P-06-302

Long-term development of the super-regional area of Olkiluoto/Forsmark/Laxemar

Minutes from the Posiva and SKB workshop, October 12–13, 2006 Rånäs Slott, Sweden

Tobias Lindborg, Lotta Rubio Lind (editors)
Svensk Kärnbränslehantering AB

December, 2006

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Contents

1 Introduction and background

The siting program for a repository of spent fuel currently collects large data sets from the surface ecosystem, as well from the geosphere. The program for the surface ecosystem is described in /Lindborg and Kautsky 2000/ and /Löfgren and Lindborg 2003/, and the general siting program in /SKB 2001/. Correspondingly, the Posiva programme is described in /Posiva 2003ab, 2005/ and /McEwen and Äikäs 2000/. The collected data is used in different kinds of modelling, mainly for the safety assessment for the repository and for environmental impact assessment (EIA). Since, Posiva and SKB are sharing the same super regional area in terms of historical and future development, it is of great importance to coordinate the descriptions of this area and its properties to avoid discrepancies and to make better use of the data collected at both sites/countries.

In order to accomplish this collaboration, a consensus was attained on which properties/parameters/variables that were important to consider and it was decided which references, models and equations to be use in the site descriptions. Furthermore, possible gaps in the understanding of the site were identified and discussed. A plan on how to handle these gaps was made, i.e. do we need to initiate more research? Participants from the site investigation program, the analysis group, safety assessment and research from Posiva and SKB were invited to the workshop. The workshop was held at the Castle of Rånäs in Roslagen October 12–13, 2006, and the participants are shown in Table 1-1. Besides the major aim of the workshop, other important objectives were to enhance the communication between Posiva and SKB, increase the awareness of different issues handled at the sites/subject area, and to build a better understanding for the models. Additional it should be mentioned that this is only a record of initial discussions and there might be changes in the practical implementation due to e.g. change of focus with advances in the programmes.

The workshop and this report of the minutes were delimited in the description of the surface system part of the geosphere-biosphere system and its development in time, primarily in terms of geometry and sea water salinity. However, no effort was made to discuss the geological evolution of the area or any parameter in the bedrock separately. Instead, the focus was to list, describe and suggest the parameters and variables of the surface system that can be described in a common way for the three sites Olkiluoto, Forsmark and Laxemar.

1.1 Participants and the agenda

Table 1-1. Participants from Sweden and Finland at the workshop at Rånäs, October 12–13.

Participants (Sw)	Subject	Participants (Fin)	Subject
Ulrik Kautsky	(SKB) Safety assessment and dose modelling	Ari Ikonen	(Posiva) Biosphere assessment overall coordination,Terrain and ecosystem development
Tobias Lindborg	(SKB) Project leader and ecologist	Anne-Maj Lahdenperä	(Pöyry Environment) Overburden, Baltic Sea, Geosphere-biosphere interface
Björn Söderbäck	(SKB) Limnic descriptions, limnic ecosystem, surface water chemistry	Reija Haapanen	(Haapanen Forest Consulting) Olkiluoto Biosphere Description (report chief editor)
Jens-Ove Näslund	(SKB) Safety assessment	Jere Lahdenperä	(Posiva) Environmental monitoring programme
Marcus Laaksoharju	(Geopoint) Responsible for the description of hydrogeochemistry	Thomas Hjerpe	(Saanio & Riekkola) Biosphere assessment documentation & Quality Assessment
Eva-Lena Tullborg	(Terralogica) Description of hydrogeochemistry	Robert Broed	(Facilia) Radionuclide transport modelling
Gustav Sohlenius	(Geological Survey of Sweden, SGU) Description of Quaternary deposits		
Sven Follin	(SF Geologic AB) Hydrogeolocical modelling and description		
Bo Gustafsson	(Göteborgs University) Development of the Baltic Sea		
Lotta Rubio Lind	(SKB) Secretary		

Table 1-2. Agenda at the workshop.

12 October		13 October	
12:00	Lunch	08:00	Breakfast
13:00	Welcoming and presentation of participants	08:30	Workshop: Results from day one. Have we found all common parameters of interest? Do we have a good understanding of how we shall handle them in the future site descriptions and safety analyses?
13:15	Purpose, expectations and outcome of this meeting	11:00	Conclusions: Did we succeed with the task? How is this work best reported?
13:30	Description of present SKB work within meeting topic	12:00	Lunch
14:30	Description of present Posiva work within meeting topic	13:00	End of meeting
15:30	Coffee brake		
15:45	Workshop: Parameters of interest, discussion, listing of references, future common handling between SKB/Posiva, writing a memo/report		
18:00	End of workshop		
19:00	Dinner and informal discussions		

2 Summary of the participants' presentations

2.1 Descriptions of the historical and future development in the Baltic area *(Tobias Lindborg)*

Tobias Lindborg started by welcoming the participants and presenting the agenda (Table 1-2) for the meeting. He presented the aim of the workshop: to coordinate the descriptions of this "super regional area and its properties to avoid discrepancies and to make better use of the data collected at both sites/countries.

2.2 Site evolution for a glacial cycle *(Jens-Ove Näslund)*

Jen-Ove Näslund argued that it is not possible to predict climate in a 100,000-year time perspective with enough confidence for safety assessments. However, from knowledge on general climate variations in Fennoscandia, we can identify three characteristic and relevant climate domains; a temperate domain, a permafrost domain, and a glacial domain. In addition submerged/non-submerged conditions need to be taken into account. Scenarios used in the safety assessment are: [1] The reference scenario is a repetition of last glacial cycle conditions (the Weichselian glaciation), [2] example of complementary scenarios is Warmer Greenhouse scenario and a colder scenarios (Figure 2-1).

Each climate domain includes a set of process related variables, e.g. permafrost, ice sheets. For the first 8,000 years from present, the shoreline displacement is extrapolated from observed shoreline data /Påsse 2001/. After 8,000 years, the relative sea level was in the SR-Can scenarios modelled by using a Global Isostatic Adjustment (GIA) model /SKB 2006a/.

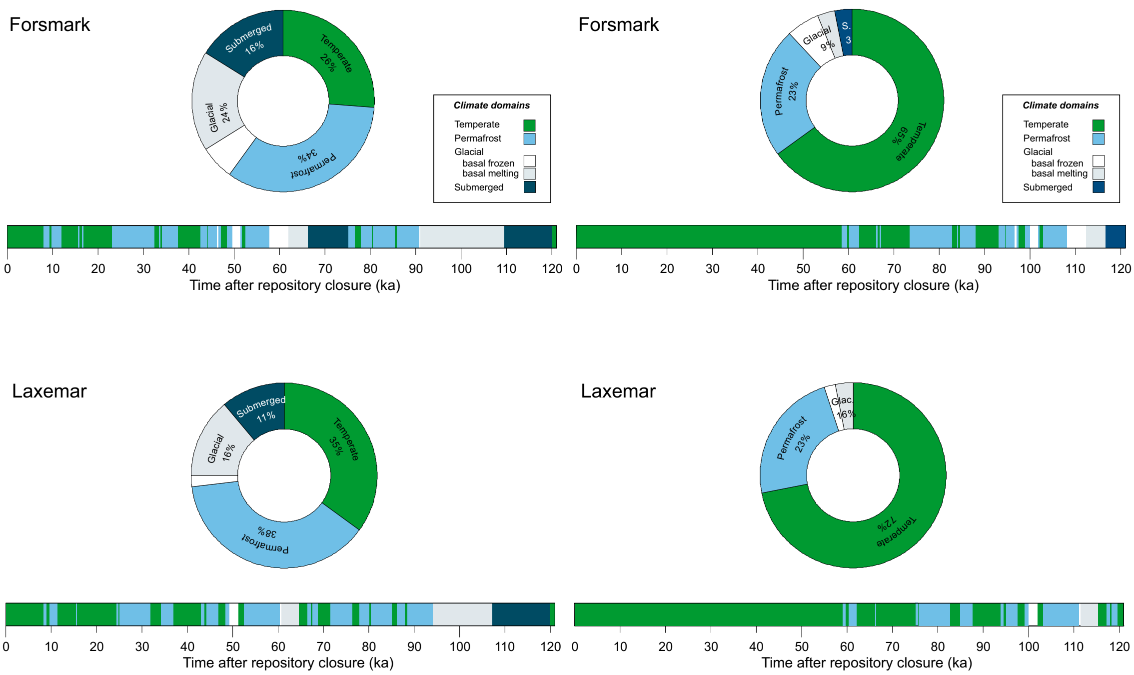

Figure 2-1. The figures to the left shows the reference scenario and the figure to the right shows the greenhouse scenario from SR-Can. Green, temperate climate domain; Light blue, permafrost climate domain; White, glacial climate domain – basal frozen; Grey, glacial climate domain – basal melting; Dark blue, submerged conditions /SKB 2006a/.

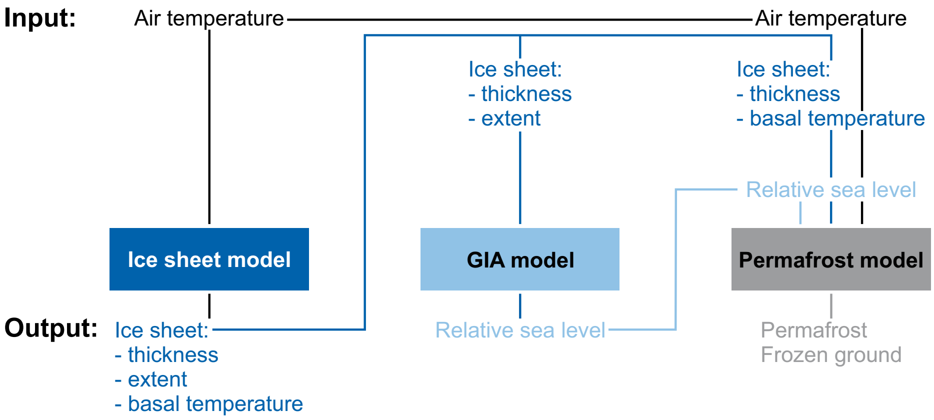

Figure 2-2. *Numerical simulations for scenario analyses of ice sheets, isostatic changes, and permafrost /SKB 2006a in press/.*

2.3 Salinity variations in the Baltic Sea *(Bo Gustafsson)*

Bo Gustafsson presented the results from investigations of salinity variation in the Baltic Sea published for SKB in /Westman et al. 1999, Gustafsson and Westman 2002, Gustafsson 2004ab/ (Figure 2-3).

The effect of past morphometric (sea level) and climate variations on the overall salinity in the Baltic Proper is currently well quantified and understood. The next scientific step will be to investigate the temporal and spatial variability in salinity in the Baltic Sea, and to forecast the effect of changes in major external drivers, e.g. freshwater supply from rivers, storminess and climate-induced sea level variations.

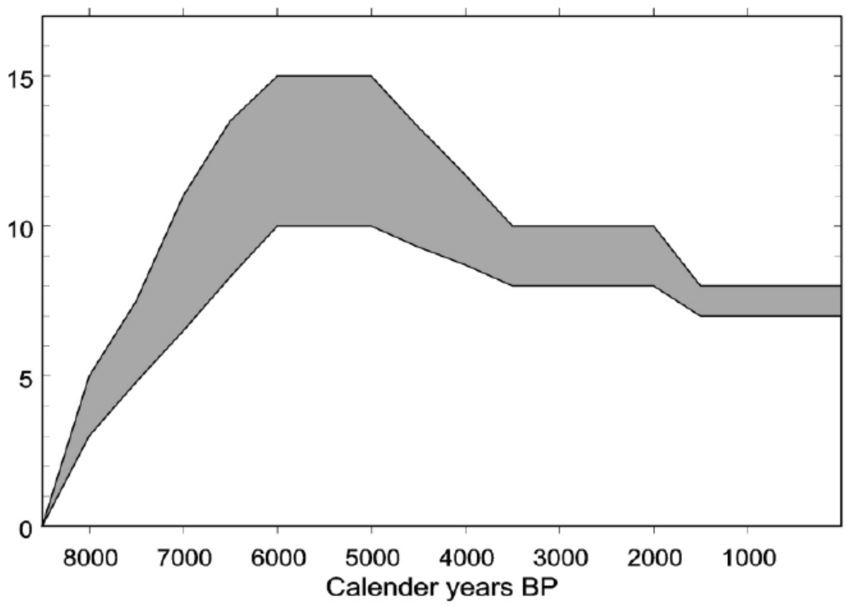

Figure 2-3. *Salinity development of the Baltic proper 8,500 years BP to present /Westman et al. 1999, Gustafsson and Westman 2002/. The salinity variations are estimated from proxy data.*

2.4 The practical use of models for shoreline displacement and Baltic Sea salinity from a hydrogeological perspective – the Forsmark site *(Sven Follin)*

Sven Follin started by showing a map over boreholes at Forsmark. He continued with an illustration of Jacob's and Peter's interference test. He then presented the water type profile in the hang wall rock mass, foot wall rock mass, and in the boarders of the foot wall rock mass of ZFMNE00A2 (Figure 2-4), and discussed our conceptual understanding of the hydrogeological patterns at the Forsmark site.

2.5 Postglacial conceptual model used in hydrochemistry *(Marcus Laaksoharju)*

Marcus Laaksoharju presented the postglacial conceptual model for Forsmark and Laxemar. In order to detect the origin of groundwater it is possible to use e.g. Cl, $\delta^{18}O$ and Mg. The results from the modelling are presented in a site descriptive model for Forsmark /SKB 2005/, see Figure 2-5. Four main groundwater types are found at the Forsmark site. In addition to the recent to young Na-HCO_3 type groundwater and older Na-Ca $Cl(SO_4)$ type groundwater (with a Litorina Sea and glacial signature), there exist at greater depths (KFM03A; 645 m) an even older saline Na-Ca-Cl type groundwater with a small glacial component ($\delta^{18}O$ = –11.6‰ SMOW; D = –84.3‰ SMOW). At even greater depth (KFM03A: 990 m) the groundwater changes to a higher saline Ca-Na-Cl type, characterised by an even greater glacial signature ($\delta^{18}O$ = –13.6‰ SMOW; D = –98.5‰ SMOW). He also showed how influences from the Baltic Sea could increase HCO_3 and decrease SO_4 concentrations trough microbial sulphate reduction.

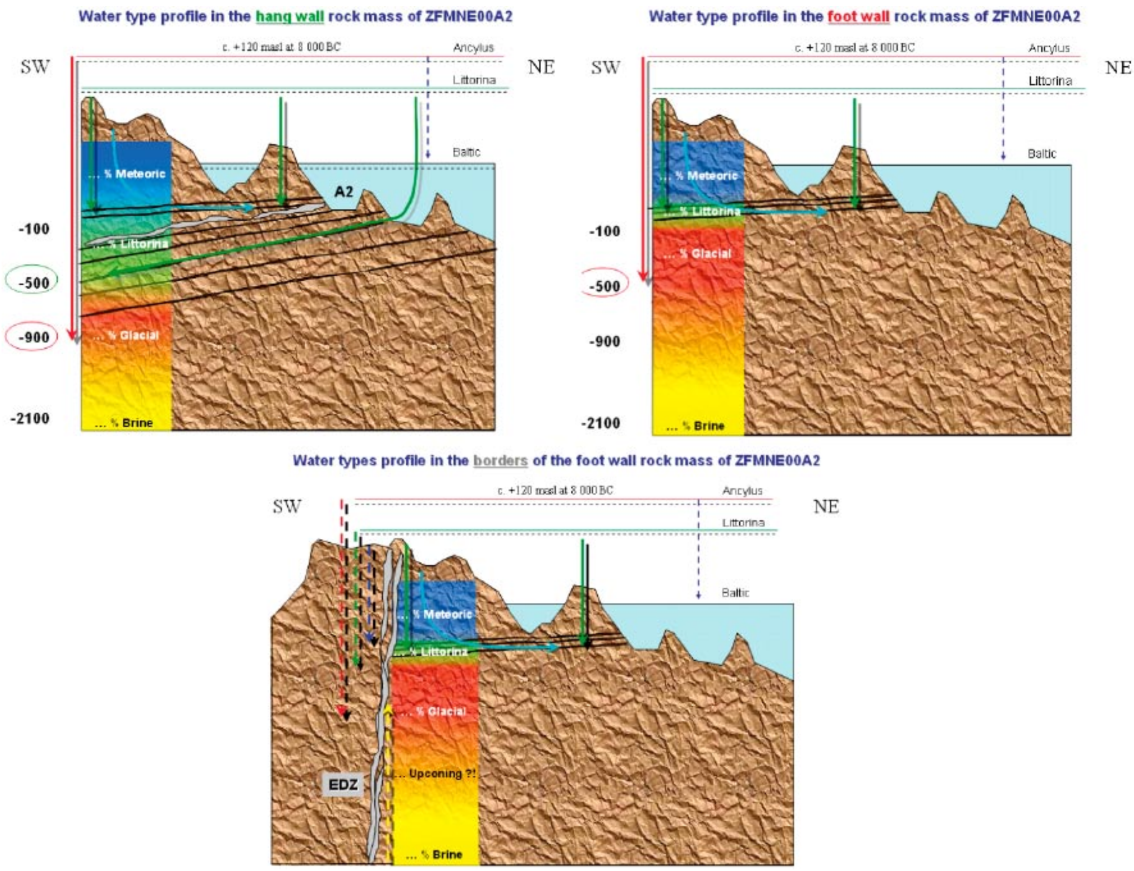

Figure 2-4. *The water type profile in the hang wall rock mass, foot wall rock mass and the borders of the foot wall rock mass of ZFMNE00A2 /Hartley et al. 2006 in press/.*

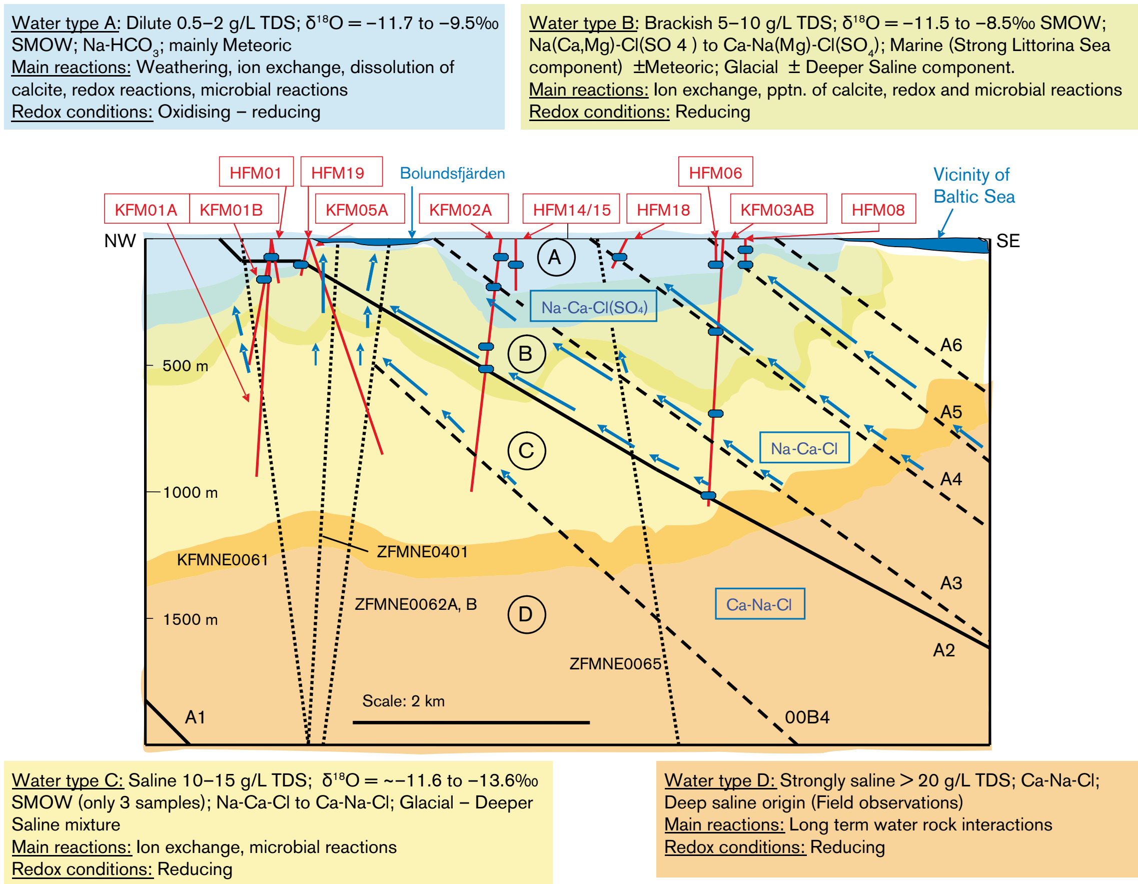

***Figure 2-5.** Schematic 2D groundwater model of Forsmark /SKB 2005/, integrating the major structures, the major groundwater flow directions and the variation in groundwater chemistry (Types A–D) from the sampled boreholes (indicated in blue). The blue arrows are estimated groundwater flow directions and their respective lengths reflect relative groundwater flow velocities (short = low flow; longer = greater flow).*

2.6 The Quaternary description of Sweden *(Gustav Sohlenius)*

Gustav Sohlenius started by showing deep sea records of Quaternary deposits based on /Andersen and Borns 1997, Mangerud 1991/. Thereafter two different versions of the ice sheet fluctuations by /Lokrantz and Sohlenius 2006 in press/, was illustrated (Figure 2-6).

He also showed the deglaciation of the southern parts of Sweden /Fredén 2002/, the development of the Baltic Sea /Fredén 2002/, the shoreline displacement curves for Forsmark and Simpevarp /Påsse 2001/, and the salinity development of the Baltic proper by /Westman et al. 1999/.

2.7 Recent biosphere assessment work for Posiva *(Ari Ikonen)*

Ari Ikonen presented the recent work for the biosphere assessment by Posiva, which includes the Olkiluoto Biosphere Description, geosphere-biosphere interface (overburden and Baltic Sea sediments), terrain and ecosystems development, and knowledge quality assessment in the biosphere assessment. He presented the main objectives and the work plan of Posiva /Ikonen 2006/. The work is primarily focusing on the establishment of a solid basement by comprehensive description of the site and the processes, secondarily to describe realistically the development of the site during the time, and only after that to consider the dose implications from the repository. All this is put together by applying knowledge quality assessment procedures (see also section 2.11) in all the steps.

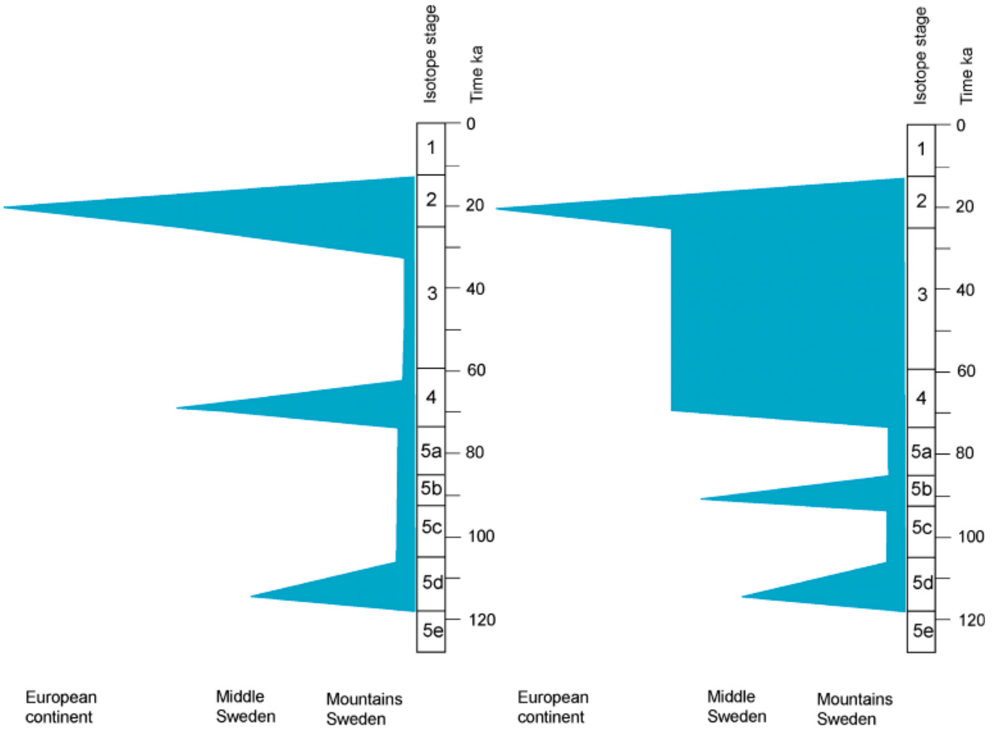

***Figure 2-6.** Two different versions of the ice sheet fluctuation for the European continent, the middle of Sweden, and the mountains of Sweden /Lokrantz and Sohlenius 2006 in press/.*

From outside the biosphere assessment, preparation of a report on the expected evolution of the repository /Posiva 2006/ was highlighted as a major advance.

2.8 Terrain and ecosystem development at Olkiluoto *(Ari Ikonen)*

Ari Ikonen showed the TESM methodology, and presented the terrain and ecosystem development model at Olkiluoto site, version 2006. He showed the Baltic and regional development at present and at year 4,000 AD, and a draft of the base scenario (no anthropogenic climate warming) (Figure 2-7). The presentation was ended with a summary on the methodology for vegetation forecasts.

2.9 Unity in historical/future descriptions *(Reija Haapanen)*

Reija Haapanen presented the current work concerning Olkiluoto biosphere description report, which is to be published in late 2006. The Olkiluoto specific data (Figure 2-8) available from the terrestrial and sea ecosystems was shown, except for overburden and sea sediments (covered by Anne-Maj Lahdenperä, section 2.10). Lack of site specific data was listed. The calculation of final estimates of carbon pools and fluxes was shortly presented. Also some ideas concerning the basis for use of common models, equations, and parameters/variables of interest for both countries were discussed. It was suggested that efforts could be combined in the cases of most laborious measurements such as inventories of soil fauna.

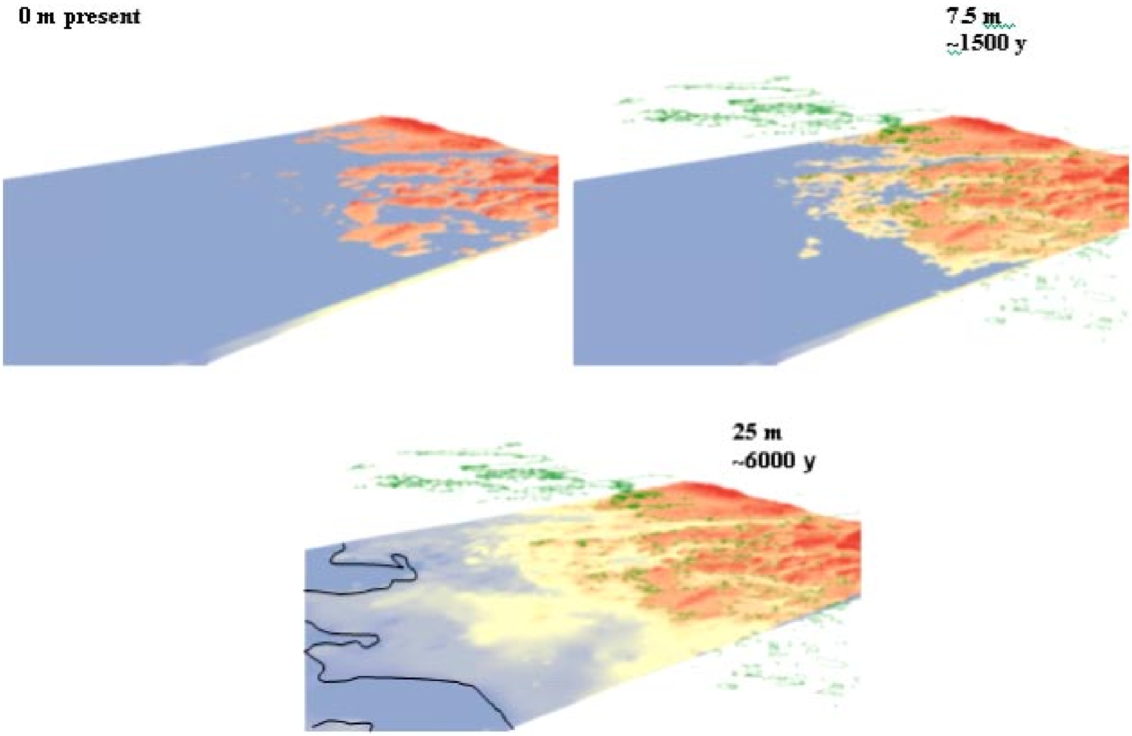

Figure 2-7. *The Olkiluoto base scenario (draft) at 0 metre of relative sea level change (net uplift; both isostatic and eustatic) at present, 7.5 metres in ~1,500 years, and 25 metres in ~6,000 years AD.*

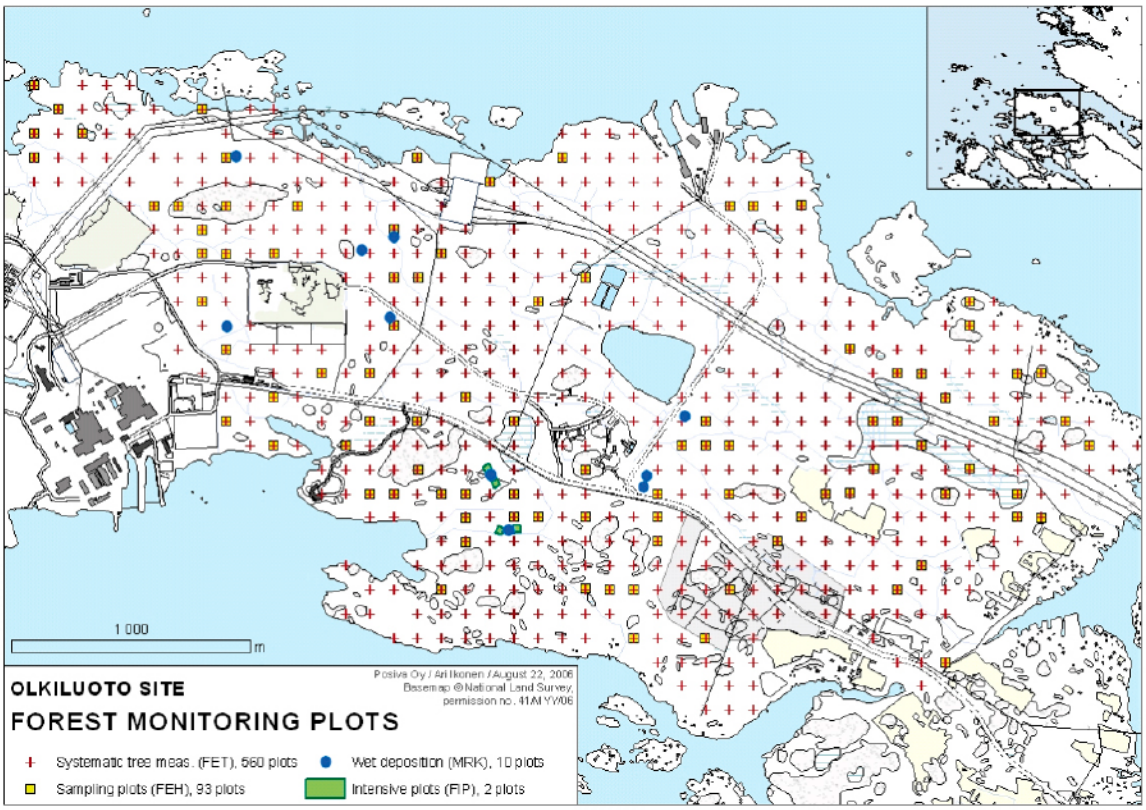

Figure 2-8. *The forest monitoring plots at the Olkiluoto site.*

2.10 GBIZ – overburden and Baltic Sea sediments *(Anne-Maj Lahdenperä)*

Anne-Maj Lahdenperä presented the current topography in the Olkiluoto area, which is relatively flat with an average elevation of 5 metres above sea level. The highest points of the investigation site are around 12–18 meters. The overburden data in the area shows a thickness of 2–4 metres (12–16 meter thick layers have been observed) (Figure 2-9). The Olkiluoto Island is characterised by land uplift since last deglaciation and the present uplift rate is 6.8 mm/yr /Kahma et al. 2001/. Olkiluoto Island forms a hydrological unit of its own; the surface water flows directly into the sea. Only a few percent, at the most, infiltrates into the deeper parts of the bedrock /Posiva 2003a/. The sea-floor deposits presents a very fragmentary pattern in the surroundings of the Olkiluoto Island /Rantataro 2001, 2002, Posiva 2003a/. The most common Quaternary sediment on the Olkiluoto offshore bottoms is till (about 30–40%) covered by post-glacial clay. Changes in climate and geological environments have had a significant effect on local palaeohydrogeological and groundwater composition conditions at Olkiluoto site. The salinity of the Baltic has changed during past ice ages and is expected to do so also in the future /e.g. Pitkänen et al. 1994, 1999ab, 2004/.

2.11 The Information Infrastructure and Knowledge Quality Assessment in the POSIVA Biosphere Assessment Portfolio *(Thomas Hjerpe)*

Thomas Hjerpe presented the information infrastructure and the knowledge assessment (KQA) work and how the KQA adds dimensions to the traditional 2D-uncertainty assessment. He continued by discussing how a well functioning infrastructure is the foundation for a good KQA and how to achieve this.

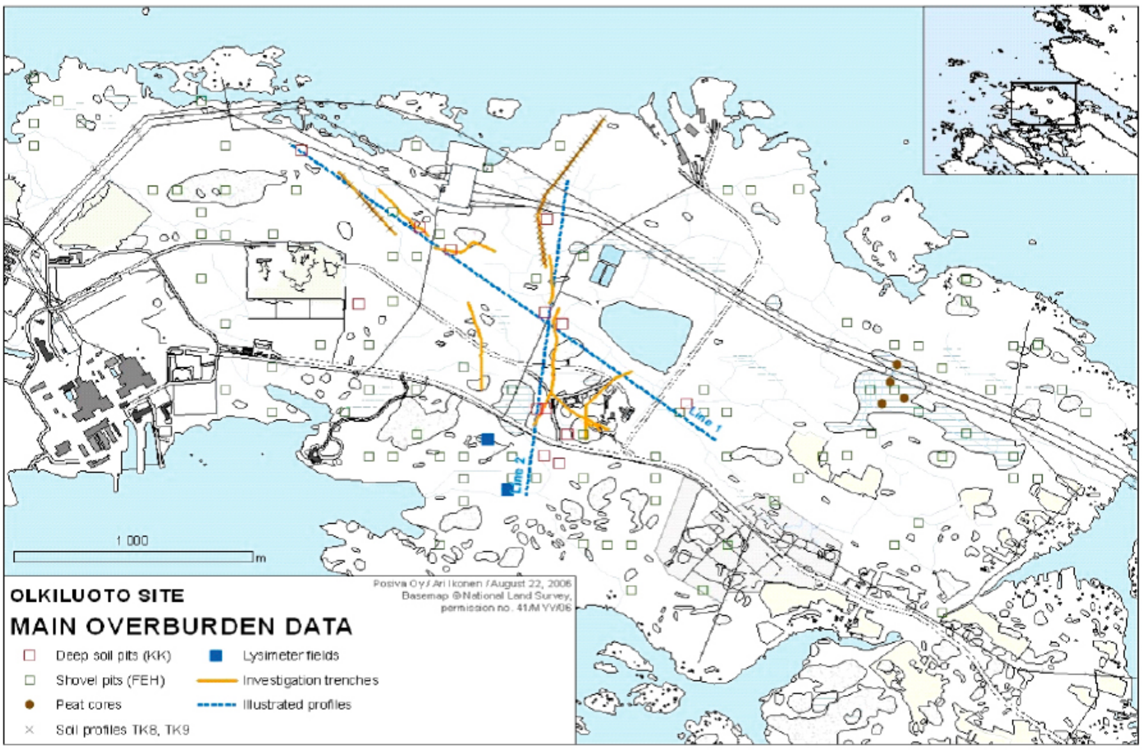

Figure 2-9. *The main overburden data at Olkiluoto (modified by Ari Ikonen 2006, Posiva Oy).*

3 Discussions and conclusions

3.1 Salinity

Posiva and SKB have used the same salinity model (based on the work by Gustafsson and Westman, see section 2.3). The major issue is if the current salinity model used in version 1.2 is still valid or if there are any new findings in this matter to consider. Moreover, it is important to verify if there are obvious gaps in the model that need further investigation. The model has to be acceptable from a scientific point of view and uncertainties in the model must be clearly presented.

Concerning the uncertainties, they are already presented and discussed, at least for the Baltic Proper, in the report covering this topic /Gustafsson 2004a/. As a complement, some more work may be done for the different basins. Vertical variations in the Forsmark area, i.e. whether the Forsmark area during any time period after the latest glaciation has been situated below the halocline, may be of interest to investigate further. When it comes to separate the Baltic into a North and South part, this has already been done for the surface water.

Conclusions: Although the participants do find the salinity model valid, it was decided that a literature review should be performed to ensure that there are no new data on the historical development of the Baltic that might change the model. Moreover, it should be evaluated whether the sites at any time during the development have been located below the halocline.

Contact persons: Gustav Sohlenius (SKB/SGU) and Ari Ikonen (Posiva).

3.2 Time scale

The different time scales used in the reports are confusing and some times misleading. It is therefore very important to agree on a common time scale. The discussion was focusing on the carbon-14 years and whether it was possible to convert carbon-14 years to BC. The major concern was that the conversion may lead to larger errors in an already uncertain time scale. However, without the conversion it would not be possible to use the data in the models.

Conclusions: The decision was to use BC/AD for the time period (+/–) 10,000 yrs from today, in order to avoid misunderstandings in future reports.

Contact persons: Tobias Lindborg (SKB) and Ari Ikonen (Posiva).

3.3 Shoreline displacement

Different versions of the Påsse equation, for calculating the shoreline displacement, have been used. The Safety Assessment at SKB has used the equation from 2001 and 2005, whereas the Analysis group at SKB/Posiva has used the version from 1997. Another concern was how far in the future the Påsse equation should be used.

The first concern was whether there are any important differences between the 2001 and the 2005 versions /Påsse 2001, Påsse and Andersson 2005/, but the conclusion was that it is in all essential the same model presented in the two papers. Påsse's latest published paper on shoreline displacement (2005) includes some controversial conclusions which may be criticised. In order to avoid that questioning of these conclusions implies that also the shoreline displacement model is questioned, it might be better to refer to the 2001 version.

Conclusions: It was decided that the Påsse equation from 2001 should be used during the period from the latest deglaciation until 10,000 AD. Thereafter the isostatic model, Global Isostatic Adjustments (GIA) /SKB 2006a/ developed in the UK, Durham, should be used. The transition between models has to be handled in a proper way.

Contact persons: Jens-Ove Näslund (SKB) and Ari Ikonen (Posiva).

3.4 Modelling of ecosystems and their development at the sites

1. Terrain development (which factors/processes are needed to be included in the forecast modelling of shoreline displacement, emergence and development of lakes and wetlands (and rivers), vegetation types and typical fauna, and which ones are better to be omitted).
2. Ecosystem model (common background models and procedures, common data, uncertainties).
3. Generic data list (use of site data from another site as the best reference, for which parameters this can be done and where the data is reported).

Conclusions: A new meeting is needed for this topic, focusing on the ecosystem modelling, and Anders Löfgren from SKB should be present at this meeting. The meeting is to be held in late spring 2007 and Posiva will be the host.

Contact persons: Anders Löfgren (SKB) and Reija Haapanen (Posiva/Haapanen Forest Consulting).

3.5 Naming/definitions of water types and groundwater chemistry

There is some confusion about certain definitions concerning water types and groundwater chemistry. ChemNet has discussed this within the group and finds it necessary to go through it again. One question is how to define shallow ground water. ChemNet did also address that they lack sediment samples for analyses.

Conclusions: It was decided that ChemNet should be responsible for naming and defining the water types and groundwater chemistry. A representative for Posiva (Petteri Pitkänen) should be involved in the process.

Contact persons: Marcus Laaksoharju (SKB/Geopoint), Eva-Lena Tullborg (SKB/Terralogica) and Petteri Pitkänen (Posiva/VTT).

3.6 Denudation

It is important for the Safety description to give a proper and credible description of how much of the bedrock that disappears through erosion and weathering over time, even though the result will show that denudation does not have an impact on repository safety. SKB and Posiva share this opinion and find it necessary to describe the denudation in a proper way.

Conclusions: A decision was made that Jens-Ove Näslund will review the SKB/Posiva reports in the topic, and he will also communicate directly to Anne-Maj Lahdenperä concerning this.

Contact persons: Jens-Ove Näslund (SKB) and Anne-Maj Lahdenperä (Posiva/Pöyry Environment).

3.7 Historical development of the Baltic Sea

Depending on which time scale that is used, the periods of the Baltic Sea differ in, for example how long there has been brackish water in the Baltic. If calibrated years are used, a shorter period of brackish water is observed then if carbon-14 is used.

Conclusions: It was decided that the Swedish National Atlas /Fredén 2002/ should be used as a standard for the description of the historical development. All maps should be calibrated into calendar years.

Contact persons: Gustav Sohlenius, Anna Hedenström (SKB/SGU) and Ari Ikonen (Posiva).

3.8 Future development of the Baltic Sea

There will be morphological changes in the Baltic due to, for example uplift of the earth crust, and eventually the Baltic will get isolated from the sea. This issue will be handled in the safety assessment description.

Conclusions: Posiva will investigate this further (2007/2008) with help of experts and SKB will use the Posiva results. SKB might conduct further GIA modelling studies to resolve specific questions related to the future development of the Baltic.

Contact persons: Jens-Ove Näslund (SKB) and Ari Ikonen (Posiva).

3.9 Greenhouse scenario

The results from an increased greenhouse effect are considered to be the main uncertainty in assessments of future shoreline displacement, affecting for example the handling in the GIA-model. This is an important issue also when constructing the climate scenarios for the safety assessments. SKB and Posiva have different practical approaches /SKB 2006a, Posiva 2006, Cedercreutz 2004/ concerning the greenhouse scenario. In order to handle this, both SKB and Posiva feel that continued cooperation is needed.

Conclusions: To handle the greenhouse scenarios it was decided that Jens-Ove Näslund and Ari Ikonen will form a working group of relevant persons to discuss the issue and to seek for a common approach for the next versions of the safety case documentation. Regular meetings between SKB and Posiva are also important in order to facilitate the cooperation.

Contact persons: Jens-Ove Näslund (SKB) and Ari Ikonen (Posiva).

3.10 Sediment model

A discussion concerning differences in the amount of glacial clay at the sea bottom and on land is important. The fact that it is more glacial clay on the sea bottom than on land has to be further studied both at the Swedish sites and at Olkiluoto.

Conclusions: It was decided that Gustav Sohlenius will investigate this issue in more detail and that Sven Follin has to formulate a specific question. Posiva will be informed when an "explanation model" is ready.

Contact persons: Gustav Sohlenius (SKB/SGU) and Ari Ikonen (Posiva).

3.11 Development of vegetation

The large-scale vegetation development (at given latitude) is expected to be similar for Sweden and Finland. To describe the large-scale vegetation development, SKB uses the Swedish National Atlas description.

Conclusions: It was decided that Posiva and SKB will use a similar description of the large-scale vegetation development, based on the description given in the Swedish National Atlas /Fredén 2002/.

Contact persons: Anders Löfgren (SKB) and Reija Haapanen (Posiva/Haapanen Forest Consulting).

3.12 Ice cover

Concerning ice sheet configurations at different times throughout the last glacial cycle, SKB have used a model that has somewhat other ice configurations than what is presented in the Swedish National Atlas. SKB used a standard numerical ice sheet model (University of Maine Ice Sheet Model) forced by a proxy air temperature curve from the GRIP ice core, a common way of conducting simulations of the last Fennoscandia ice sheet. Further descriptions and references for the ice sheet model is provided in /SKB 2006ab/.

Conclusions: Posiva and SKB will use the same ice sheet model.

Contact persons: Jens-Ove Näslund (SKB) and Ari Ikonen (Posiva).

Property	Unit	Reference	Additional comments	Recommendation/ Decision	Contact persons
Timescale	BP or BC		Occurs in the context of calendar years and carbon-14 years with different meaning (1950, 2000 and 2006).	BC/AD is to be used and is valid for the time period (+/–) 10,000 yrs from now (see section 3.2).	Tobias Lindborg (SKB) and Ari Ikonen (Posiva)
Shoreline displacement model	m/year	/Påsse 2001, SKB 2006a/	Sea level components, greenhouse effect.	/Påsse 2001/ is to be used until 10,000 yr, thereafter GIA model. The transition must be handled in a proper way (see section 3.3).	Jens-Ove Näslund (SKB) and Ari Ikonen (Posiva)
Ice cover (stages) UMISM-model		Sveriges Nationalatlas, /SKB 2006ab/	Development in Fennoscandia during the last glacial cycle.	SKB and Posiva will use the same ice sheet model (see section 3.11).	Jens-Ove Näslund (SKB) and Ari Ikonen (Posiva)
Future development of the Baltic		Posiva work (planned, a joint project will be proposed)	Shoreline, salinity, overall description.	SKB will use the Posiva version. SKB Might conduct further GIA modelling studies to resolve specidic questions (see section 3.8).	Jens-Ove Näslund (SKB) and Ari Ikonen (Posiva)
Historical Development of the Baltic Sea		Sveriges Nationalatlas	Four main stages which characterize the development of the Baltic Sea since the latest deglaciation.	Sveriges Nationalatlas is to be used for the description of the historical development. All maps should be calibrated into calendar yr (see section 3.7).	Gustav Sohlenius/ Anna Hedenström (SKB/SGU) and Ari Ikonen (Posiva)

Property	Unit	Reference	Additional comments	Recommendation/ Decision	Contact persons
Salinity development in the Baltic Sea	g/L	/Westman et al. 1999, Gustafsson 2004a/	Estimated range for the salinity development in the Baltic Sea from the onset of the Litorina period until today.	The present model will be used, and some specific questions will be investigated further (see section 3.1).	Gustav Sohlenius (SKB/SGU) and Ari Ikonen (Posiva)
Denudation	m/myr		Quantification of bedrock denudation over the past millions of years.	Jens-Ove Näslund will review the reports from Posiva/SKB and give some references to Anne-Maj Lahdenperä (see section 3.6).	Jens-Ove Näslund (SKB)/Anne-Maj Lahdenperä (Posiva/ Pöyry Environment) Ari Ikonen (Posiva)
Sedimentation conceptual model (glacial clay etc)			Different stages of properties, when? Gustav Sohlenius and Sven Follin will investigate further.	Gustav Sohlenius will investigate this issue and Sven Follin will formulate a specific question (see section 3.10).	Gustav Sohlenius (SGU/SKB) and Ari Ikonen (Posiva)
Greenhouse scenario		/SKB 2006a/	The results from an increased greenhouse effect are considered to be the main uncertainty in the assessment of future shoreline displacement.	Jens-Ove Näslund and Ari Ikonen will form a working group to discuss the issue. Regular meetings between SKB and Posiva are to be held (see section 3.9).	Jens-Ove Näslund (SKB) and Ari Ikonen (Posiva)
Naming/defining of watertypes and endmembers			Water type should be based on the composition and end-member names on origin. Use unique words for any category.	ChemNet will give strict definitions of the different types and involve Posiva in the work (see section 3.5).	Marcus Laaksoharju (SKB/ Geopoint)/ Eva-Lena Tullborg (SKB/Terralogica) and Petteri Pitkänen (Posiva)
Generic ecosystem data list			Site specific data from SKB's and Posiva's investigations & relevant data from Finnish and Swedish Forest research.	Will be handled within a meeting late spring -07. Posiva will host the meeting (see section 3.11).	Anders Löfgren (SKB) and Reija Haapanen (Posiva/Haapanen Forest Consulting)/ Ari Ikonen (Posiva)
Landscape development (Carbon models (forest, mire))			Combination and further development of works in e.g. R-04-71, R-05-03, Olkiluoto Biosphere description 2006 etc.	Will be handled within a meeting late spring -07. Posiva will host the meeting (see section 3.11).	Anders Löfgren (SKB) and Reija Haapanen (Posiva/Haapanen Forest Consulting)/ Ari Ikonen (Posiva)
Future vegetation model (Posiva model)			SKB work e.g. in R-01-09, from Posiva first future vegetation literature study report in preparation /Haapanen et al. 2006/.	Will be handled within a meeting late spring -07. Posiva will host the meeting (see section 3.11).	Anders Löfgren (SKB) and Reija Haapanen (Posiva/Haapanen Forest Consulting)/ Ari Ikonen (Posiva)

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