Clathrates are host-guest crystalline compounds in which the host structure consists of a skeleton of polyhedral structural cages of one chemical species that surround molecules of the other species - the guest structure. They are rare in nature. The best-known clathrate complexes are clathrate hydrates, consisting of water and methane-rich gases. Recent studies have shown that minerals belonging to the mayenite supergroup can also form clathrate compounds. Their general chemical formula can be presented as follows: $X_{12}T_{14}O_{32-x}(OH)_{3x}[W_{6-x}]$, where X = Ca, T = Al^{3+}, Fe^{3+}, Mg^{2+}, Si^{4+} or Ti^{4+} and x = 0-2. They can be found in calcium-silicate pyrometamorphic rocks formed at conditions of high temperature and low pressure conditions. They have a nanoporous structure, which consists of a tetrahedral skeleton and six structural cages. At each cage, the center is the *W* site, which can be occupied by ions or molecules, such as F^-, Cl^-, OH^-, H_2O, etc. Due to its specific structure, the occupancy at the *W* site is non-persistent and can be changed easily. Therefore the minerals of the mayenite supergroup can "capture" components of gases or liquids circulating within pyrometamorphic rocks.

The aim of the project is an elaboration of a model of clathrate formation within mayenite supergroup minerals. In order to achieve this, the different ions and molecules at the *W* site in the minerals of the mayenite supergroup and their synthetic analogs will be investigated.

In order to compare the mayenite supergroup minerals with different substitutions at the *W* site, the planned project assumes investigations of these minerals from several different localities, such as pyrometamorphic rocks from the Hatrurim Complex (Israel) and xenoliths located within volcanic rocks of Shadil - Khokh volcano (South Ossetia), Bellerberg volcano (Germany), Upper Chegem Caldera (Russia) and Balaton Highland volcanic field (Hungary) and quarry in Tadano (Japan). In addition to the study of natural phases, the proposed project involves the reconstruction of studied minerals using synthetic material. In recent years, the synthetic analogs of mayenites have attracted widespread attention thanks to that they are ionic conductors. Therefore, the development of various substitutions within the mayenite supergroup minerals will provide a lot of important information in the field of geology and will contribute to the advanced materials used in electronics, environmental protection, and cements elaboration.

The presented research problem is innovative due to involving new natural clathrates. The experience of the leader of the proposed project in researching the minerals of the mayenite supergroup and extensive laboratory facilities guarantee the reliable implementation of the project and the achievement of the planned results. The preliminary investigations on fluormayenites from the Hatrurim Complex provided data on the presence of various sulfur compounds substitutions, including the neutral H_2S molecules, at the *W* site. The presence of a neutral H_2S molecule proves that the minerals of the mayenite supergroup can be a new, natural clathrate.

The most important expected result of the project will be the discovery and description of a new natural clathrate compound. Besides intensive research on the mayenite supergroup, not all natural counterparts of synthetic phases (such as "pure-oxygen" $Ca_{12}Al_{14}O_{33}$ member) are known. Detailed studies of various substitutions in the mayenite supergroup provide a real possibility of discovery and description of a new mineral, which is a great success and a significant contribution to the fields of mineralogy, chemistry, and solid-state physics. The data obtained in the frame of the planned project will also contribute to the development of new, advanced materials for the detoxification of environmentally harmful elements such as sulfur, chlorine, and fluorine.