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Contents

REPORT

Super Sedimentological Exposures

Talara Basin (Northwestern Peru): More than 100 years of Oil production, Good Food, and Wonderful Outcrops!

Introduction

The Talara Basin is located in the northwestern of Perú (Figure 1). It was originated by the process of subduction of the oceanic Nazca plate beneath the continental South America plate. It is interpreted as a forearc basin (Dickinson & Seely, 1979) and it has been a prolific petroleum basin for almost 100 years. And, what is really interesting for us, it has wonderful outcrops, some of them with an espectacular continuity. Many of these outcrops are still poor understood in terms of sedimentology and stratigraphy, waiting to be «re-discovered».

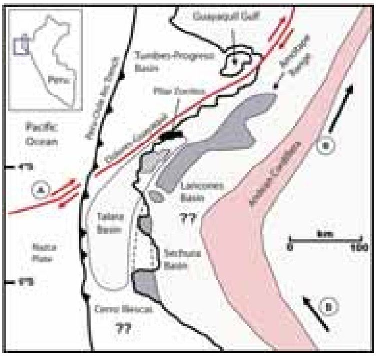

Figure 1. Location map of Talara Basin, showing the main geotectonic features in the area. The hachured small area is the Block X, under concession of Petrobras Energía (based on Fildani et al., 2005).

Reservoirs and Outcrops: Are they really there?

The presence of petroleum in the area of Talara has been known for several centuries, even long time before the Spanish conquest when the Indians (Tallan and Capullana cultures) used to take the oil to mummify their dead (Travis, 1953). Subsequent use of the oil to caulk the Spanish boats had increased this first oil «boom», triggering the appearance of the oldest refinery of the South America (Gerardo Pozo, *pers. commun.*). Since the beginning, the presence of the outcrops had certainly intrigued the early prospectors.

But, which intervals are outcropping? According to the current model, the tectonic history of the basin made possible the uplift and outcropping of several of the main units that are found in subsurface. Some of them are also producing a quite considerable amount of oil (the total production

Figure 2. Location map of the figures (outcrops) mentioned in the text. Satellite image from Google Earth ®. The main road is the Panamericana (yellow line) and the secondary roads, that may be used to access the outcrops, are represented in blue.

of the basin is approximately 29 MBBLS per day). Let´s take a look at some of the most interesting (the cronostratigraphical framework is based on Pozo, 2002, and Pozo & Daudt, 2007). The location of these outcrops is shown in Figure 2.

a) San Cristobal (Lower Eocene): although this unit is not very important in terms of production, the outcrop in Punta Negritos is amazing by the cyclicity in the sedimentation (Figure 3). Several high frequency coarsening upward cycles were recognized in the Negritos outcrop, perfect to be used as a «cool» site for stratigraphers in training… Petrobras is preparing a field trip for the next XIII Latinamerican Congress of Geology, to be held in Lima in October, 2008. You must participate!

b) Mogollón Formation (Lower to Middle Eocene): it is almost a tight reservoir with very low porosity and permeability in subsurface, due to the strong diagenetic impact (zeolite cementation mainly). Fortunately, the production rate is enhanced by a natural fracture system and facilitated by the oil quality (very high gravity). In outcrops, it is interpreted as a variation from a typical braided stream (Figure 4) to a proximal, alluvial fan of high energy, able to carry enormous fragments of trees (Figure 5). In the Peña Negra

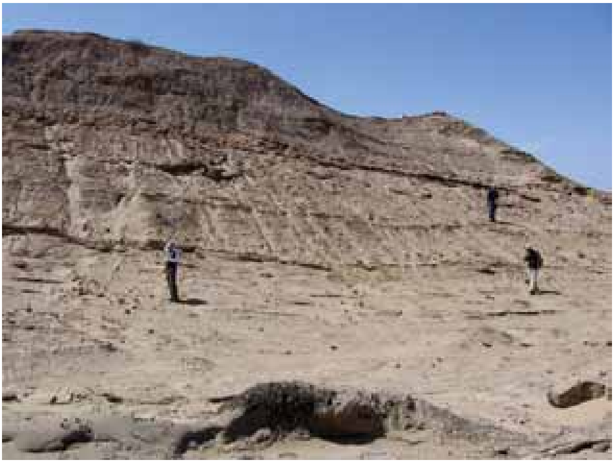

Figure 3. San Cristóbal Formation (Punta Negritos): several cycles of sandstones, siltstones and mudstones that show a clear stratigraphical evolution affected by the base level variation. Deposits include shallow water platform, proximal deltaic and fluvial environments (Photo by Eduardo Borges Rodrigues).

area, the Mogollón has a more distal aspect suggesting a deltaic environment, with better sorting and better reservoir quality.

Figure 4. Mogollón Formation (Quebrada Mogollón): conglomeratic facies of a high energetic braided fluvial system (Daudt et al., 2001) (Photo by Eduardo Borges Rodrigues).

Figure 5. Mogollón Formation (Quebrada Mogollón): a metric fragment of tree within the proximal, alluvial fan interval of Mogollón (Photo by Eduardo Borges Rodrigues).

c) Echinocyamus Formation (Middle Eocene): an excellent lateral continuity is found in the El Ñuro Outcrop, 40 km far from the Talara City (Figure 6). Although very complex, this unit is one of the most important reservoir in the basin, responding for the majority of the secondary recovery projects that Petrobras is implementing. The reservoir is interpreted as a series of shallow water parasequence sets in the lower interval (one of them is shown in Figure 6) that are cut at the top for a fluvial prone system (Daudt & Scherer, 2006).

Figure 6. Echinocyamus Formation (El Ñuro Outcrop): The Echinocyamus Formation at this site is a typical parasequence set of about 70 m thick and with an amazing 2 km of lateral continuity. Intervals of shallow water deposits (sandy prone) are intercalated with inner shelf, bioturbated and storm affected shalier intervals. Towards the top it is possible to characterize the increase influence of the proximal part of the deltaic system (delta plain). The cliff is approximately 70 m high (Photo by José Daudt).

d) Deep-water deposits (Middle to Upper Eocene): it comprises several lithostratigraphical units as Helico, Areniscas Talara, Brechas Talara and Verdún. Take a look at these fantastics pictures of Areniscas Talara in Las Peñitas, a very continuous outcrop of a transition of lobe-channel elements (Figure 7). Slump type facies may be found in the Quebrada Ovejas outcrop, in an amazing set of slope apron succession, referred to Brechas Talara (Figure 8), although there is some controversy about the correlation of these outcrops with the subsurface reservoir (Picarelli *et al.*, 2003). The Verdún Formation has also a good spot at the Pacific beach (Figure 9) where you can see the traction structures that predominates in the lowermost part of the reservoir. Toward the top you will find beautiful dewatering features, suggesting a rapid deposition from suspension (I am sure many of you, as *Sedimentology* readers, would find several types of dish structures in this picture).

e) Mirador Formation (Oligocene): in this outcrop is possible to describe almost 250 meters of a vertically continuous interval ranging from fluvio-deltaic to shallow plataformal ending up to an inner shelf depositional environment. Take a look in Figure 10 and you will have an idea about how incredible is this outcrop!

I have just mentioned some of the most known outcrops of Talara. Of course, many more are still waiting to be described and to have their genesis looked with a modern stratigraphical «eye». But, apart

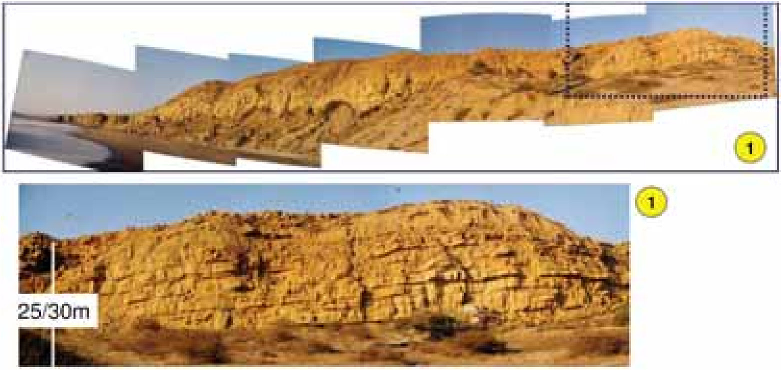

Figure 7. Areniscas Talara (Punta Las Peñitas): sandstone deposits with lenticular geometries. The general stacking pattern is typical progradational with the system evolving from distal and well sorted fine grained turbidites to proximal, strongly channelized, coarse to very coarse sandstones and conglomerates (Picarelli et al., 2003) (Photo by Gerardo Pozo).

Figure 8. Brechas Talara (Quebrada Oveja): slump type facies (mud debris flow, slump and slide features) of very restricted lateral extent, related to the failure of the previous platform of the Echinocyamus Formation (Picarelli et al., 2003). A minuscule geologist as a scale on the bottom of the picture (Photo by Andrea Fildani).

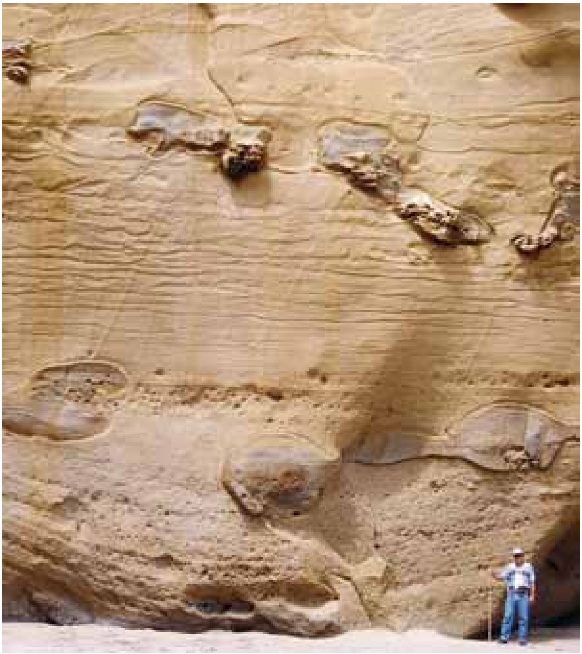

Figure 9. Verdún Formation (Pacific beach): conglomerate and sandstone facies in outcrop located in the Lobitos area. The lower part has predominantly traction structures and the upper part, dewatering features related to rapid deposition from suspension (Daudt, 2004). A prophetical Gerardo Pozo as a scale on the bottom of the picture (Photo by Andre Picarelli).

from stratigraphy, If you really like tectonics and structural geology, Talara is also your paradise…

To make things better, Talara is not only geology! Peruvian food has also its place in this history! If you have the opportunity to know Talara Basin, obviously you will get the chance to taste the sea food that the locals prepare in the town of Talara! Try and you will see! I strongly recommend the «Cabo Blanco» Restaurant located close to the Pacific Hotel. And another very cool spot is the restaurant in the Cabo Blanco beach, about 50 km from the town of Talara. There you will find lots of stories that will be told by the owner, Mr. Cordoba. He had the pleasure to meet and to share many moments with Ernest Hemingway in the fifties. The famous author used to

Figure 10. Mirador Formation (Quebrada Seca): fluvio-deltaic and shallow marine deposits that are showing a clear retrogradational stacking pattern. This is only a small part of the outcrop. In the total, it is possible to access around 250 m in vertical of a continuous unit (Photo by José Daudt).

visit the region to take a break and to fish Marlins that nowadays you can also taste in the same restaurant. Mr. Cordoba will tell you that «The Old Man and the Sea» was written in that very restaurant! A small piece of the history of the literature right beside your table…

Accomodation:

Gran Hotel Pacífico
Phone: +51.73.385449
Av. Aviación Nº 411 - Barrio Particular Parioas, Piura - Talara – Peru
Rates between US 40 and US 60 per day.
Web site: http://www.ghotelpacificotalara.com.pe

Forthcoming Event

XIII Latinamerican Congress of Geology: An event to be held in Lima, from 29th September to 3rd October, 2008. This congress will be sponsored by the Peruvian Society of Geology, governamental and private institutions. Program will be announced very soon! It will include special sections, short courses and field trips. Be prepared to drink «pisco sours» and eat «ceviches»!

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REPORT

Sedimentology in Poland

Sedimentology has a long radition in Poland reaching the middle of the last century. In the sixties of the last century the famous Polish sedimentologist Stanisław 'Miś' Dżułyński carried out experiments aimed at origin of various sedimentary structures, such as flutes, tool marks, convolute lamination. It marked the beginning of the experimental sedimentology. In the mid seventieth, the first Polish textbook on sedimentology was published. A new supplemented version was issued in 1986. Afterwards sedimentology was established as a subject for studying geology.

There are several geological centres in Poland, which assemble different geological institutions. Traditionally, five main centres are distinguished: Kraków, Poznañ, Œl¹sk, Warszawa and Wroc³aw. The area of Poland is located on the junction of several structural elements, such as the East European Craton (EEC), Trans-European Suture Zone, the Sudetes, the epi-Variscan platform and the Alpine Orogen and its foredeep. Each of these elements provides different research problems. Various and extensive sedimentological investigations are carried out both in detail and on a regional scale. The research is focused on facies analysis, sequence stratigraphy, hydrocarbon potential, regional basin analysis, as well as diagenesis and provenance of clastic material. All these topics are studied both in outcrops and in core material.

Figure 1. Variscan angular unconformity between inclined thick edded Devonian carbonates and Lower Triassic fluvial clastics; Zachełmie quarry, Holy Cross Mountains (photo by S. Skompski).

Figure 2. Seismically deformed calcarenites (coin is 2 cm across); Middle Triassic, Silesian-Kraków Upland (photo by J. Szulc).

The sedimentary cover of the EEC in Poland and neighbouring areas spans almost the entire stratigraphic table – from Proterozoic and Cambrian clastics, through Silurian carbonates, oil- and gas-bearing Carboniferous paralic series from the Lublin Basin, Mesozoic trace-fossil bearing clastics and carbonates, to carbonate (reef-dominated) and clastic facies of Neogene age in Poland and Ukraine. These rocks are accessible almost only in core materials; however, excellent outcrops are located in neighbouring countries. It concerns, for example, Silurian stromatoporoid-dominated sediments of a peritidal carbonate platform exposed in Podolia (Ukraine). These outcrops attract also interest of Polish sedimentologists and are studied in close collaboration with Ukrainian geologists.

The Holy Cross Mountains are one of the very few areas in Europe where Palaeozoic rocks are exposed in direct vicinity of the EEC, and at the same time give the opportunity to study deposits representing almost the entire Phanerozoic succession in a relatively small area. Sedimentological analysis of the pre-Devonian strata supply data on the complex terrane composition of the Trans-European Suture Zone. Precise biostratigraphic control of the Devonian successions allows tracing the relationships between the platform and basin carbonates. Thick package of mainly peritidal carbonates crops out also in the vicinity of Kraków, where several facies of shallow water deposits were recognized.

Figure 3. Slightly dolomitized alpha caliche horizon in shallow-water carbonate succession (coin is 2.3 cm across); Lower Carboniferous, Czatkowice quarry, Silesian-Kraków Upland (photo by M. Gradzinski).

Sedimentological investigations of the epi-Variscan cover are crucial for oil and gas research in the Rotliegend and Zechstein deposits. These studies are based on core material and seismic analysis from boreholes in western and north-western Poland. Particularly attractive for sedimentologists are also the Mesozoic rocks. The Triassic evolution of the Peri-Tethys area was eustatically controlled; however, it was also influenced by the Tethys rifts. Spectacular variability of sedimentary environments in the Early and Late Jurassic in the Mesozoic cover of the Holy Cross Mountains allows recognition of eustatic events in both epochs.

The analysis of sponge-microbial reef complexes developed in the northern passive margin of the Tethys Ocean and presently outcropping in the Kraków-Wieluñ area led to several conclusions on faunal assemblages, microbial activity, sea-bottom topography, and sea-level changes.

Traditionally, sedimentological studies were carried out in the Upper Silesia Basin and in the Carpathian Foredeep. These classical areas of investigations are now the regions where facies analysis together with modern methods, such as provenance analysis, geochemical and mineralogical studies and sequence stratigraphy are applied in complex basin analysis.

The Outer Carpathians are the area where extensive sedimentological investigations were carried out for more than fifty years. These mountains, comprising stack of nappes belongs to the Alpine mountain chain. The complex sedimentological study in this area points at the reconstruction of evolution of Late Jurassic-Miocene

Figure 4. Picturesque rock-cliff formed by Oxfordian spongy-microbial buildup; Silesian-Kraków Upland (photo by M. Gradzinski).

Figure 5. Cross-bedded Aeolian sandstone; Lower Triassic, Holy Cross Mountais (photo by R. Gradzinski).

basins filled mainly with clastics of flysch origin and other deep water sediments. The palaeoenvironmental analysis of these deposits was supported by ichnological studies as well. The reconstruction of alimentation areas based on the studies of so-called exotic pebbles and heavy mineral analysis are also in progress.

The Polish part of the Central Carpathians is the fragment of the Mediterranean Tethys. Different rocks, mainly carbonates of Triassic, Jurassic and Cretaceous age crop out in this region. Sedimentological studies conducted there suggest that the origin of these rocks was influenced by several processes taking place in the Tethys Ocean, such as synsedimentary tectonics related to rifting, eustatic and climatic changes.

The Sudetes have been explored by Czech, German and Polish geologists since the end of the 18th century. Here the fundamentals of knowledge on the European Variscides have been established, in particular on palaeogeography of the Devonian and Carbonifereous. Here excavation of ores and coal had long history and tradition. The post-Variscan development of the Sudetes was determined by the overall evolution of the Bohemian Massif and regional shearing and extension that led to foundation between the Carboniferous and the Neogene of numerous pull-apart basins filled with volcanic-sedimentary successions. The inversion that started in the Neogene initiated modern stage of the basin development. At present, the Sudetes belong to tectonically and seismically most active regions in Poland, which results in variable landscape, dominated by morphological escarpments, intra-mountain valleys and leveling surfaces.

The study aimed at the youngest Pleistocene deposits were conducted in Poland as well. Almost the whole northern and central part of Poland is covered with a thick package of such deposits, whose origin is related to several glaciation episodes. These deposits provide excellent opportunity to study glacial and fluvioglacial processes.

Polish sedimentologists work not only in Poland but also abroad. Our activities in neighbouring countries deal with the same basins as in Poland, but located on the other sides of the state boundaries. Thus, we carried out the studies in Germany, the Czech Republic, Slovakia, Ukraine and Lithuania. In these countries our researchers closely collaborate with local geologists. The Poles work also in further regions, not only in Europe.

Polish sedimentologists established a Sedimentological Section affiliated to the Geological Society of Poland. Between 1992 and 1998 the section annually organized Polish Sedimentological Meetings, which was re-established in 2004 and named POKOS. Since this year the meeting has been held every second year. The upcoming POKOS meeting will take place in Kudowa Zdrój (the Sudetes) in September 2008 and it will be focused among others on sedimentary successions within intramontane basins.. More information on the meeting as well as on past POKOS conferences is available at http://www.pokos.ing.uni.wroc.pl/. Welcome!

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REPORT

What I did on my sorby lecture tour-spring 2007

In August 2006 I was awarded the Sorby Medal and subsequently learned that there was a duty that came with the honour, the IAS Special Lecture Tour was all mine! Because there were numerous requests from many disparate areas, I broke the tour into several parts (lest I never see home again). In the spring of 2007, I travelled to North America and Western Europe, visiting 10 different academic and industrial groups, giving 12 talks and 3 extended workshops, and participating in 4 fieldtrips. In autumn 2007 I will continue this lecture tour, travelling for 4 more weeks in Eastern Europe (6 lectures, plus 12 days of field work together with my hosts) and a few weeks later I will travel for another week in North America (3 talks and an extended core workshop in the U.S. mid-west).

My first trip was to Pemex Exploración y Producción in mid February ’07 (Boca del Rio, Veracruz, Mexico). I was privileged to speak to a group of experienced petroleum geologists as an actual audience and a similar virtual audience (TV on line). Questions, after the talk, led to considerable discussion because they were incisive and interesting. After the talk I had the pleasure of visiting the El Tajin pyramid complex at the World Heritage site (N. Veracruz, near the city of Poza Rica). The structures are largely built of Cainozoic, carbonate-cemented, sandstones (Fig. 1a), but also have some interesting thin carbonate interbeds (Fig.1b) that are present within the archaeological complex. Driving through the mountains to and from Mexico City was also most enlightening because there one sees the results of phased but rapid compressional tectonism and associated uplift and the drama of their appearance is not clear on maps and in geological papers. But when seen in context, they provide an amazing terraced vista!

Next, in March 2007, I visited 2 universities in Michigan at which much present work on carbonates and evaporites is taking place. Western Michigan University (Kalamazoo, MI), which also houses the Michigan Basin Core Research Laboratory, became my first centre of attention in the USA. Drs. Bill Harrison and Mike Grammer, and

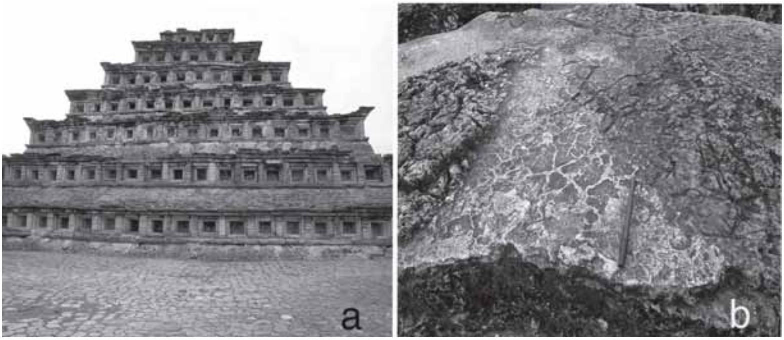

Figure 1. Observations made at El Tajin (Veracruz, Mexico) during my sightseeing expedition. (a) Pyramid with 365 windows, one of a number that have been restored at El Tajin, made up of Cainozoic, carbonate-cemented, arenite blocks; (b) Loose block of arenite (dark colour) similar to those used in building the pyramids (1a), used for seating near one of the ritual ball-courts. Note well-exposed, desiccated (and brecciated) surface, cemented and coated by early carbonate cements (light coloured).

their students, are coordinating a much-needed reconsideration of the Palaeozoic deposits in that basin, using the many available cores that they have stored in their repository warehouse. Here I began by conducting a core workshop for the research group using a freehand study of diverse Devonian, Silurian and Ordovician carbonates and associated evaporites. I had the good fortune to study this basin years ago, when I spent a sabbatical year with Shell Oil (Houston, Texas), so I was already quite familiar with these deposits. Thus I was reasonably prepared to address many of the questions that came up in discussions. In the Upper Silurian reefs, because considerable diagenesis has overprinted many of these sections, my main job was to point out those preserved features in the evaporites and sulphate-plugged and replaced carbonates that we do recognise and know. Naturally there is much that is still only inference, particularly in the diagenesis of those Silurian reefal carbonates entombed within the evaporites (see Sandomierski, *et al*. 2006). There is good deal we do recognize, particularly in the relic evaporite structures (Figs. 2 a-c). I will return to this laboratory in November, to carry out further cooperative studies.

At Central Michigan University (Mount Pleasant, MI), I had the great pleasure of speaking to and then interacting with the sedimentary faculty group and their students. My friend, Dr. Kathy Benison, shared her studies (and samples) of the acidic hypersaline lakes of Australia and Chile, and their ready comparability to the evaporitic environments on Mars (Benison *et al.*, 2007). She and her students, who have been studying evaporites from those most unique lakes (with pHs as low as 1), realized that the acid-lake depositional environments are not now particularly common on earth but may serve as good models both for earthly Archean settings and surprisingly equivalent evaporites on Mars. Dr. Benison is coming to Seattle in late June to present her

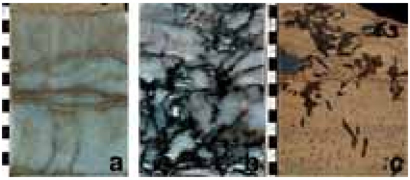

Figure 2. Core sampling of clearly identified evaporite facies within the sediments of the Michigan Basin. Scale bars are in centimetres. a) Regularly bedded anhydrite after gypsum (relics of «grasslike « crystal beds, now anhydrite). Usually formed just below the pycnocline. Allexco Prins #1-16 core at 2432 feet (741 m) Allegan Co. (MI); Devonian; b) Clear relic outines of twinned gypsum crystals, now massive anhydrite. Dark colour is caused by organic-rich clay that lay between original gypsum crystals. Summit-Anderson #131 at ~4300 ft (1310 m), Isabella Co. (MI); M. Devonian (Richfield Member); c) Typical anhydrite replacement of carbonates. Dark grey colour represents anhydrite replacement of carbonate. White nodule represents both infilling of a void plus replacement by anhydrite. Allexco Prins #1-16 core at 2463 feet (750.7 m), Allegan Co. (MI); Devonian.

Figure 3. Evaporites from outcrop within the continental Miocene deposits of the Madrid Basin. a) Exposure of Madrid basin clastic sediments (continental) interlayered with regular anhydrite layers formed when the water-bodies became very hypersaline. These layers are very regular on the outcrop and appear to have formed below a few metres of water in a persistently stratified water body (broad continuity and regular thickness) Some relics of original crystal forms may be noted; b) «Christmas tree» gypsum, showing inverted crystal forms in a regular, continuous be (bed thickness about 70 cm). This gypsum is primary, thus has not been deeply buried. It formed below the pycnocline, based on the regularity of the bed and the lack of truncated surfaces within the crystals. Other layers, composed of gypsarenites, were affected by mixed waters and the fragments are both corroded and reworked (only a metre or two of water in a strong current-affected zone).

studies to our faculty and continue our dialog.

In April I spoke In Madrid, Spain at REPSOL to members of the AGGEP, and the group was well-primed by Dr. Susana Torrescusa-Villaverde. As a result there were a great many interesting questions that continued to come to me for the next few days, and during the associated field trip to the Madrid Basin on the following Saturday. One of the most significant points that came up was the precipitational behaviour of many of the unusual salts that are present in many areas of the world, such as the Cretaceous deposits in Brazil. What is odd in those salts (and in others as well) is that during deposition each salt may have a different thermal behaviour; hence precipitation for one salt may occur while other salts are going into solution - confounding the problem of what a deposit actually signifies.

The associated field excursion, under the auspices of AGGEP, was most ably led by Drs. Esther Sanz-Montero, J. Pablo Rodríguez-Aranda and José Pedro Calvo, who have studied this area in great detail (Sanz-Montero *et al.*, 1994). This Cainozoic continental, evaporite-deposit has filled a basin formed by the uplift of it margins, rather than the subsidence of the actual basin floor. Its sediments include considerable volumes of clastic sediments plus continental carbonates and evaporites **(**Fig. 3a). Most interestingly the gypsum in this basin, much of it still in its primary condition, presents as beds of unusual twinned crystals- in which the twin form is inverted (upside down from «Mottura's Rule for gypsum crystallization)) and from most other gypsum crystals known in sedimentary deposits on earth. The reason for morphologic inversion is still unknown, but has engendered much discussion (Fig. 3b).

On Friday of the same week I had the pleasure of presenting a talk at Madrid University (hosted by my friend Dr. Rafaela Marfil). The audience was largely academic but with very diverse backgrounds and levels of knowledge, so I presented what one participant termed «Evaporites 101», and this very basic approach became more and more my aim during all of my presentations. Primary evaporites are so rare that other than the occasional scrap of laboratory gypsum, few students get to see them in the field. While such primary sediments are relatively atypical because of early diagenesis, they are the key to many other non-evaporite settings because the evaporites form in variably but persistently stratified water bodies (Fig. 4). Any shift in stratification (of the boundary or pycnocline within a water body) results in major facies changes in sedimentation that seem profound and are commonly labelled as «unconformities», These facies changes are usually the result of a simple pycnoclinal boundary shift, whilst other components of the setting may remain the same, but demonstrating the idea of a shifting water boundary within an enclosed basin, without major regional tectonism, has been difficult indeed.

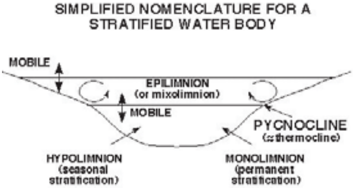

Figure 4. Simplified model of stratification in an evaporative waterbody. Note, both the positions of the water surface and the pycnocline may move up and down (relative to the basin floor) depending on influx of water and evaporation rates (modified from Schreiber, Babel & Lugli, 2007). Precipitates above the pycnocline are commonly corroded and reworked but below that boundary they are protected and show little corrosion or dissolution.

At University of Modena (Università degli Studi di Modena e Reggio Emilia, Italy) I presented a very different topic for my lecture because I have spoken to this particular group of geologists many times before (at the invitation of my former student, Dr. Stefano Lugli). Here I described the tectonic development of the Michigan Basin (Ordovician through Devonian) by illustrating the development of particular sedimentary facies (carbonates and evaporites) and how they fit in with the many structural treatments of the basin. The sedimentary deposits in these well-cored sequences demonstrate basinal conditions, depths and slope gradients.

When I was a student, carrying out fieldwork for my thesis on the Messinian evaporite deposits, Bologna University (Italy) was the first place that I visited. The city is surrounded by and partially built of the Messinian evaporites that made up the bulk of my own doctoral study. Being invited to speak there this year, by Dr. William Cavazza, was a singular honour. In my audience were some of the people who helped me at the start of my studies. Back then we argued endlessly concerning the interpretation of the facies we thought simply formed in water of different depths. Part of the disagreement arose because the Messinian of the Apennines are strongly tectonized, and much of the dismemberment actually took place during deposition, hence many of the deposits contain or are entirely composed of reworked sediments (Manzi *et al.*, 2005; Manzi *et al.*, 2007). Thirty-five years ago the Apennine deposits appeared so complex as to be incomprehensible to me (a novice in their study), hence I fled to the somewhat less dismembered venue, the Messinian of Sicily. Only now can geologists look back and recognize the multifaceted pieces. At the three seminars, the questioning was intense, and the discussions most rewarding.

A few days after my lecture in Bologna, two of the geologists who had been my students (many years past) took me out on a lovely fieldtrip to revisit the turbidites of the Marnosa Arenacea Formation (Upper Miocene), which I had not seen for a number of years (Fig. 5a, b). These deposits immediately underlie the shallow water Messinian evaporites — which makes them an especially interesting topic of study. How can such deep-water turbidites immediately underlie shallow water evaporites? Worse, there are also turbidites ABOVE the evaporites. Many questions remain unanswered due to the short time interval represented by these deposits. The entire story pivots on the stratigraphy and its exact timing, which is not at all simple.

Vienna (Austria) has always been on my list of «must see» cities. Even my own mother, who was much taken with Paris and London, told me that a musical recital in the Vienna concert hall was worth the effort and cost of all the travel. It was! Afterwards the activities and discussions at the Centre for Earth Sciences (University of Vienna), ably led by Dr. Michael Wagreich, were equally stimulating. As a special point of discussion, because Alpine thrust sheets commonly ride on a substrate of evaporites, my presentation of the many varied degrees of evaporite deformation (and what they look like) permitted a great deal of interesting discussion and comparisons. The faculty offered me many examples of their carefully detailed Austrian décollement layers that more than

Figure 5. The turbidite sections in the Santerno valley (near Fontanelice, Italy). a) Well-studied turbidite sequence; b) Channel-cut (at arrows) into Castel del Rio system of slope-turbidites (Marnoso Arenacea Formation).

matched my own observations. We all agreed that many of the features (taken alone) could readily be confused with both sedimentary structures and/or soft-sediment deformation but that together there would be no question of their origin from structural controls.

At my final stop on the tour, in Switzerland, the fieldtrips & workshop held at University of Neuchâtel were wonderful experiences for me. While I was working there, Dr. Karl Föllmi provided the background most ably and with great enthusiasm (and hospitality). My visit began with a 2-day fieldtrip into the Helvetic Alps (in the canton of Tessin/Ticino))- and no wonder Swiss geologists are so field oriented, because there is so much to see at every scale. A few kilometres of walking on a hillside displays millions of years of deposition in exquisite detail and in many areas, with spectacular fossils (Fig. 6a, b). This area is replete with many problems and possibilities for new research among the framework of known factors. Discovery of unexpected new questions and unusual sediment accumulations gives Swiss geologists a great deal to study on every scale. Even the first outcrop I visited contained half a dozen unanswered scientific questions, all are suitable for an immediate study projects. On our second excursion, after my lectures and workshop were over, the fieldtrip (into the Jura) again made me want to stay a few months in order to study the plethora of unanswered questions. Some of the questions were about the physical behaviour of evaporites during deformation but the rest were the many poorly understood carbonates... there are many unanswered questions — so much to learn and Karl so ably pointed me to their study.

In the autumn of 2007 the planned Sorby itinerary will include visits to Poland, Hungary, Croatia, Greece and then Chicago (USA). I hope I will learn as much on those trips as I have in the previous few months and I will glory in the geology of regions I have never seen.

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Figure 6. Points of interest seen on the fieldtrip in the canton of Tessin (Ticino), Switzerland. a) Vista of Monte San Georgio; b) A spectacular sauropterygian skeleton from the late Middle Triassic (Ladinian), seen in a local museum near Monte San Giorgio. The sauropterygian are marine reptiles and occur in the same beds as many other well-preserved marine fossils.

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Bibliography - ½ page
Budget - ½ page
Curriculum Vitae – 1 page

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The letter from the supervisor should provide an evaluation of the capability of the student to carry out the proposed research, the significance and necessity of the research, and reasonableness of the budget request. The letter must be sent directly to the Treasurer of IAS by post or e-mail by the application deadline (Patric Jacobs, Department of Geology and Soil Science, Ghent University, Krijgslaan 281/S8, B-9000 Gent, BELGIUM. E-mail: patric.jacobs@ugent.be). An application form is on our website (http://www.iasnet.org).

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- **Title**
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- **Motivation:** It should have a clearly written hypothesis or a well-explained research problem of geologic significance. It should explain **why** it is important. Simply collecting data without an objective is not considered wise use of resources.
- **Methods:** Outline the research strategy (methods) that you plan to use to solve the problem in the field and/ or in the laboratory. Please include information on data collection, data analyses, and data interpretation.
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- **Curriculum Vitae -** Name, postal address, e-mail address, university education (degrees & dates), work experience, awards and scholarships, independent research projects, your abstracts and publications.

Application deadlines:	1st session:	March 31
	2nd session:	**September 30**
Recipient notification:	1st session:	before June 30
	2nd session:	**before December 31**

CALENDAR

25TH MEETING OF SEDIMENTOLOGY (SEDIMENTOLOGY AND ENVIRONMENT) *

September 4-7, 2007
Patras,
Greece

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9TH INTERNATIONAL SYMPOSIUM ON FOSSIL ALGAE

19-20 September 2007
Zagreb,
Croatia

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11TH French Congress of Sedimentology

23-25 October 2007
Caen, Normandy, France

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26th MEETING OF SEDIMENTOLOGY *

1-3 September, 2008
Bochum, Germany

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Website: http://www.ruhr-uni-bochum.de/sediment/

POKOS'3 - Polish Sedimentological Conference
Regional Context of Sedimentary Environments and Processes

17-19 September, 2008
Kudowa Zdrój,
Sudetes, Poland

Dr. Jurand Wojewoda
Institute of Geological Sciences,
University of Wroclaw
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Web-page: http://
www.pokos.img.uni.wroc.pl/

The Second International Congress on Ichnology
ICHNIA 2008

1 – 5 September, 2008
Cracow, Poland

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Web-page: http://www.uj.edu.pl/ING/ichnia08/index.html

18TH INTERNATIONAL SEDIMENTOLOGICAL CONGRESS *

26 September
1 October, 2010
Mendoza,
Argentina

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