The igneous origin of salt deposits and structures

Stef J. Heerema and Gert-Jan H.A. van Heugten

It is strange that Blom published his theistic evolutionist view on the origin of salt deposits in *Journal of Creation* (*JoC*).[1] All the more curious is the fact that he disqualifies his own paper on his website. He writes[2]: "The JoC is of poor quality, even by creationist standards" (translated from Dutch). Furthermore, he disregards the JoC's peer review process[3]: "the pool of potential JoC reviewers does not contain qualified salt geologists. One could imagine that this results in a rather superficial review process." Finally, he notes that his "suggestions for a creationist salt model", as suggested in his paper, will not work.[3] That last point is true.

In his paper, Blom disputes the igneous origin of salt deposits that was published in *JoC*.[4] Instead, Blom defends a sedimentary, cold-water origin of salt deposits. He argues that after the slow deposition of the overburden, salt structures formed by means of solid-state salt flow, with these processes taking place over millions of years. Blom, and all other evolutionists with him, have to believe that *solid* salt flows like a fluid.[5] However, field and seismic observations suggest a rise of *liquid* salt within a *fluidized* overburden (e.g. figure 1). The internal friction of the solid salt and the drag forces applied by the solid top and sublayers— which are beyond description and without a driving force to overcome them—are neglected by Blom. The problems with synchronous flow of the solid sedimentary rock are also ignored. That allows him to embrace a theoretic model that focuses on rising salt pillars only, while disregarding the simultaneous displacement of sedimentary rock.

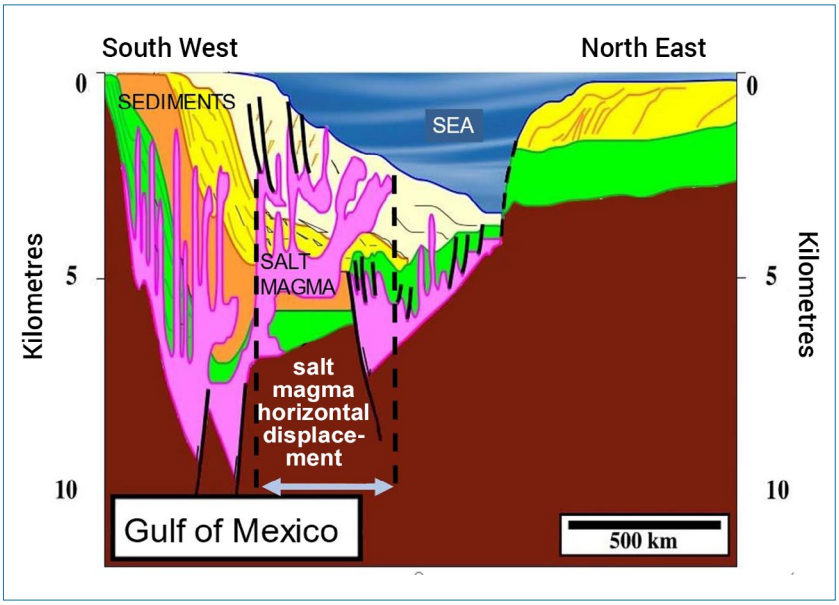

Figure 1. If this salt structure was formed in a solid state in between solid sedimentary rock, the overlying rock should have been pushed up into mountain ranges above the salt pillars. However, these underwater ridges have not been formed. The dotted lines show the horizontal displacement of the salt. Only a salt magma could have flowed several hundred kilometres horizontally in between Flood mud. Solid rock doesn't flow and, even if it did, it would require a timescale that far exceeds the biblical age of the earth. Thus, the resulting salt structure plus the sedimentary rock which surrounds it were in a liquid state when this took place.

Liquid, not solid

Blom's salt pillar model begins with the sudden appearance of a three-km-deep and three-km-wide graben in the overburden.[6] Figure 2 shows the graben formation he advocates. In a miraculous way, the underlying salt and the subsalt rock stayed undisturbed in the process of graben forming. With Blom's supernaturally formed graben in place, the differentially loaded overburden delivers the driving force for the salt to move. Although the solid overburden rests upon the solid salt, Blom falsely believes that the salt layer can move without displacing it. Figure 1 shows a lateral displacement of salt of hundreds of kilometres. These enormous horizontal movements and the time path involved are neglected. Blom focuses on the rise of the vertical pillar only. Surprisingly, he uses the *observed* behaviour of viscous fluids to calculate *unobserved* movement of solid rocks over millions of years. He calculates that it took one million years to form a 500-m-tall NaCl pillar. To speed up the theoretical framework, Blom advises YECs to assume the salt had a high water content as that lowers the viscosity of NaCl. However, salt is among the driest rocks on Earth. That is despite the fact that most of

the rock salt is situated below ground water level. So Blom's advice seems pointless.

Blom also advises creationists to consider that large tectonic forces during the Flood could have enhanced solid-state flow of salt. This is another dead end as the Flood *mud* can't supply the necessary large tectonic forces to shape *solid rock* salt. Also, salt exhibits viscous behaviour that leads to the slow plugging of mine galleries and caverns. But deformation at higher velocities by greater deviatoric stresses from large tectonic forces leads to rock salt fracturing—a process that is called 'dilation' and destroys the impermeability which salt layers are known for.[7] Thereby, it is likely that the waters of the Flood would have dissolved the salt layers after the disintegration of the polycrystal structure occurred. The water would certainly not have deposited it again as impermeable dry salt giants.

Anhydrite is also a big part of salt pillars. Figure 3 shows an example. Anhydrite is not known for its ductile behaviour. It is called non-ductile.[8] Therefore ductile behaviour does not seem to explain the existence of salt pillars.

False suggestions

Another inaccuracy in Blom's paper is that salt pillars are considered less dense than the overburden. He writes: "If the average density of the overburden is higher than the density of the salt (which is 2,200 kg/m^3 or even lower[9]), the salt will even reach the surface and spread out." He believes that salt pillars consist mainly of NaCl (2,160 kg/m^3). The higher density salts such as anhydrite (2,970 kg/m^3), which make up a significant portion, are ignored. Figure 3 shows an example where anhydrite in fact contributes about 50% to the total salt mass. Other salts, like polyhalite (2,780 kg/m^3), dolomite (2,840 kg/m^3), and aragonite

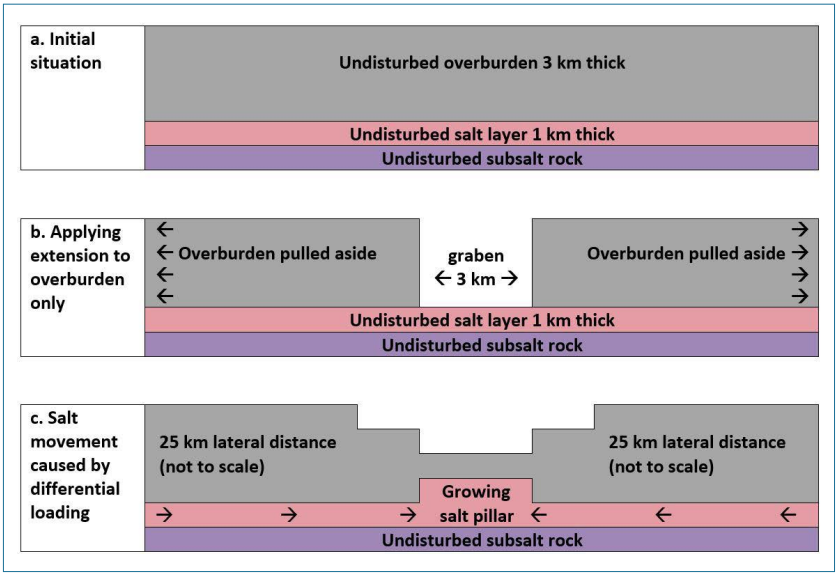

Figure 2. The undisturbed salt and subsalt layers in Blom's model show that the displacement of the overburden (from a to b) is unlikely and would not have affected the salt and subsurface layers. So, there must have been an external force that applied extension to the overburden only. By some unknown mechanism this force was able to overcome the shear stresses to create a graben 25 km away. It is highly unlikely that these types of geologic forces existed. Thus, situation b will never occur. Thereby, step c is also highly improbable, as not only would the walls of the graben have collapsed, the entire overburden would most likely also have been carried away into the graben by the moving salt. Despite these problems, Blom starts with situation c (to do the maths in his calculation) as if they did not exist.

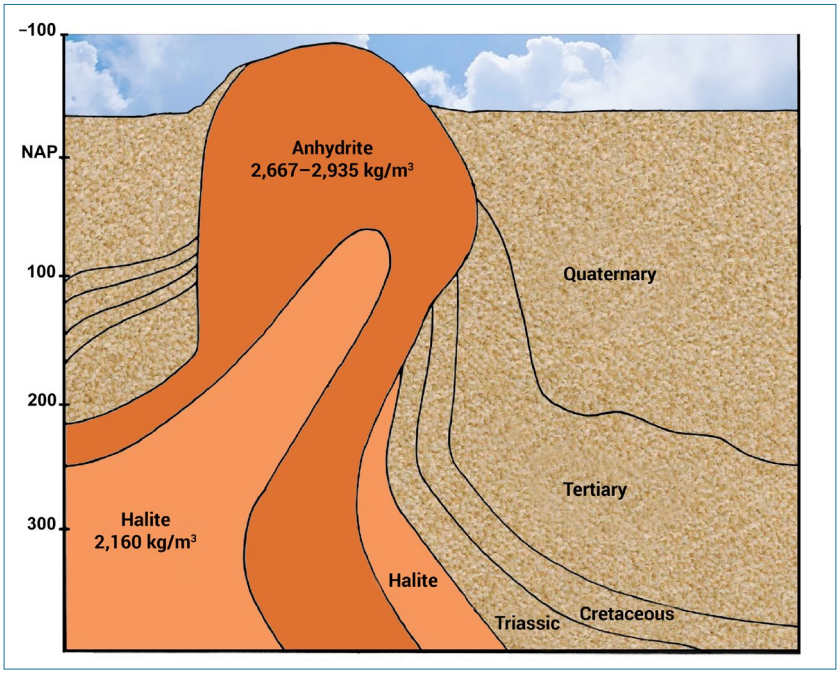

Figure 3. Salt profile at Segeberg, Germany (depth in metres below sea level). Anhydrite is one of the salts that contributes significantly to the average density of salt pillars. This shows that salt diapirs can be denser than the overburden. The overburden typically shows densities of 1,200–1,400 kg/m^3 in near-surface positions,[10] increasing to 2,100 kg/m^3 at a depth of 500 m. The latter, and the given densities, are estimated on the basis of a density study carried out on similar strata in the Netherlands.[15]

(2,930 kg/m^3) contribute to the overall density of salt layers worldwide as well. Also, salt is usually an impermeable material with a porosity of less than 1%.[10] Sedimentary rock, however, has high porosities up to 40%, which lowers the density significantly.[11] These higher porosities allow many sedimentary rocks near salt structures to hold immense reservoirs of fossil fuels. Gases and liquid oils typically have a lower density than the water originally present in these pores.

Blom advises YECs to consider the serpentinized lithosphere instead of long-lasting evaporation as a salt source. But the serpentinization process is just another long-lasting process that will not fit in any biblical creation model. We addressed the problems recently and concluded: "Even from a secular point of view, it seems a stretch to try and use serpentinization to explain salt giants."[12]

On his website, Blom writes: "I think the standard evaporation model is just too well supported by the facts. … I don't think there is a creationist salt model that will ever fully work." This shows that his suggestions to creationists are in fact misleading. He holds to slow desiccation, driven by solar energy. It is remarkable that he ignores the growing group of geologists that argue against it. They do so for good reasons. Scribano *et al.* conclude: "the evaporite model hardly explains deep-sea salt deposits."[13] For example, they list difficulties with the sequential deposition and the relative amounts of different types of salt. Also, Oard hints at an igneous origin for limestone, dolomites, and anhydrite.[14] These 'salts' are also commonly found in salt giants.

It is good news that evolutionists are looking into creationist thinking on the origin of salt. But it can be concluded that Blom's vision is of little value.

References

1. Blom, J., Evaluating the origin of salt deposits and salt structures, *J. Creation* **35**(3):125–129, 2021.
2. "Het *Journal of Creation*, waarin twee publicaties van Heerema verschenen, is zelfs naar creationistische maatstaven van belabberde kwaliteit." willemjanblom.wordpress.com/2020/12/02/de-toekomst-van-het-creationisme/, accessed 29 June 2021.
3. willemjanblom.wordpress.com/2021/11/04/salt-geology-in-the-journal-of-creation/, accessed 15 December 2021.
4. Heerema, S.J. and van Heugten, G-J. H.A., Salt magma and sediments interfingered, *J. Creation* **32**(2):118–123, 2018.
5. Hudec, M.R. and Jackson, M.P.A., *Terra infirma*: understanding salt tectonics, *Earth-Science Reviews* **82**(1–2):1–28, 2007.
6. Blom, ref. 1, figure 1.
7. Fokker, P.A., The behaviour of salt and salt caverns, Thesis TU Delft, H5.1, 1995.
8. Fokker, ref. 7, p. 43.
9. Weinberger, R., Begin, Z.B., Walmann, N., Gardosh, M., Baer, G., Frumkin, A., and Wdowinksi, S., Quarternary rise of the Sedom diapir, Dead Sea basin, *Geological Society of America*, Special Paper 401, pp. 33–51, 2006.
10. Wong, Th.E., Batjes, D.A.J., and de Jager, J., *Geology of the Netherlands*, Royal Netherlands Academy of Arts and Sciences, chapter concerning salt, edited by Geluk, M.C., Paar, W.A. and Fokker, P.A., p. 284, 2007.
11. Heerema, S.J., *De dichtheid van gesteenten op het Zechstein in relatie tot zouttektoniek; Zoute magma drong opwaarts vanwege dichtheidsverschil*, Grondboor & Hamer, pp. 134–139, Tabel 2, 2015.
12. Heerema, S.J. and van Heugten, G-J.H.A., Difficulties with applying serpentinization origin for salt formations to the Bible and geological evidence, *J. Creation* **36**(1):3–4, 2022.
13. Scribano, V., Carbone, S., and Manuella, F.B., Tracking the serpentinite feet of the Mediterranean Salt Giant, *Geosciences* **8**:352, 2018 | doi.org/10.3390/geosciences8090352.
14. Oard, M.J., What is the origin of carbonates in sedimentary rocks? *J. Creation* **34**(2):19–20, 2020.
15. Heerema, ref. 11, table 3.

Stef Heerema *was involved with heat treatment processes in molten salt. He also was posted to the UK for the engineering of a uranium enrichment plant and sold steam installations. As a self-employed consultant, he investigated the feasibility of a salt mine in the Netherlands. He is a former board member of* Logos Instituut NL *and holds a Bachelor's degree in aircraft engineering. He lectures on the topic of Flood geology and publishes in several YEC-journals.*

Gert-Jan van Heugten *has an M.Sc. in chemical engineering. He is a former board member of Logos Instituut. He is owner of WaaromSchepping, an enterprise that presents the creation message via lectures and written format. Since 2012, Gert-Jan has been a writer and editor for Weet Magazine, a Dutch creationist magazine. In 2018 he published a book for general audiences on the biblical age of the earth.*