Carbohydrates, also called sugars or saccharides, are organic compounds containing carbon, hydrogen and oxygen in their molecules. Sugars can be classified as: monosaccharides, disaccharides and polysaccharides.

Carbohydrates are important constituents of living biomass. They are present in cells of all organisms starting with protists to vascular plants and mammals. In bacteria, carbohydrate accounts reach 20 to 40% of dry weight, while in vascular plants they can reach even 80% of dry weight. Saccharides play various functions in living organisms. Some (e.g. starch) are used by organisms for energy storage, while others (e.g. cellulose, hemicellulose, or chitin) are associated with cell walls or exoskeletons, where they provide protection and strength. Despite the fact that carbohydrates are very common in living organisms, it is believed that their occurrence in the geological record is very rare.

The aim of this project is to provide evidence that monosaccharides, and maybe also disaccharides and polysaccharides, can be preserved under special conditions in sedimentary rocks for hundreds of million years and be an important constituent of sedimentary organic matter. The occurrence of free saccharides was preliminarily demonstrated in a pilot study on Middle Jurassic fossil wood and a Eocene to Miocene xylite. Such a finding is unique in global geochemical data and can contribute to a better understanding of the thermodynamic properties of these labile compounds.

In this project we are planning to provide detailed molecular characteristics of Mesozoic (Middle to Upper Triassic, Middle Jurassic) as well as Cenozoic (Eocene to Miocene) organic matter from diverse geological materials (fossil wood, lignites, organic-rich sedimentary rocks), specifically focusing on polar compounds. The main method used in saccharide detection will be gas chromatography coupled with mass spectrometry (GC-MS).

The second important aspect of the investigation will be focused on characterizing the thermal stability of carbohydrates. We will carry out laboratory thermal simulation experiments using mono- and disaccharide standards. Controlled heating in an inert gas atmosphere and with catalytic clay mineral contact will assess the thermal stability of saccharides in comparison to other biomarkers. The experimental results will be compared with the computed thermodynamic properties of the compounds investigated.

The implementation of such a pioneer study would contribute to the understanding of the preservation potential of carbohydrates, which are still considered to be completely unstable in the diagenetic processes of sedimentary organic matter transformation.