Radioactive Waste: Some Ethical Aspects of its Disposal

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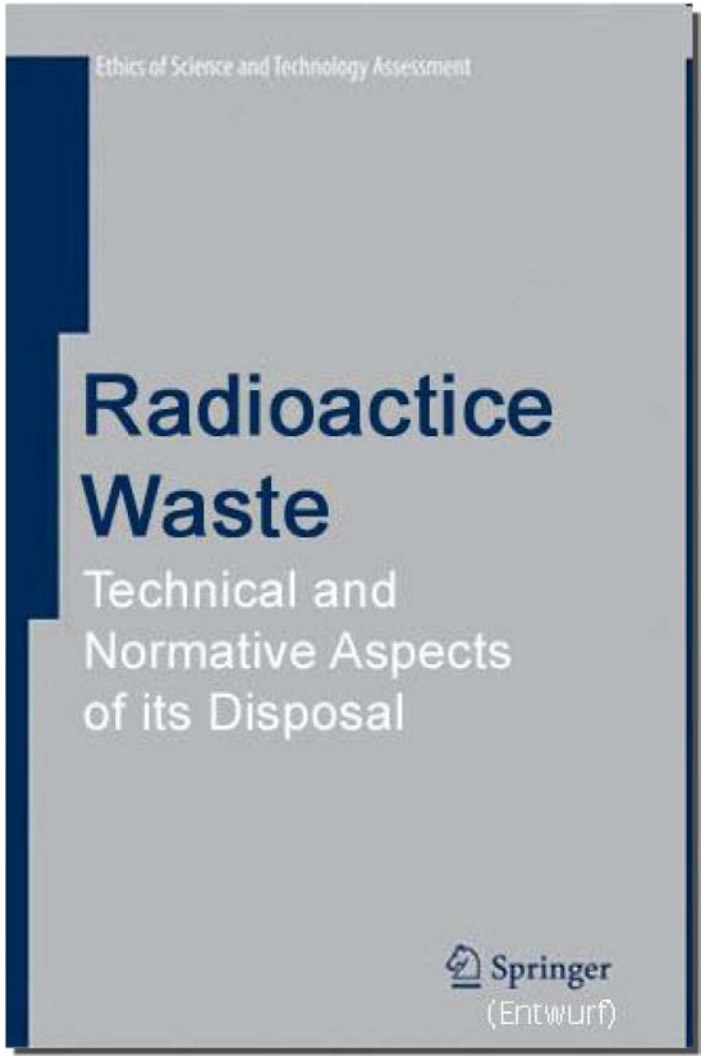

Radioactive Waste. Technical and Normative Aspects of its Disposal

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The strong protests and debates in many countries, especially in Germany, about the management of radioactive waste and the finding of an adequate waste disposal strategy shows that a considerable potential for conflict has been built up.
An approach for the development of valid recommendations and strategy how to deal with radioactive waste may be:

(1) The problem should be considered on the basis of its technical feasibility independent of its social effects and independent of the existing, often emotional assumptions.

(2) However, the problem should not solely be reduced to its technical aspects. The various conflict-generating differences in the evaluation should be taken into account.

(3) The conflict should be clarified and the arguments should be valued with regard to both the available options and the existing normative (ethical) as well as social aspects.

- **In order to develop proposals and make recommendations as to which problem-solving strategies could be accepted (serving as a preparation of such a discourse), it may be helpful to first consider the problem causing the conflict on a rational basis, independent of its resonance in society and politics and beyond the definitions.**
- **As already pointed out this does not mean, however, that the problem should be reconstructed as a merely technical issue – on the contrary. Such a reconstruction on the pure technical basis will certainly be considered as a "technicistic" and reductive interpretation of the problem, and therefore will not be supported by the concerned people. At least it will be strongly opposed.**
- **Transparency of the decision making processes is needed. Participation of stakeholders is necessary.**

Objective Problems with Disposal of Radioactive Waste

1. **The threat posed to humans and nature by radioactive material is a result of the ionizing radiation released during the radioactive decay.**
2. **It is therefore necessary to safely store radioactive waste (particularly high level waste from nuclear facilities).**
3. **The decisive factors determining a safe disposal are:**

- **The physical half-life times of some radioisotopes are ranging up to many millions of years. It is accepted worldwide therefore that the radioactive material needs to be confined in isolation from the biosphere for very long periods of time. (How long time periods are necessary?)**
- **After certain time periods it has to be assumed that some radioactivity will enter the biosphere and will expose humans by incorporation of radionuclides. (Which range of radiation dose should not be exceeded?)**

The Following Time Periods are Considered

1. **Periods of several tens of thousand years were initially taken into consideration in Germany.**
2. **A key argument for such a period was that a new ice age can be expected in Europe within this time frame.**
3. **On the basis of prognostic statements about the timescales of possible changes in the repositories of disposal facilities and especially on the prognosis of geologists about the possible migration of material through the geological barriers, assessments of the long-term safety of disposal facilities for radioactive waste have now been expanded to a range between hundreds of thousand and one million years.**

An ethical framework for disposal of radioactive waste

- **The present generation as the primary beneficiary of nuclear energy has the obligation to initiate the solution of the disposal problem. The demand for *immediate* disposal of high level waste, however, imposes an unjustifiable burden on the present generation.**
- **Processes to solve the question of disposal facilities must be designed in such a way that they do justice to everyone equally as far as possible, and in particular give adequate consideration to the claims of future generations.**
- **A categorical rejection of all proposed solutions for the disposal of high level waste is incompatible with our obligations towards future generations.**

Some Points to Consider Ethics for Disposal of Radioactive Waste under these Conditions

1. **Ethical justification of long-term responsibility**

2. **Long-term obligations in the absence of knowledge**

1. Ethical justification of long-term responsibility

(1) **Are we obliged for protection only to the generations interacting directly with us?**

(2) **Does the obligation finish at a generation** $k>i$ **(cf. with** $i=3-4$**)?**

(3) **Are we obliged to the members of the** k^{th} **generation to the same extent as to those of the first generation after us?**

(1) Are we only obliged to the simultaneously with us interacting members (3-4 generations)?

<u>Pay attention to the difference:</u>

- **to make a claim,**
- **to have a claim**

Compare moral Experience:

- Consideration of absence by chance

- Advocatoric percepton of interests with or without a mandate

- Tutoric care of interests (cf. parents for their children, protection of the unborn, disabled)

Egoism of „Presentation“:

- **The intention to realize the own preferences without care for the coming generations has to be rejected for ethical reasons. We have undoubtedly to care for future generations.**

- **Such an egoism of presentation is a variance of** *particularism.*

- **There exist obligations which cannot be limited to a certain number of generations in a reasonable way (even not for one million years) (Ethical universalism)**

(2) Does the obligation end with a generation of the grade *k>i* (cf. with *i =3-4*)?

- **When the obligations would end with a definite grade this would mean that for members of a generation G_{i+1} no obligation would exist in contrast to generation G_i**
- **Ethical universalism means that no temporal limitation can be set on a rational basis. When a concession of human rights exists it exists unlimited.**

(3) Do we have obligations to the kth generation to the same degree as to the first generation after us?

- **It is essential to distinguish between the existence of an *obligation* and the degree to which it is *binding* (this distinction follows (Kant, Metaphysik der Sitten).**
- **For issues of long-term obligation the assumption of an unchanging obligation for the individual leads to an utterly paralysing pragmatic paradox: what is the situation if we are obliged towards the 10,000th generation to the same degree as obliged towards our children's generation?**
- **While we are sufficiently familiar with the "life-world" of our children to determine the circumstances and consequences of actions, with a fair degree of certainty, however, we can describe these only in the framework of an imagined "life-world" for the 10,000th generation after us.**

2. Long-term obligation in the absence of knowledge

- **It is necessary for *ethical* reasons to distinguish between the obligation which exists universalistically, i.e. indefinitely, and the degree of binding force which decreases with spatial, social and temporal distance.**
- **Then the question arises: how has the obligation towards future generations to be qualified?**
- **The particular requirements of long-term obligation become clear when one bears in mind that the moral paradox developed above regarding an obligation spanning 10,000 generations, makes considerable use of the fact that our relationship to the future is characterized by decreasing levels of knowledge.**
- **If the ethical relevance of our increasing ignorance about the future would not be acknowledged, then the qualification of moral obligations would be separated from important factors of action and its consequences.**

- **The assumption of equal obligations at different levels of knowledge is wrong. Ignorance is a dimension for differentiation with respect to the grade of obligation and has to be considered for decision processes.**

- **If an ethical relevance of ignorancce with respect to the future conditions would not be acknowledged, the moral obligations towards important circumstances of acting would lead to very questionable or wrong results and consequences.**

- **On the basis of the present obligations it is absolutely necessary to improve the status of knowledge. Research is required in order to improve the knowledge with respect to the disposal of radioactive material (cf. Transmutation, migration of RN). Good science is necessary in order to narrow uncertainties.Those actions of which the knowledge is better should have the preference in the process of decisions.**

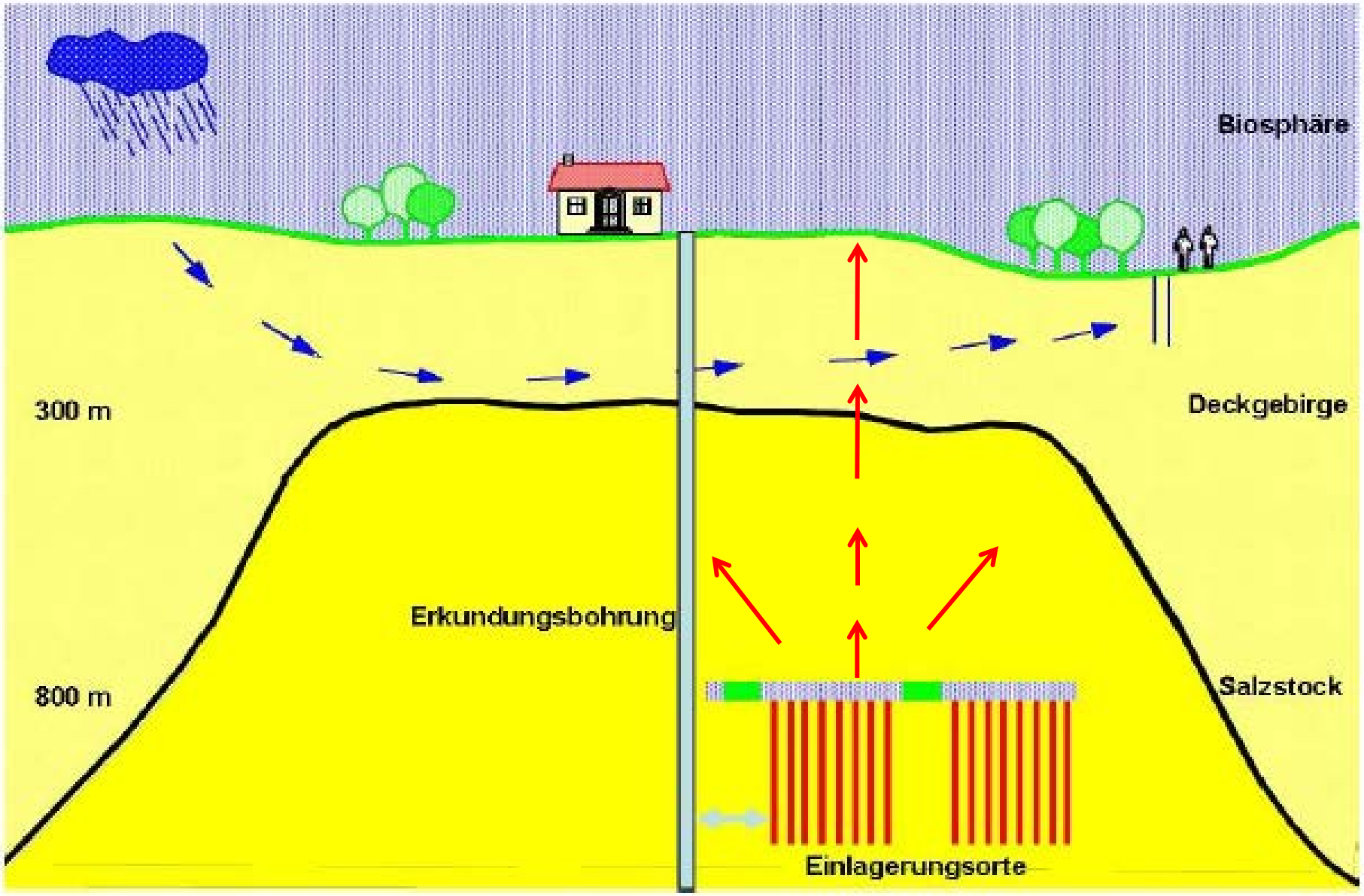
Factors, which are decisive for the exposure of humans and the environment through repositories

1. The duration of physical half-life-time of radionuclides, (^{238}U: $4{,}47 \cdot 10^9$ years; ^{129}I: $1{,}57 \cdot 10^7$ years)

2. The mobility of the radioactive material after release from the repository and the folllowing migration through the technical as well as through the geological barrier in the biosphere,

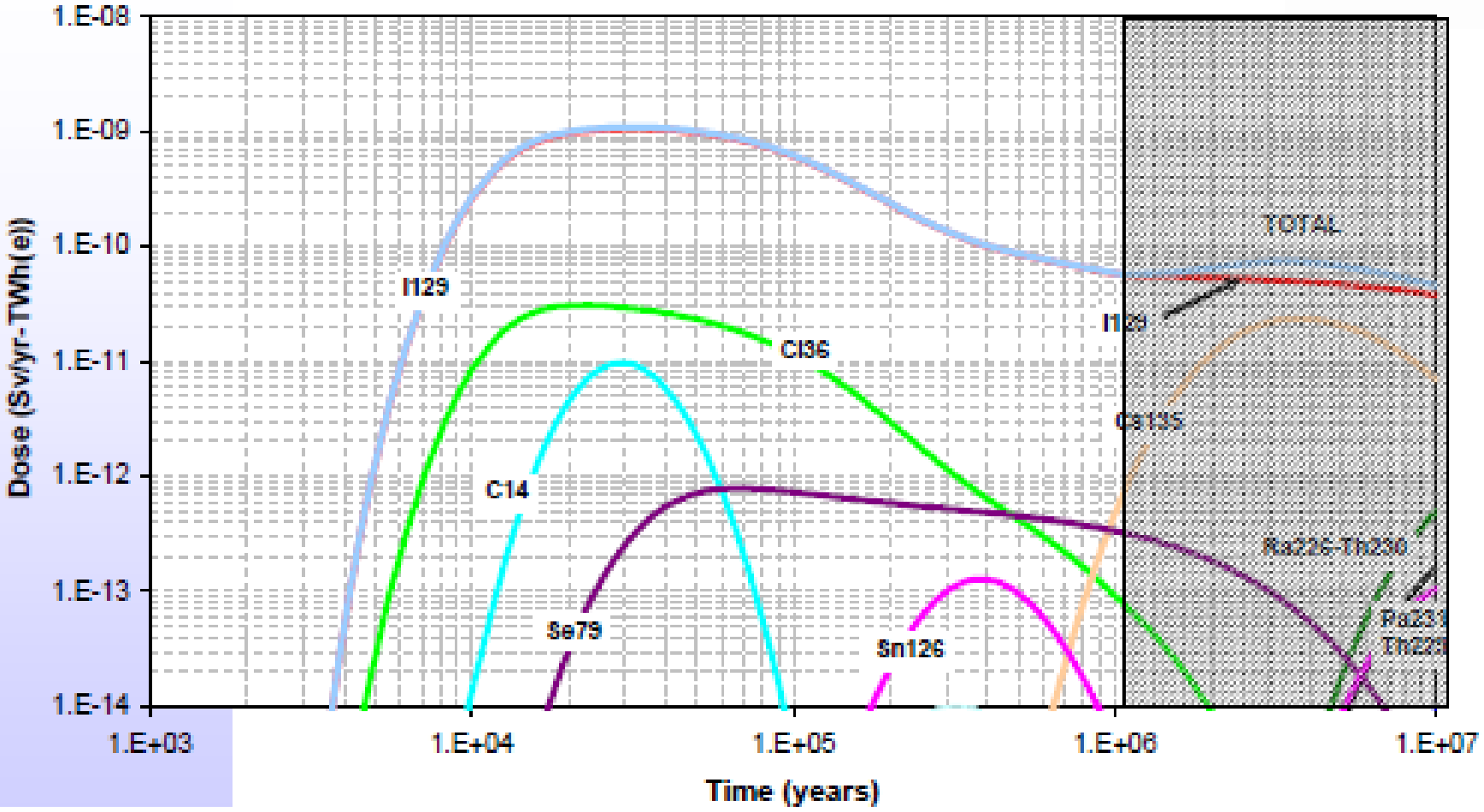
3. The migration of the radioactive material depends, whether the material is gaseous or water soluble.

4. For the exposure of humans the internal exposure after incorporation is decisive.



Schemat. Schnitt durch das Endlager mit Wirts- u. Deckgestein (GRS 2008)

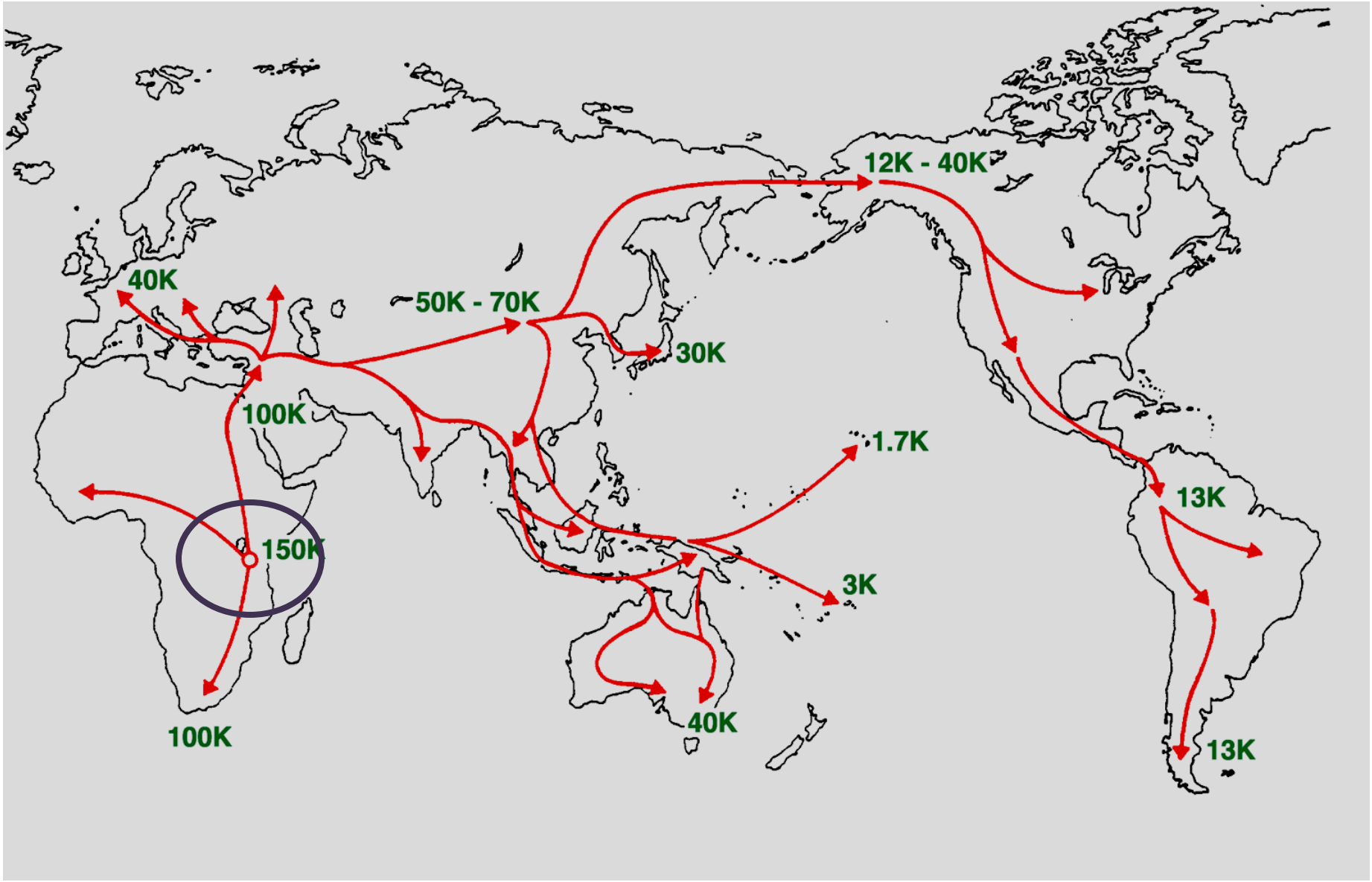
Marivoet et al. (2008) Dose Estimates in Granite



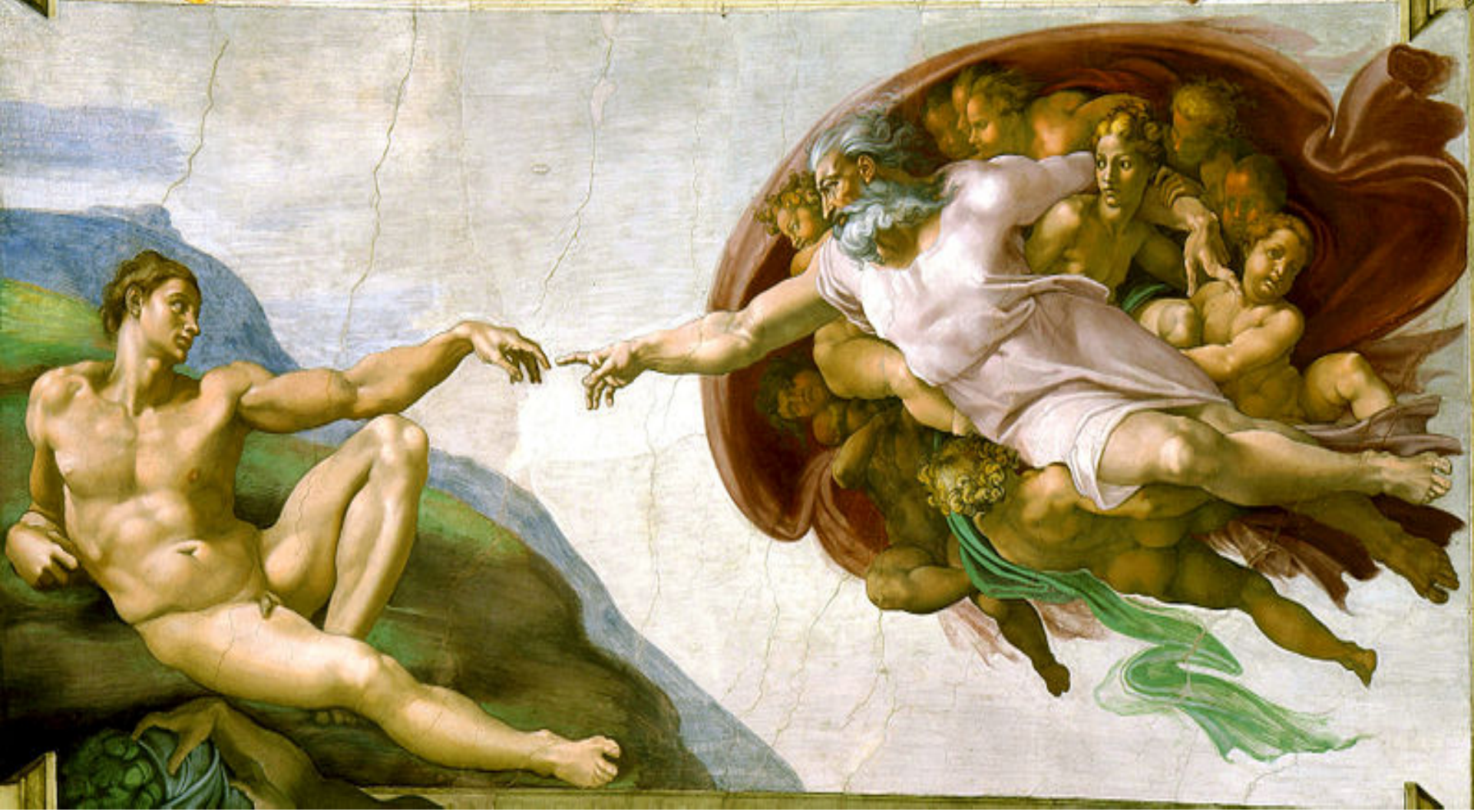
Periods of Homo-Species
(Concluded from findings of bones)

- **Homo erectus 1.9 Millions bis 100.000 a**
- **Homo heidelbergensis 600,000 bis 200,000 a**
- **Neandertaler 250,000 bis 28,000 a**
- **Homo sapiens 150,000 a until now**
- **1st script (uncomplete) 5,000 to 6,000 a earlier**

Homo sapiens: Out of Africa



(Modifiziert nach New Scientist, 27 October 2007, p. 36-41)



Michelangelo, Creation of Adam

Sixtine Chapel (between 1508-1512)