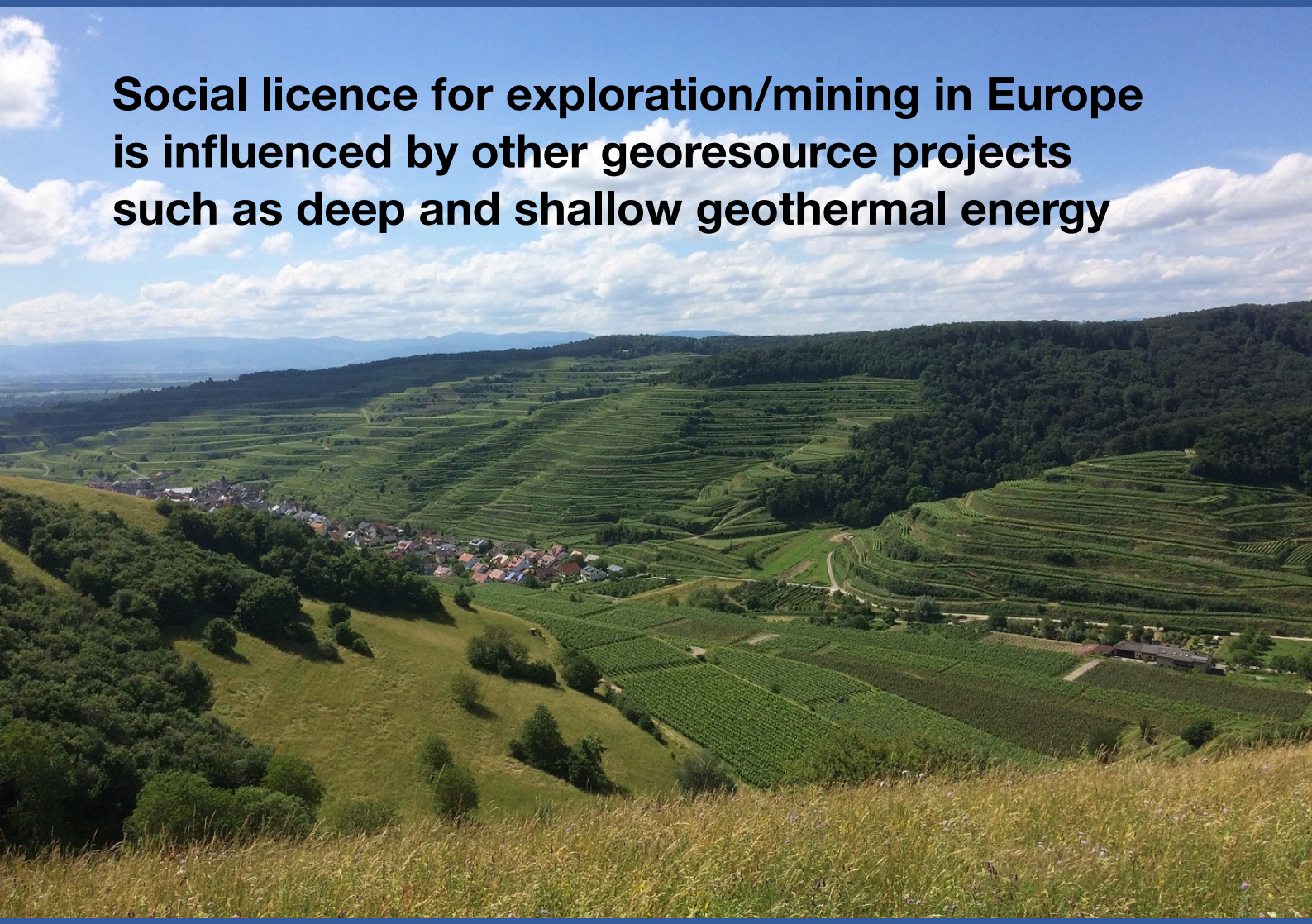
Social licence for exploration/mining in Europe is influenced by other georesource projects such as deep and shallow geothermal energy



HiTech AlkCarb

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 689909.

Alexandra Speiser[1], Frances Wall[2], Kate Smith[2], Kathryn Moore[2],
[1]A Speiser Environmental Consultants, [2]Camborne School of Mines, University of Exeter

Lessons arising from recent exploration research drilling plans in Germany

Summary

The Horizons 2020 HiTech AlkCarb project planned a 300m deep research drill hole, together with geological and geophysical exploration studies, in southwest Germany, all carried out to international minerals exploration best practice. The geology and geophysics were well received by the local public, authorities and politicians. However, the local politicians expressed concerns about the drill hole and requested a long term insurance policy against any negative impacts. In practice, this meant that the research team could not drill the hole. The cause of this concern was the negative public perception of drilling caused by problems with two geothermal projects in the region. Although the HiTech AlkCarb team had been meticulous to apply mining-related best-practice to public and official interactions, they had not realised the depth of feeling and loss of trust caused by the geothermal projects – in effect, the social licence for minerals exploration drilling had been lost, and could not be regained during this project. The lesson here for expansion of mining or geothermal energy in Europe is clear – that in terms of social licence, the implications of past and present geology-related projects must be considered together. The public does not discriminate and neither can industry, regional authorities nor national and international legislators.

Key findings/Learning outcomes

The early stages of planning a geoscience project involving drilling should include appropriate public consultation and a socio-economic assessment of the study area.

Negative public opinion from earlier drilling projects in the locality can leave a legacy that adversely affects perceptions of any future drilling schemes regardless of their scale or purpose.

All drilling-related projects (geothermal, mining or research) should be seen to be adopting high standards of good practice, both technically and in public communication. This is essential, not only for legislative compliance but to gain and maintain public goodwill, i.e. the social licence.

Once the social licence has been lost, technical explanations, such as illustrations of the different drilling techniques and geological settings that were relevant in this case, appear often to have little influence on public opinion.

The HiTech AlkCarb project

Funded from 2016 to 2020 by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 689909.

Aims:

- **Step-change in exploration geo-models for alkaline and carbonatite provinces.**
- **State-of-the-art interpretation of high resolution geophysics and downhole measurement tools.**
- **Twelve partners from industry, geological, geophysical and environmental companies, as well as universities and geological surveys.**
- **Seven key natural laboratories including Kaiserstuhl, Germany, the main focus of geophysical research.**

Starting in 2016, the EU Horizon 2020-funded HiTech AlkCarb project has carried out a programme of field geology and geophysics and aerial geophysical surveys at Kaiserstuhl, southwest Germany to investigate the characteristics and structure of the area's carbonatite and alkaline rocks. These rocks are of interest because of their potential as hosts for rare earths and other technology-related elements that are essential for use in the development of environmentally-responsible, high-tech applications such as electric cars, wind turbines and smartphones. The project itself was designed to assist in the development of geomodels and did not have a commercial objective.

For further information please contact:

hitech.alkcarb@exeter.ac.uk

www.carbonatites.eu

Kaiserstuhl case study location

The Kaiserstuhl is located in the southwest of Germany, in the districts of Emmendingen and Breisgau-Hochschwarzwald in the province of Baden-Württemberg. It is an extinct volcano, which erupted 15.5 million years ago during the Miocene geological period. It is formed of carbonatites and alkaline rocks, unusual rocks that are important because they are the main source of critical elements such as rare earths and niobium.

The Kaiserstuhl area was considered to be an ideal natural laboratory for the HiTech AlkCarb project. As well as offering an established body of literature, the area benefits from easy access, has a well-preserved range of volcanic rocks, an active aggregate quarry and other small quarries from earlier niobium exploration.

The ecological importance of the area is well recognised. Unique ecosystems thrive in the warm climate and in the fertile loess soil covering part of Kaiserstuhl. Numerous Designated Conservation Areas (DCA), ranging from 60 – 70 hectares each, and many other smaller DCAs have been established over time. Part of the locality, which was the main focus point of the HiTech AlkCarb project belongs to a Fauna Flora Habitat area (FFH no. 7911-341).

Tourism and viticulture are the main sources of income in the region.

Figure 1a: *Location of sites mentioned in the text. 'Kaiserstuhl' marks the location of the case study site and is shown in greater detail in Figure 1b below.*

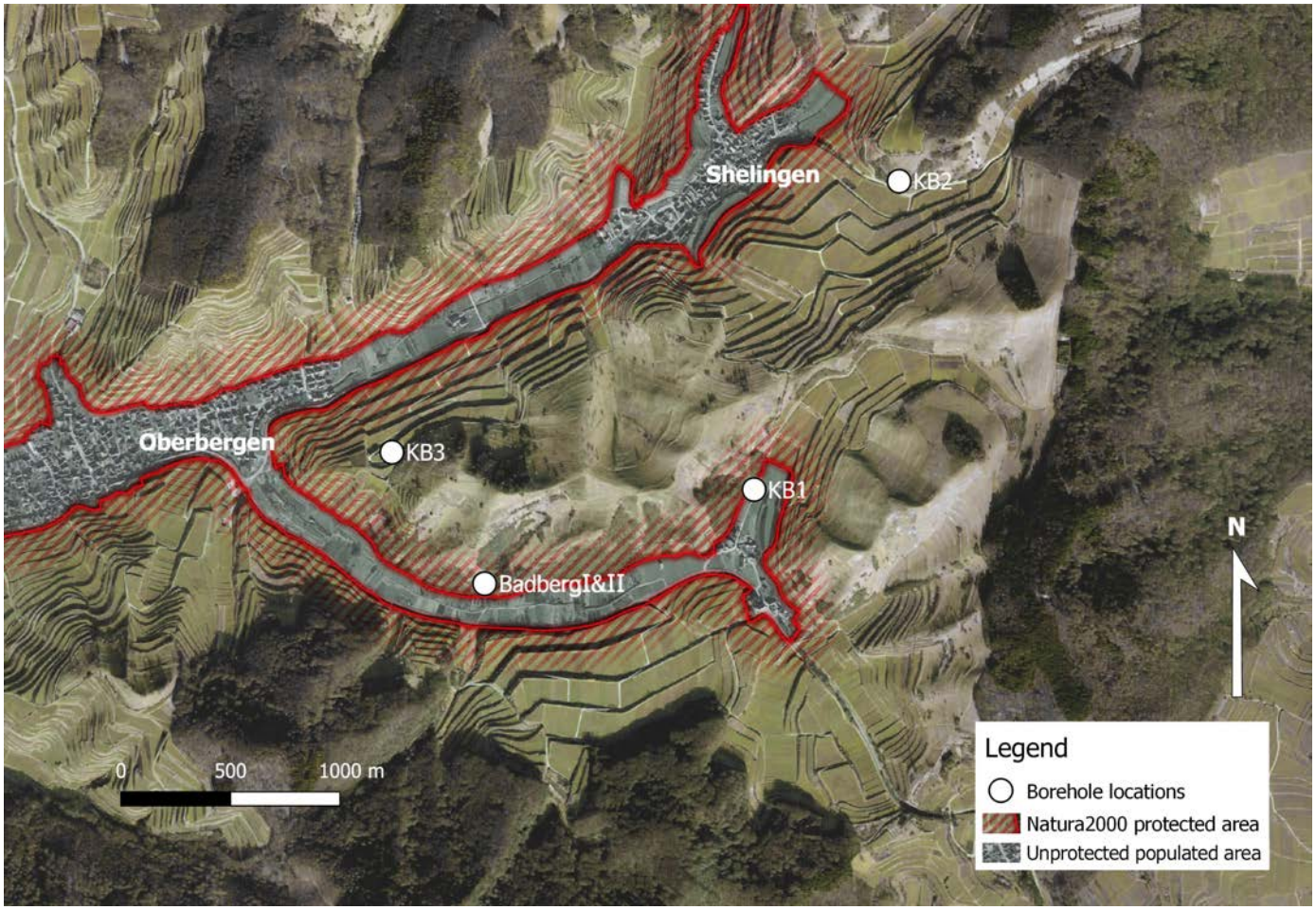


Figure 1b: *Location of Kaiserstuhl historic drill holes (Drill hole KB3 is also known as 'Steinreisse')*

The early stages of scientific research and/or exploration should always be accompanied by public consultation and a socio-economic assessment of the area

HiTech AlkCarb interaction with the community in Kaiserstuhl

For the environmental and social impact assessments of its planned research in Germany, the HiTech AlkCarb project followed best practice gained from its exploration experience in Namibia. This involved more emphasis on public consultation than is required by German legislation.

In compliance with German legislation, prior to commencement of the studies, in April 2016, permit applications to conduct the ground-based geological fieldwork and geophysical surveys were submitted to the Regierungs-präsidium Freiburg and the permit application to drill the scientific borehole was submitted to the Landratsamt Breisgau-Hochschwarzwald. These are the bodies with the legal authority to grant permits pertaining to geological activities. All permits were granted except the drilling permit (see Drilling permission granted with conditions). The application to fly the airborne geophysical survey was submitted to the aviation authority on 5th October and granted on 10th October 2016.

Meetings with the Mayor and heads of the councils of Vogtsburg Municipality were held from April 2016, when the project was introduced, and continued during 2017 to provide progress reports. There was strong local representation and knowledge in the HiTech AlkCarb team. The lead partner for the geophysics and drilling was a local company, whose staff are long-time residents of the region, and the geological research fellow was also local.

Various activities were carried out to provide information for the general public of the Kaiserstuhl area. A series of brief summaries of project activities was placed in the local press, covering researching the geology of the area in the field, and carrying out ground-based and airborne geophysics studies.

Figure 2b: *Visitors from the local community discuss the geology of Kaiserstuhl and HiTech AlkCarb with the project team.*

Further public engagement was facilitated by an Open Day, with activities, posters and short films about the project, organised at the Naturzentrum Kaiserstuhl in Ihringen village in October 2017. The research team introduced the general use of rare earth elements (REE), the importance of carbonatites as hosts for REE deposits and explained to the public audience how the project would further scientific understanding of geological processes at Kaiserstuhl. Events offered during the day included activities for children.

The Badische Zeitung published a very positive article:
http://www.badische-zeitung.de/ihringen/der-kaiserstuhl-ist-eine-beispielregion-fuer-seltene-gesteine--143196319.html
and the team were invited to repeat the event later in the project.

Figure 2a: *Ben Walter talking at the Naturzentrum Kaiserstuhl museum open day.*

Drilling-related projects (for geothermal, mining or research) should be seen to adopt high standards of good practice in order to gain and maintain public goodwill.

How was the social licence lost at the drilling schemes in Staufen im Breisgau and Basel?

Geothermal bore holes in Staufen im Breisgau

In September 2007, seven 140 m deep geothermal bore holes were drilled at the town of Staufen im Breisgau (25km from Kaiserstuhl) to establish borehole heat exchangers for the town hall. In one of the boreholes, a technical problem permitted water to enter layers of anhydrite. The anhydrite reacted to form gypsum and this reaction can lead to a c.60% increase in volume of the rock. Weeks after drilling was completed, the ground swelled, causing the ground surface of the town centre in Staufen to lift at rates up to 10mm/month, and up to 26 cm in some places. Seven years later in March 2014, the inflation appeared to have stopped.

http://www.staufenstiftung.de/risse-chronik.html

Unfortunately, 250 buildings in the historic town centre have been affected. The company responsible for the drilling ceased trading and responsibility for the costs of repairing the damage has fallen to the municipality. The damaged buildings are now themselves a tourist attraction as the historic town tries to raise the money for repair.

Geothermal energy project Basel

At Basel, 60 km south of Kaiserstuhl, drilling to a depth of 4.8 km was conducted for a geothermal power project in 2006/2007. Several small earthquakes of between magnitude 3 and 3.4 were felt in the surrounding area. Following this induced seismicity with a total of more than 200 earthquakes of magnitude greater than 0.9, a risk assessment resulted in the project being halted in 2009. Geopower Basel AG, the company responsible for the drilling, paid compensation to affected owners, and also reported that they had previously advised the cantonal authorities that drilling could cause some minor tremors.

http://www.seismo.ethz.ch/en/earthquakes/monitoring/geothermal-energy-basel/Project-Description/

Figure 3: *Damage to buildings in the historic town centre of Staufen im Breisgau.*

Negative public opinion from drilling projects can leave a legacy that adversely affects perceptions of any future drilling schemes, regardless of their scale and purpose

The Mayor of Vogtsburg and the heads of the local councils were interested in HiTech AlkCarb's scientific research and supportive of all activities except for the drilling.

HiTech AlkCarb drilling permission granted – but with conditions

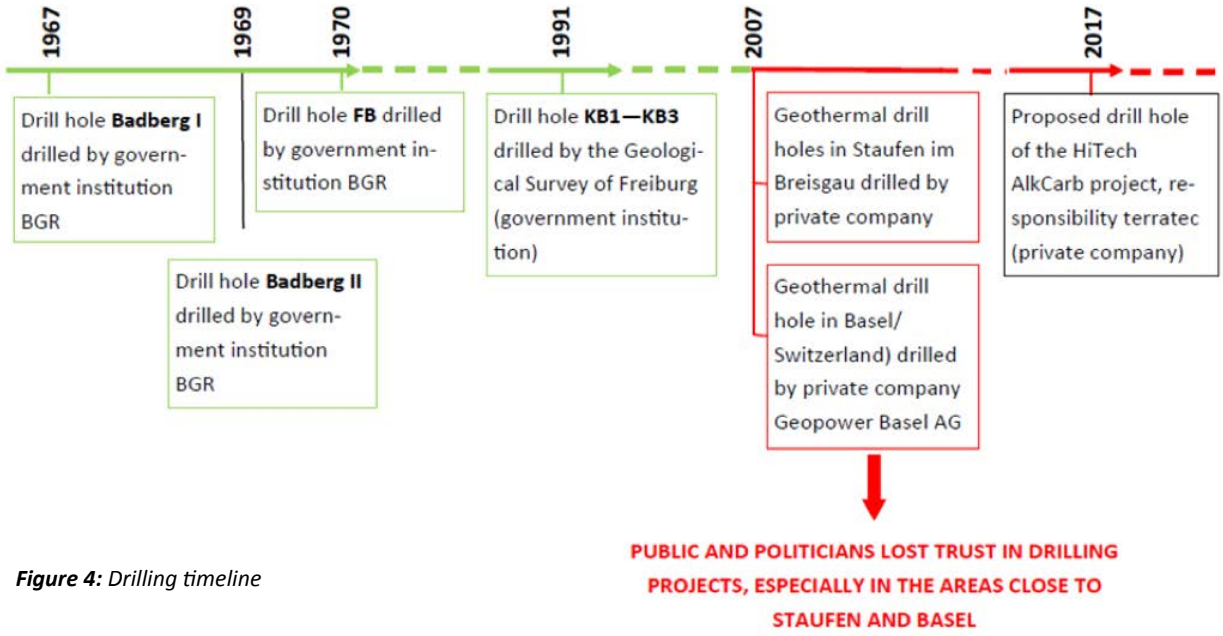


Figure 4: *Drilling timeline*

The Landratsamt Breisgau-Hochschwarzwald granted permission for a research drill hole in August 2017 on the condition that the Municipality of Vogtsburg also agreed to the drilling. The Municipality stipulated several conditions of its own. One of these conditions was that the applicant was to be liable in the long term for making good any damage caused by the drilling and would therefore be required to take out an insurance policy to cover any claims arising. Of particular concern was possible damage or negative effects on the 'Neunbrunnenquelle' (a spring in the valley south of the Badberg) and the presence of a sewage pressure line in the area, and these were to be expressly covered by the insurance. The Mayor requested that HiTech AlkCarb acquired a 10-year insurance policy to cover any and all possible project-related impacts.

Even though a positive response to our project had been received from the local community, and despite all permits for the ground and aerial surveys being in place, the poor experiences and problems associated with the drilling episodes at Staufen and Basel caused local politicians to insist that this additional insurance was necessary to cover the perceived risks posed by even the small-scale research drill hole that we were proposing. However, insurance for this risk is not readily available.

As a result, in October 2017, the project team took the decision not to drill at Kaiserstuhl. Fortunately, the combination of the discovery during fieldwork of an old, but still open, drill hole at the site (see Figure 1b), together with new results from a project partner's active exploration work in Malawi, provided sufficient data for the project to meet its reporting objectives.

Figure 5: *Geophysical survey fieldwork and downhole geophysical investigations at the old borehole. Photos: Terratec geophysical services*

Our experience during this project suggests that technical explanations regarding different drilling techniques and geological settings appear often to have little influence on public opinion

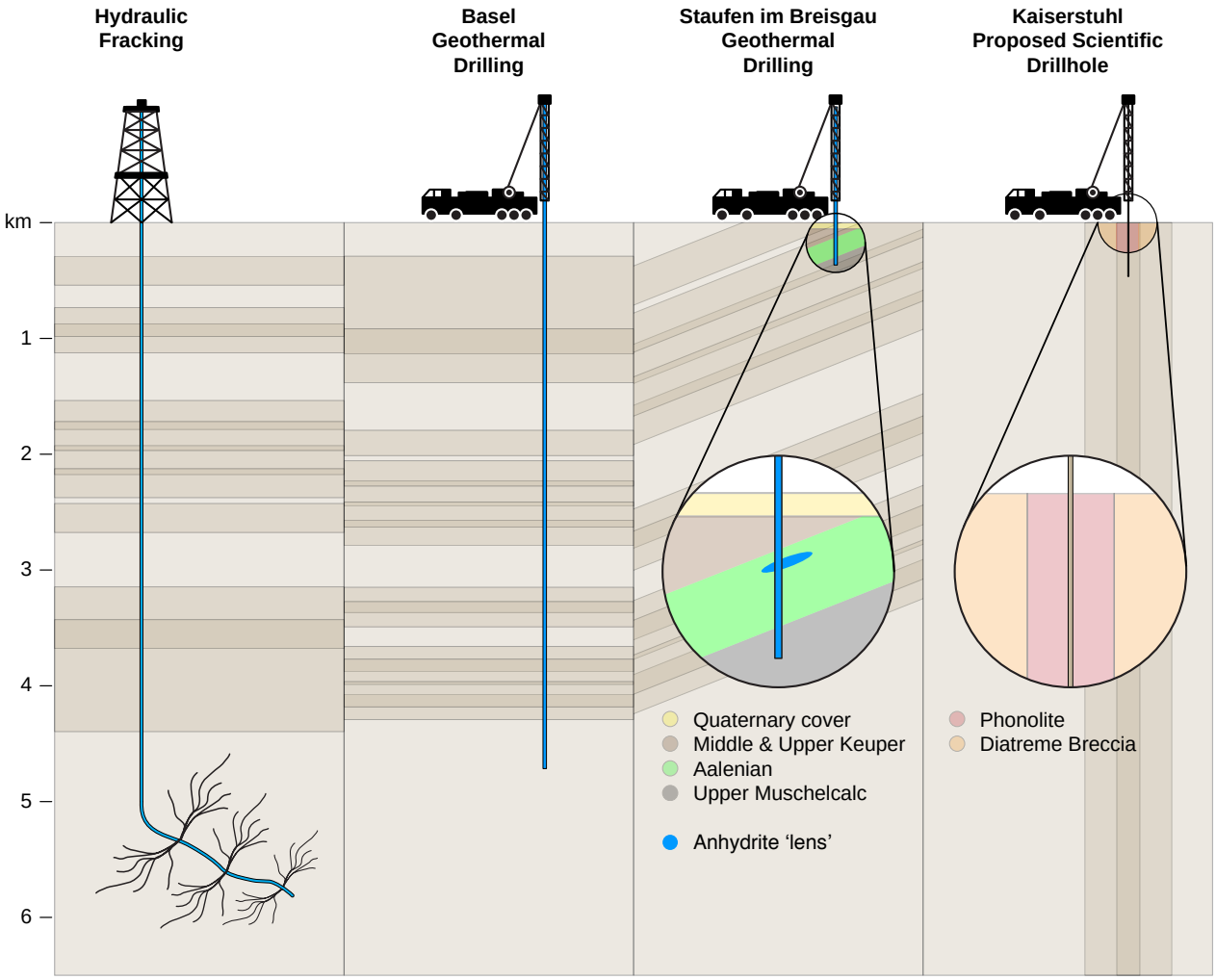


Figure 6: *Comparison of drilling applications. (drilling equipment not to scale).*

Hydraulic Fracking

A process that involves drilling deep down into the shale layers that contain gas. A water-sand-chemical mixture is injected into the rock under high pressure to release the gas, allowing it to rise to the head of the well.

Basel Geothermal Drilling

Deep drilling for direct heat and electricity generation. Pressurised water is circulated through the rock several kilometres underground to absorb the heat and extracted back up the outer walls of the drill hole or via another drill hole. The drill hole walls should be sealed to prevent water escaping to other layers.

Staufen im Breisgau Geothermal Drilling

Geothermal shallow boreholes for borehole heat exchangers (BHE) equipped with ground source heat pumps. Pressurised water is circulated through one or more shallow drill holes to absorb the heat from the rock. The drill hole walls should be sealed to prevent water escaping to other layers, such as into Anhydrite lenses in the case of Staufen im Breisgau.

Kaiserstuhl Proposed Scientific Drill hole

Scientific exploration drill holes can be of variable depth, usually up to several hundred metres. Rock chips or solid core are extracted for tests and the void is used for downhole studies using instruments lowered into the cavity. The hole is then usually closed. No water circulation is required.

Recommendations for the European Commission

Public perception of experiences and issues associated with geothermal projects also extends to mineral exploration projects. Therefore, all georesources projects - mining, quarrying, deep and shallow geothermal - need to adopt the highest standards of good practice to acquire and retain public support. This is vital as the European Commission work to improve the social licence to operate for mining in Europe.

The early stages of all scientific research and/or exploration projects should include appropriate public consultation, outreach and a socio-economic assessment of the area. Our project is an example of good practice in this respect, except that we did not adequately consider the likely effects of the previous geothermal projects at our project proposal stage. We did however, recognise that not being able to drill was a risk, and had set up a contingency plan accordingly.

Assets from earlier field work, such as research infrastructure of drill holes as well as the drill cores, should be retained for possible future use. This project benefited from the fortuitous discovery of an old, unintentionally open, drill hole.

It may be preferable that research projects involving activities perceived as being high risk, such as drilling, should be undertaken by a government institution, such as a university or national geological survey. These institutions are automatically insured in some countries, such as Germany. An alternative solution is for projects to collaborate with active exploration projects that already have drilling permits and appropriate insurance in place. This was our contingency plan but was outside of Europe.

Once the social licence has been lost, it is difficult to regain. Examples of positive outcomes from georesources projects are required in south west Germany to allay public scepticism and restore confidence.

Acknowledgements: Anatole Beams, Emma Dowman, Marko Cacanoski, Benjamin Bohn (Mayor of Vogtsburg) and local council members, Peter Siegfried, Klaus Brauch, Claudia Pohl and the HiTechAlkCarb team. The HiTech AlkCarb project has received funding from the European Union's Horizon 2020 research and innovation programme (grant agreement no. 689909). Further information: www.carbonatites.eu