Since the fall 2016 I have been mentoring undergraduate student Bo Tang (Tsinghua University) to come and work with me on the my ACS-PRF ND grant “Two-phase flow and episodic fluid migration through rock salt” starting in the fall 2017. Unfortunately, Bo decided last minute to attend graduate school at the University of Cambridge. It was not possible to find a replacement for Bo, because the proposed work requires very good mathematical preparation. Instead, I decided to work with a talented senior undergraduate student at UT Austin, Preston Durham, with the aim of recruiting him as a graduate student for the fall 2019. Preston has not been paid out of the ACS grant, to save the money to fund him as a graduate student in the following year.

In the academic year 2017/2018, we started working on the first of three proposed research questions: “Determining the flux due to porosity waves”. We are considering a soft ductile salt layer sandwiched between two elastic rock layers (sandstone). We assume that continued sedimentation loads the three layers at a constant rate. This leads to build up of pore pressure in the sandstone below the salt, due to the low initial permeability of the salt. However, as pore pressure builds-up the salt begins to dilate (due to is ductile nature) and porosity and permeability increase. The aim this first project is to determine the steady-state flux through the salt under uniform loading rate, because it will determine the magnitude to the pressure build up below the salt.

The first challenge to be overcome is the formulation of the problem. To our knowledge the coupling of ductile and elastic porous media has not so far not been considered. Over the course of the year Preston has developed combined mathematical formulation that allows us to solve for pressure in both ductile and elastic rocks at the same time. He is currently working on finding a appropriate non-dimensionalization of the problem that allows us to determine the governing dimensionless parameters determining the flux through the salt. The aim is to have this completed before the end of the year and to move to the numerical implementation in the spring of 2019. My hope is that we can write a first manuscript over the summer 2019.