



Scientific Report

ESF Science Meeting: Spring School of the FIMIN Networking Programme (Córdoba, 7–11 March 2011)

Summary

This five-day Spring School, which was part of the FIMIN activities for 2011, was set up for PhD students with different backgrounds whose research project is related to the nature and dynamics of iron and iron minerals in natural environments. The School was attended by 30 students of universities and other institutions of ten countries. The dynamics of and methods for studying iron species in soils, sediments, surface water, ground water, and geological systems were presented by sixteen speakers (of which fifteen from FIMIN contributing countries) on 7, 8, 10 and 11 March in the Rabanales Campus (University of Córdoba); a field trip to the Guadalquivir River Valley and the Río Tinto mining area to discuss the mineralogy, geochemistry and geomicrobiology of iron in different environments took place on 9 March.

The School was very successful. The programme was realized as planned and the students showed great enthusiasm while attending the lectures, presenting their own research, or when participating in the discussions. Important goals were to help students putting their own research in the context of the broad field of iron biogeochemistry, to inspire them adopting methods or concepts in neighbouring fields, and to support them to develop an international research network. The evaluation indicated that these goals have been reached. Both the scientific level and the diversity of subjects treated in the presentations fulfilled the expectations of the participants. The opportunity of discussing research questions with teachers and other participants was highly valued; on the other hand, the density of the programme somewhat limited the opportunities for discussion. The scientific level of the presentations was challenging to most students but apparently not too high. Most participants expressed their interest to apply for a travel grant or training activity within FIMIN in the future and attend the final FIMIN conference. The speakers also enjoyed the School very much. The School provided an excellent opportunity for updating their knowledge about neighbouring disciplines and stimulated intensive scientific exchange.

Scientific contents and discussion

The FIMIN Research Networking Programme activities hinge on the role iron minerals and species play in a wide range of environmental processes, such as regulation of element cycles and contaminant degradation. This Spring School dealt, on the one hand, with the nature and dynamics of iron minerals in soils, sediments, surface and ground water, and geological systems. On the other, the students learnt about the possibilities offered by various methods of study of iron species in the environment, with particular emphasis on the powerful instrumental and analytical tools that have been developed in recent years.

The School included presentations by sixteen teachers (of which fifteen from contributing countries; see Programme and List of Speakers) that were delivered in the Rabanales Campus of the University of Córdoba on 7, 8, 10 and 11 March and during the field trip to the Río Tinto area (9 March). These presentations (in ppt or pdf format) were made available to teachers and students either before or during the School through the FIMIN website (<http://www.bayceer.uni-bayreuth.de/fimin/workshop2011/>) and will remain available until the end of 2011.

The School started on 7 March with an introduction to the nature and properties of iron minerals of environmental significance, followed by examination of the iron species in aqueous systems. The iron minerals and species in different natural compartments (soils, sediments, fresh and marine water, acid mine drainage) were examined on 8 March. The physicochemical and chemical processes affecting iron minerals and species in natural environments were the topics presented on 10 March; in this context, sorption and desorption processes, and redox reactions affecting iron species received particular attention. The role of iron as a nutrient and in biota, and microbial reactions affecting iron were presented on 11 March, together with a general consideration of iron and iron minerals in Earth and planetary history. Speakers were open to questions and discussion during and after the presentations.

Various instrumental and analytical tools not dealt with in past or future FIMIN training courses were presented at the School. Together with well-established techniques that have been used to a different degree (selective extraction, visible and IR spectroscopy, X-ray diffraction), rapidly growing, new techniques (e.g. isotopic specific techniques) were presented. Some of the corresponding presentations included hands on practical on the use and possibilities of chemical speciation software. Training sessions devoted to iron speciation calculations (10 March) and modeling sorption (11 March) consisted basically on direct use of software by the students.

The field trip to the Río Tinto area took place on 9 March. On the way to Río Tinto, an en route brief introduction to the factors involved in the acquisition of iron by plants in the calcareous, iron-poor soils in the Guadalquivir River Valley was presented. A stop was made to discuss *in situ* the iron oxides transformation pathways in soils developed on the Guadalquivir River terraces, and the pedoenvironmental significance of these minerals. In the Río Tinto mining area the participants travelled along the river with the mining railway to observe the geological and mineralogical features of this area with its typical natural and anthropogenic acid mine drainage (AMD) and samples of the river water were taken. After lunch, presentations on the geological setting of the Río Tinto area and the geomicrobiology of rocks and waters were delivered at the Río Tinto

Museum followed by a visit to the Peña del Hierro Mine, near of which AMD samples were taken (subsamples of the river water and AMD were distributed later to the interested participants).

Thirty Ph.D. students had been selected to participate in the School out of more than 50 applications from other Ph.D. students and postdoc researchers. The twenty-four female and six male students pertained to university departments or research institutions from ten countries [Austria (1), Belgium (1), Denmark (2), Germany (3), Hungary (1), Israel (3), Spain (8), Sweden (6), The Netherlands (2), and United Kingdom (3)], and thirteen nationalities (including China, Chile, India, Italy and Japan). They were asked to present a brief summary of their ongoing iron-related research activities or research project (10 min plus 5 min for questions and discussion) at the end of 7, 8 and 10 March sessions. In a broad classification the students' presentations fell into the general topics of AMD (4), iron bioavailability (1), biogeochemistry of iron in aquifers, sediments, soils and lakes (6), degradation and remediation processes (2), microbiology and microbial transformations (3), iron mineralogy (4), speciation (4), and surface processes (5). These figures attest to the variety of topics that the FIMIN network encompasses.

Results and future impact

Table 1 summarizes the results of the evaluation made by the students on the basis of thirteen questions referring to different aspects of the School. These results are useful not only to appraise the quality of the School but also to design or redesign future courses, training activities and meetings. A few brief comments follow.

The highest scores were given to questions referring to the usefulness of the School for performing the PhD project of the participant (Question 1), learning about new concepts/techniques in iron biogeochemistry (Question 3), and the organization of the School (Question 10). Thus, the School was successful from the standpoint of increasing the participants' knowledge on the topics covered by FIMIN. On the other hand, its contents fulfilled the expectations of the participants (Question 2), and the scientific level of the talks seemed suited for participants to follow the talks (Question 5). The participants also thought that the diversity of the topics was reasonable (Question 4).

A high proportion of the participants that filled in the corresponding box said that the most profitable aspect of the School was the opportunity to meet and discuss with students and/or senior researchers about the research topics/projects encompassed by FIMIN. This is reflected in the high scores of questions 7 and 8.

On the debit side, it should be mentioned that many of the participants that filled in the corresponding box expressed the idea that the School could have been more profitable if the schedule had not been so dense and/or more time had been allowed for discussion after each talk. Undoubtedly, the fact that the School had to be limited to one week for obvious logistic reasons, and that there were no parallel sessions (and thus allowance was made for speakers slightly exceeding their allotted time) contributed to this opinion.

A high proportion of the participants said that the School stimulated them to apply for a travel grant within FIMIN in the future (Question 11) and would like to attend the final

FIMIN conference (Question 12). A somewhat smaller proportion was interested in applying for the upcoming training activities (workshops) (Question 13).

Finally, from the experience drawn from the School, it is recommendable that future ESF RNPs that schools as this one should be organized right at the beginning of the RNP. This type of action sets the framework for the growth of a network and constitutes and excellent advertisement for the grant tools applications.

Table 1. Summary of students' evaluations[†]

Question	Mean	Standard deviation
1 Attending the Spring School was useful for performing my PhD project (agree = 5; disagree = 1)	4.68	0.56
2 The content of the Spring School fulfilled my expectations (agree = 5; disagree = 1)	4.50	0.58
3 I learnt about new concepts / techniques / and other aspects of iron biogeochemistry (agree = 5; disagree = 1)	4.77	0.43
4 Diversity of subjects presented during the Spring School (too high = 5; too low = 1)	3.69	0.79
5 Scientific level of the lectures (too high = 5; too low = 1)	3.87	0.87
6 The field trip was relevant and of value for me (agree = 5; disagree = 1)	4.15	0.92
7 The Spring School gave me the opportunity to discuss my research questions with other PhD students (agree = 5; disagree = 1)	4.50	0.76
8 The Spring School gave me the opportunity to discuss my research questions with the invited speakers (agree = 5; disagree = 1)	4.38	0.70
9 Attending at the Spring School was useful to expand my professional network (agree = 5; disagree = 1)	4.58	0.70
10 The Spring School was well organized (agree = 5; disagree = 1)	4.65	0.56
11 The spring school stimulated me to apply for a travel grant within FIMIN in the future (yes = 5; maybe = 3; no = 1)	4.54	0.76
12 I would like to attend the final FIMIN conference (yes = 5; maybe = 3; no = 1)	4.50	0.81
13 I plan to apply for the upcoming FIMIN training activities (workshops) (yes = 5; maybe = 3; no = 1)	3.88	0.95
The most profitable aspect of the Spring School for me was...		
The Spring School could have been more profitable if... (Please use the back of the page if you need extra space)		

[†]Based on 26 evaluations

Programme

The final programme is shown below. No significant changes respect to the original programme distributed before the School were made.

FINAL PROGRAMME OVERVIEW	Monday		Tuesday		Wednesday	Thursday		Friday			
	Coordinator: Torrent		Coordinator: Smolders		Coordinator: Torrent	Coordinator: Smolders		Coordinator: Behrends			
8:30 - 9:00	Welcome to participants	Peiffer/ Torrent	Isotope specific techniques	Erel	Field trip (7:45): River Guadalquivir Valley – Fe minerals in soils and Fe as plant nutrient (Torrent/Kraemer)	Sorption/desorption processes	Kretzschmar/ Smolders	Fe requirement of organisms	Kraemer/ Pósfai		
9:00 - 9:30	Environmental Fe minerals: structure and morphological properties	Barrón/ Pósfai								Fe in different compartments: soil sediments & aquatic systems	Torrent/ Koch
9:30 - 10:00			Coffee break	Coffee break				Coffee break			
10:00 - 10:30			Coffee break	Coffee break	Coffee break	Coffee break					
10:30 - 11:00	Coffee break		Coffee break		Notes on Fe minerals in soils and rocks in western Andalusia (Torrent)	Redox reactions of/on/with Fe minerals & dynamics of contaminants	Behrends/ Peiffer, Kretzschmar	Microbial Fe(III) reduction	Lloyd		
11:00 - 11:30	Thermodynamic and surface properties	Majzlan	Atmosphere	Pósfai						Microbial Fe(II) oxidation	Kappler
11:30 - 12:00			Marine systems	Kraemer							
12:00 - 12:30	Fe speciation in aqueous solutions	Peiffer	Acid mine drainage	Peiffer/ Lövgren							
12:30 - 13:00			Synthesis of Fe minerals	Torrent							
13:00 - 13:30	Lunch break		Lunch break		Río Tinto: Description of the area; travelling on the mining railway	Lunch break		Lunch break			
13:30 - 14:00											
14:00 - 14:30								Modelling sorption processes with Vminteq	Smolders		
14:30 - 15:00	Selective extraction of Fe minerals	Torrent	XRD	Barrón	Lunch break	Microbeam techniques	Behrends	Concluding session	Peiffer		
15:00 - 15:30	Visible and IR spectroscopy	Barrón	Fe speciation calculations with Vminteq	Smolders							
15:30 - 16:00	Student presentations										
16:00 - 16:30											
16:30 - 17:00											
17:00 - 17:30	Coffee break		Coffee break		Description of the geology and sample collection techniques; visit to the Peña del Hierro Mine (Amils/Nieto)	Coffee break					
17:30 - 18:00	Student presentations		Student presentations								
18:00 - 18:30											
18:30 - 19:00											