DOCTORAL CANDIDATE:	Jan Stanislas Cornet
DEGREE:	Philosophiae Doctor
FACULTY:	Faculty of Mathematics and Natural Sciences
DEPARTMENT:	Geosciences
AREA OF EXPERTISE:	Rock mechanics
SUPERVISORS:	Daniel Walter Schmid and Marcin Dabrowski
DATE OF DISPUTATION:	27th of April 2018

DISSERTATION TITLE: *Analytical and numerical modeling of cavity closure in rock salt*

Steinsalt finnes naturlig flere steder, og skyldes fordampning av havvann, der salt senere avleires i tykke lag. Salt endrer fort form, og kan tette igjen hulrom. Denne avhandlingen omhandler problemet med tidsavhengig hulromslukning i saltformasjoner. Det er utviklet analytiske løsninger som beskriver hullukking ved hjelp av en beskrivelse av salt som tar hensyn til effekten av intergranulært vann. Dette kan hjelpe ingeniører til å raskt vurdere hullukking som forekommer i saltformasjoner.

Rock salt is a material that is easily deformable and, in the underground, it tends to flow like a fluid. Every material has a fluid like behavior when it melts at high temperature, but the specificity of salt is that it also flows at the low temperatures encountered close to and at the surface. The best way to understand the viscous behavior of salt is to picture ice and how ice glaciers slowly flow with time. Although rock salt can also form glaciers when it reaches the surface, most of it is found in the upper 5 km of the underground where its flow is hidden from direct observation. Salt flow becomes problematic when a cavity like a cavern or a well is placed in a salt formation because the hole starts to close with time.

This PhD work introduces new analytical solutions for estimating the speed at which hole closure occurs in rock salt. These solutions are new because they take into account the effect of intergrain water on salt deformation. The deformation of rock salt is often considered to be solely due to the movements of dislocations inside salt grains but pressure solution at grain contacts has also been found to be important. By taking pressure solution into account, the closure velocity can increase by several orders of magnitude (up to 10000 times).

Salt is a common rock in the underground and its unique sealing properties makes it involved in many applications. From wells going through thick salt formations looking for oil reservoirs, to shallow caverns storing oil, gas, hydrogen or pressurized air, there are many scenarios for which the findings in this PhD work are directly relevant. The new solutions will hopefully be used in the future by engineers to better assess hole closure in salt and increase the safety as well as the success rate of operations.