



HAL
open science

Correction to: How do the geological and geophysical signatures of permeable fractures in granitic basement evolve after long periods of natural circulation? Insights from the Rittershoffen geothermal wells (France)

C. Glaas, A. Genter, J.F. Girard, P. Patrier, J. Vidal

► To cite this version:

C. Glaas, A. Genter, J.F. Girard, P. Patrier, J. Vidal. Correction to: How do the geological and geophysical signatures of permeable fractures in granitic basement evolve after long periods of natural circulation? Insights from the Rittershoffen geothermal wells (France). *Geothermal Energy*, 2018, 6 (1), 10.1186/s40517-018-0112-5 . hal-01929828

HAL Id: hal-01929828

<https://hal.science/hal-01929828>

Submitted on 2 Sep 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

CORRECTION

Open Access



Correction to: How do the geological and geophysical signatures of permeable fractures in granitic basement evolve after long periods of natural circulation? Insights from the Rittershoffen geothermal wells (France)

C. Glaas^{1,2*} , A. Genter¹, J. F. Girard², P. Patrier³ and J. Vidal¹

*Correspondence:

carole.glaas@es.fr

² CNRS, UMR 7516 IPGS,
University of Strasbourg,
5 Rue René Descartes,
67084 Strasbourg Cedex,
France

Full list of author information
is available at the end of the
article

Correction to: *Geotherm Energy* (2018) 6:14

<https://doi.org/10.1186/s40517-018-0100-9>

After publication of the article (Glaas et al. 2018), it has been brought to our attention that there are some errors. The authors have listed them below.

In the “Borehole data and methods” section, the vertical resolution and horizontal resolution in the header of the Table 1 are not information about the data resolutions. Instead, “Vertical resolution and Horizontal resolution” should be replaced by “Vertical sampling and Horizontal sampling”.

In the “Electrical logs; Petrophysical observations” section, the issues of the following sentences are incorrect: “Although RLA1–4 represent the resistivity closer to the borehole, they have a better vertical resolution than RLA5; thus, we show them in the figure for reference”. The article should instead state: “Although RLA1–4 represent the resistivity closer to the borehole, we show them in the figure for reference, but the work in this article focuses on the RLA5 curve only.”

In the “Electrical logs; Synthetic resistivity” section, the value of the counterions mobility (noted B) used in Eq. 5 is false.

We used $B(25\text{ °C}) = 5.19 \times 10^{-8} \text{ m}^2\text{s}^{-1}\text{V}^{-1}$ which corresponds to the Na^+ ions mobility in bulk water. Instead, as it has been recently published, we should have used a mobility value accounting for the mobility of the counterions in the Stern layer and in the diffuse layer. Following Eq. 2 in Ghorbani et al. (2018), the mobility can be expressed as $B = \beta_{(+)}(1 - f) + f * \beta_{(+)}^s$. The value of the mobility of the counterions in the diffuse layer $\beta_{(+)}$ is the same as in the bulk pore water. The mobility of the counterions in the Stern layer is smaller ($\beta_{(+)}^s(\text{Na}^+, 25\text{ °C}) = 1.6 \times 10^{-9} \text{ m}^2\text{s}^{-1}\text{V}^{-1}$) and a typical value is $f = 0.95$ (Revil et al. 2017a, b). The correct value is then $B(25\text{ °C}) = 4.2 \times 10^{-9} \text{ m}^2\text{s}^{-1}\text{V}^{-1}$.

This value is 10 times smaller than the value used in the calculation of the surface conductivity in the article, hence the clay contribution to the resistivity is ten times overestimated in the article. It has several consequences discussed hereafter.

Using the wrong value of B , we evaluated the contribution of the surface conductivity to be of the same order than the volume conductivity (see Fig. 7a). Then we used Eq. 6 to optimize the weighting of each term through two coefficients (see Fig. 7b). The optimization of a synthetic log considering only the Archie's term ($\text{coef2} = 0$) yields a coefficient acting as a geometrical factor, i.e. a rough approach to convert the formation resistivity to the measured (apparent) resistivity RLA_5 .

When we observed which could be the best weighting coefficients (Fig. 7b), the minimum RMS is obtained when the clay term is emphasized 10 times ($\text{coef1} = \text{coef2}$ with wrong B value) or 33 times ($\text{coef1} = 0.15$ and $\text{coef2} = 0.56$), which is far away from an acceptable range from the nowadays well established model (Eq. 1).

The reader should consider the following changes.

- In Eq. 5, the right value of $B(25\text{ °C})$ is $4.2 * 10^{-9} \text{ m}^2\text{s}^{-1}\text{V}^{-1}$.
- In Fig. 7a, the “clay term” resistivity log is in fact 10 times higher (and the contribution to the conductivity is 10 times lower).
- In the paragraph after Eq. 7, “Optimization is illustrated in the cross-plot ...” until “... good fit results are also obtained.”, considering the factor 10 for B , the conclusion is that the clay term should be inappropriately emphasized to have an effective contribution. Then, the surface conductivity plays a negligible role here.

In the “Discussion; Resistivity signature of permeable fracture zones” section, we wrote “it was also shown that both porosity and clay content/type control the resistivity value” which is true, but the sentence “with the clay term dominating (Fig. 7)” is wrong.

Based on our available logging data and synthetic models, the influence of clay through the surface conductivity on the resistivity of the studied granites is negligible. Some petrophysical work on samples could help to go further on this question.

Note that we found no consequences in the introduction and conclusion paragraphs.

Author details

¹ ES Géothermie, 5 RUE de Lisbonne, 67300 Schiltigheim, France. ² CNRS, UMR 7516 IPGS, University of Strasbourg, 5 Rue René Descartes, 67084 Strasbourg Cedex, France. ³ CNRS UMR 7285 IC2MP, HydrASA, University of Poitiers, Bat B8, Rue Albert Turpain, TSA51106, 86073 Poitiers Cedex 9, France.

The original article can be found online at <https://doi.org/10.1186/s40517-018-0100-9>.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Published online: 17 November 2018

References

- Ghorbani A, Revil A, Coperey A, Soueid Ahmed A, Roque S, Heap MJ, Grandis H, Viveiros F. Complex conductivity of volcanic rocks and the geophysical mapping of alteration in volcanoes. *J Volcanol Geotherm*. 2018;356:243–63. <https://doi.org/10.1016/j.jvolgeores.2018.03.017>.
- Glaas C, Genter A, Girard JF, Patrier P, Vidal J. How do the geological and geophysical signatures of permeable fractures in granitic basement evolve after long periods of natural circulation? Insights from the Rittershoffen geothermal wells (France). *Geotherm Energy*. 2018;6:14. <https://doi.org/10.1186/s40517-018-0100-9>.
- Revil A, Le Breton M, Niu Q, Wallin E, Haskins E, Thomas DM. Induced polarization of volcanic rocks. 1. Surface versus quadrature conductivity. *Geophys J Int*. 2017a;208:826–44. <https://doi.org/10.1093/gji/ggw444>.
- Revil A, Murugesu M, Prasad M, Le Breton M. Alteration of volcanic rocks: a new non-intrusive indicator based on induced polarization measurements. *J Volcanol Geotherm Res*. 2017b;341:351–62. <https://doi.org/10.1016/j.jvolgeores.2017.06.016>.

Submit your manuscript to a SpringerOpen[®] journal and benefit from:

- ▶ Convenient online submission
- ▶ Rigorous peer review
- ▶ Open access: articles freely available online
- ▶ High visibility within the field
- ▶ Retaining the copyright to your article

Submit your next manuscript at ▶ [springeropen.com](https://www.springeropen.com)
