

## **POPULAR SCIENCE PROJECT SUMMARY**

Soil without an aggregate structure would become a desert. From the beginnings of the organized human societies, a peasant ploughed soil improving its aggregate structure. By living in nature he intuitively felt, what later on was proved by agricultural and physicochemical sciences, that the aggregate structure governs soil fertility, water retention, microbial life and plant growth. Soil aggregates are composed of larger skeletal particles (quartz, feldspars) and very small particles of clay minerals, iron and aluminum oxides, silica and/or organic matter. Proper soil structure is stable and porous. The magnitude of interactions between the aggregate components determines the structure stability. Diversity in size and shape of the above components induces differences in porosity of the aggregates. Liming, fertilization and/or enrichment of a soil with structure effective amendments and/or bioactive substances, like biosurfactants or (recently fashioned) biochar may markedly modify soil aggregate properties. The architecture of aggregate structures may be described by mutual arrangement of the aggregate particulate components or, complementary, by a description of spaces (pores) arising between them. Therefore the aggregate build-up is determined either by direct analysis of their images (photographs) taken by microtomography or microscopy allowing to directly observe the aggregate components or by indirect methods as mercury intrusion porosimetry, gases or vapors adsorption or water retention curves, from which one can measure the aggregate porosity. In turn, the aggregate stability may be evaluated by mechanical durability studies or by observation of aggregate destruction under the action of several agents like water or ethanol. Broad interest in soil aggregation processes has been displayed in thousands of published scientific papers, a quantity of which continuously increases due to the synthesis of new structure modifiers as well as to the development of new experimental methods. According to the Project authors opinion, an important disadvantage of the published papers is that most of them describe properties and processes in natural soils, wherein mutual positive and negative interactions between various structure affecting factors, nonuniformity of mineral and chemical composition, and particle size variations lead to frequent contradictions in the results interpretations. Therefore an accurate description of formation and stability of aggregate structures requires investigation of aggregates having precisely defined composition. The proposed Project is localized in this direction. Its aim is to study artificial soil aggregates of exactly projected composition, containing soil silt fraction, different additions of selected clay minerals, and various natural or synthetic organic carbon compounds, and to observe accompanied changes in structure and stability, that up to date has not been studied in the proposed manner. Porosimetric, aggregate destruction kinetics and durability investigations should allow to the more accurate estimation of the mechanisms of formation and stability of aggregates. Some works directed onto improvement of experimental methods and theoretical description of aggregate structures (particularly its stability) will be performed simultaneously.