin of this huge volume of crude oil have been advanced on the basis of (among other things) thought-experiment results, conventional wisdom, pure speculation, and esoteric chemical data. Entire conferences have been devoted to the science and engineering of these and similar deposits in Venezuela. Despite the level of interest, research, publication and speculation surrounding the ATS deposits, there is still considerable controversy about their true nature, origin, and geological evolution.

Current theories include:

- 1) the humic substances conversion;
- 2) the gas hydrate polymerisation mechanism;
- 3) the deep earth explosion emplacement of lower crust/mantle hydrocarbons; and
- 4) the source rock model.

Readers are referred to various scientific journals, technical reports, and newspaper articles for details supporting the above noted work. Discussion here will be limited to drawing attention to a few of the unanswered questions or weaknesses associated with these theories prior to the introduction of a fifth alternative solution to this mystery.

The humic substances conversion model relies on a large accumulation of so-called humic and fulvic acids (compost or soil organic matter) and the subsequent conversion to bitumen. This conversion involves the virtual transubstantiation of what is essentially 100% insoluble organic material (in common organic solvents) to the present day bitumen, which is virtually 100% soluble in many different solvents. In chemistry, this type of process is almost always accompanied by the simultaneous production of a residue of material that is even less soluble than the starting material. The unanswered question is then, where is this residue or, if there is no residue, what is the nature of this fundamental new chemical process that enhances the properties of material without a residue?

The gas hydrate polymerisation process is essentially the antithesis of the former, in that, the simplest of organic materials in natural gas (methane with much lesser amounts of ethane and propane, and heavier hydrocarbons) combine to yield the complex mixture which is present today. If one is prepared to allow the elements sulphur, oxygen and nitrogen (which are not

known in present day hydrates but are known to be present in the ATS) to have been introduced by some post-generation mechanism, one is still left with the question as to why tar sands deposits are relatively uncommon while gas hydrates are wide spread in many deep sea and arctic environments . The question as to why plastics manufacturers have found it very difficult to effect the polymerisation of saturated hydrocarbons such as methane and ethane relative to compounds such ethylene and propylene must be attributed to either lack of scientific imagination or poor engineering practices in the face of the hydrate polymerisation theory.

The deep earth explosion mechanism proposes that pools of conventional, high - quality crude oil have erupted from deep in the earth's crust (or mantle) along with well-sorted grains of quartz sand and come to rest at and near the present surface in the present day ATS. This question merely displaces the question as to the origin from one of a current near surface problem to one of a somewhat older, deeper origin. While one would not normally expect an "explosion" to result in the accumulation (rather than dispersal) of ejecta, it is interesting to speculate as to the trajectory of the same. Could they have come from as near as Hudson Bay? Was bitumen and sand lashed out of Krakatoa and if so where did it land? This theory leaves more questions than it answers.

The conventional wisdom or source rock theory proposes that organic debris incorporated into sediments was converted over geological time to yield crude oil which then migrated due to buoyancy and has subsequently been altered by bacteria operating in the near surface environment to the present day character of tar. While this hypothesis does offer the satisfaction of allowing a residue in the form of coke or charcoal back in the source, it is by far the most complex mechanism and as such relies on a long sequence of low probability events. The largest unanswered question is how is it possible that places like Alberta and Venezuela could give rise to volumes of petroleum that exceed those of the middle east by many times? This hypothesis also contravenes Ockham's Razor ("Pluralitas non est ponenda sine necessitate" or simpler is better) and thus should not be considered further until all simpler hypotheses are disproved.

A fifth and alternative mechanism for the origin of the ATS and other similar deposits is the inter-galactic oil freighter hypothesis. This theory has a large body of supporting evidence and leaves far fewer unanswered questions than previous suggestions. It has the elegance of simplicity that does not rely on complex geology, chemistry or physics and requires little technical information, while at the same time drawing on basic facts and common sense. The essence of the theory is that the tar sands deposits represent accidental crash sites of inter-galactic tankers. These tankers were (are?) of colossal proportions and whose primary function was to transport, not oil, but water across the far reaches of the universe. While the function of the oil is not totally understood as yet, it is clear that large volumes of water were being collected and transported to earth which was being used as a temporary storage or holding facility. Periodically, a large amount of this stored resource would be removed to some distant location.

The evidence for this activity is myriad. Firstly, there is now abundant documentation available to geologists and geographers that sea level has

fluctuated widely over time. While several terrestrial based mechanisms have been invoked to explain this phenomenon, none can satisfactorily account for the time scale or the fact a number of small pulses of sea level rise are invariably followed by a large sea level drop. The inter-galactic oil freighter (IOF) hypothesis resolves this by proposing that unknown sentients were collecting water from various regions and depositing them on earth. Maximum transportation efficiency could be achieved if "small" tankers were used collect water from these far flung sources, whereas, much larger tankers would be used to carry the load on to a final, or at least subsequent, destination.

Besides the observed changes in sea-level, it has long been noted that paleontological evolution has not been one of smooth progression but rather one of long periods of relative stability punctuated with rapid bursts of highly diverse and completely unpredictable change. While no earth-based mechanism can satisfactorily explain this history, it can easily be attributed to the accidental seeding of earth's oceans by organisms brought from a large number of distant solar systems. Periodic extinctions, such as that coincident with the demise of the dinosaurs at the Cretaceous Tertiary boundary, could easily have been caused by the dumping of a load of water containing toxic materials or incompatible organisms.

There is good evidence that the Inter-galactic Oil Freighters were constructed of a nickel-vanadium alloy. High concentrations of these metals are found in the ATS and the fact that they are intimately associated with the organic phase, rather than the earthly sand or minerals into which the ship crashed, clearly precludes a terrestrial origin.

Perhaps the most compelling evidence for the IOF theory comes from historical documentation. Rather than having a tanker penetrate earth's atmosphere and land, maximum energy efficiency could be achieved through off-loading from an orbit low enough to allow for the relatively rapid gravitational capture of the water. However, the rate at which the process was undertaken would have to be carefully controlled to enable the ship to maintain a stable orbit. While unnecessary to the essence of the theory, it can be shown using higher mathematics and other forms of rocket science, that a tanker load of water large enough to raise sea level by a typical amount could be unloaded in approximately 40 days and 40 nights. The catastrophic rainfall would undoubtedly cause flooding of truly Biblical proportions that would take some weeks to months to drain from the land surfaces into the oceans. Thus the historical record provides documentation that the most recent incoming tanker visited about 3000 to 5000 years ago.

The Athabasca and Venezuela tar sands must have resulted from a slight miscalculation of the either the original orbital trajectory or too much haste in unloading. The evidence that this tanker traffic was actually inter-galactic rather than inter-stellar comes from the observation that the plane of low earth orbit defined by these two crash sites does not coincide with the plane defined by our galaxy, the milky way. Again, it would not make any sense from an energy standpoint to select an earth orbit different from that which would be aligned with the incoming trajectory.

The IOF hypothesis is a grand unifying theory because it links the two large tar sand deposits. It overcomes the constraints and complexities of earth

based origin and evolution and helps to explain a large number of other geological as well as historical phenomena. The most important unanswered questions associated with this theory, such as "who was operating the tankers and why?"

are metaphysical and thus of little significance in the rather practical context of human endeavour. The theory offers plenty of scope for research activity in the fields of physics, geology, sociology, engineering, biology and especially economics, in predicting and planning for the next arrival of either a supply or withdrawal type tanker. Opportunities for exploitation of either eventuality are endless .