The next new concise atlas we compiled in the series of the Solar System Research [1] deals with the planetary chemistry. The main chapters are a) Igneous rocks, b) Mossbauer spectra, c) Weathering of the Martian rocks, d) Photochemistry, e) Terrestrial atmospheric circulation of chemical elements, and f) The Water-Ammonia mirror for the amino acids. The main reason of this selection of topics was the actual success of the MER rovers on Mars [2-4], and Huygens lander on Titan.

**Martian igneous rocks:** The SNC (Shergotty, Nakhlita and Chassigny) Martian meteorites gives valuable experimental examples for the terrestrial igneous rocks. Of them Nakhlite and shergottites are shown in a genetic sequence.

For Nakhlites which form a group of Martian meteorites with pyroxenitic character, the cumulate pile model is shown where in a thick (some tens of meters) lava flow accumulation of crystals by settling forms cumulate piles in the lower section of the lava column. Martian nakhlites represent this section of the lava flow column. We also mention that there is a terrestrial analog for the formation of the nakhlites: this is the ultramafic lava-flow of the Theò's Flow in Canada. The Martian meteorite nakhlites have similar petrographic texture to that of the Theò's Flow piroxenites: it consists of picroxene (mainly augite) grains set in a matrix composed of plagioclase needles [5-7].

For Shergottites the three main subgroups: the basaltic-shergottites (i.e. Shergotty itself), the picritic-shergottites or olivine-phyric shergottites (i.e. Northwest Africa 1068) and the lherzolitic or peridotitic shergottites (i.e. ALHA-77005) are shown. The three groups of shergottites have formation ages between 170 and 500 Mys [8-9]. We show terrestrial counterparts to the shergottites in the form of the Szentbék-kálla series of inclusions in basalts [10].

**Mossbauer spectra:** This short chapter introduces how Mossbauer spectroscopy discovered the various Fe ion containing minerals on the landing site of Opportunity: the hematite of spherulitic beads, the jarosite as main component of the sedimentary type light colored wall rocks in Eagle and Endurance craters.

**Weathering of the Martian rocks:** The chapter starts with water and we are focused on the term of pH and factors determining its value. We explore the relationship between pH and the solubility of metal ions. It is also important how the redox reactions are affected by pH. We also touch on precipitation of sulfate salts from supersaturated sea water on Earth compared with Mars. In the next part of this chapter we will see how weathering is related to carbon dioxide. We compare the processes on the Earth with the Martian examples. The acidic environment precludes the formation of carbonate minerals (i.e. siderite), which can be a plausible explanation for the observed absence of carbonates on Mars. The water-limited chemical weathering on the acidic ancient environment of Mars resulted in formation of such rare minerals (i.e. jarosite), which – in comparison – would rapidly decompose on recent terrestrial surface conditions.

Then we move on from the crust to the atmosphere. We look at changes of states and discuss the conditions for such changes. We consider the phase diagrams for carbon dioxide and water, because they are a convenient way to summarize the conditions under which the different states of substances are stable.

Water together with gases (carbon dioxide, methane, etc.) can form unusual phases, like clathrates under certain circumstances. In the final section of this part we describe the structure and properties of methane hydrate, as an example for gas hydrates. They are thought to play an important role in the stabilization of subsurface water ice on different planets of the Solar System.

**Photochemistry:** In the chapter opening we describe the general photochemical processes resulting from the absorption of solar radiation. We look at the general features of the atmosphere of Titan – its composition, the various regions into which it is divided, and the radical reactions affected by radiation.

One of the most important processes is that the UV photons destroy the methane molecules and the dissociated hydrogen escapes from the atmosphere. The further reactions are depending from composition of atmosphere. Therefore,
we extend our knowledge comparing the decomposition of methane in the oxidized atmosphere of Earth.

Terrestrial atmospheric circulation of chemical elements: Global chemical budget of the Earth is an exciting problem of the 21st century. Both planetary science and environmental protection disciplines can use this knowledge as basis for their studies. A supplement material for education is given in the textbook using the fundamental physics, chemistry and geographic knowledge on the high school level.

As mass and energy fluxes play fundamental role in the formation and development of the planetary atmospheres, the structure of the climate system, greenhouse effect and the geochemical cycles were analyzed. Terrestrial circulations are examples on interactions among the subsystem elements of the climate system: as the atmosphere, cryosphere (e.g. Mars) and lithosphere. Circulation of water, carbon, oxygen, nitrogen, sulfur and phosphorous compounds are discussed in a consistent approach based on terrestrial biochemical cycles. Related processes – both on short and long (several million years) timescale – were summarized. The greenhouse effect and the carbon cycle of the Earth to that of Mars and Venus are also compared.

The Water-Ammonia mirror for the amino acids: This chapter duplicates the reference solvent liquids: together with water we use ammonia, when consider main characteristics of the amino acids, the elementary building blocks of proteins in cellular level terrestrial life. The amino acids have ambivalent character in respect of water-world and ammonia-world. This ambivalence may represent a kind of symmetry, which is expressed by the amino acid molecules, when liquid solvent is exchanged from water to ammonia or vice versa "around them". The characteristic radicals of amino acid molecules are carboxyl, hydroxyl, amine and amide ones, too. Therefore they can interact both with water and ammonia in a similar way in many reactions. Terrestrial life, however, is not W-A symmetric, using W radical at the positive ends and A ones at negative ends and never inversely.

Addition of ammonia is an important aspect when primary liquids as solvents in the Outer Solar System are studied. The water-ammonia ambivalence of the amino acids could have been developed on a planetary surface where both of the two liquids: water and ammonia were present. Both of them are good solvents, but they use up different radicals of amino acids in forming their chemical characteristics in their reactions in the liquids. So amino acids are "Janus-faced" chemicals which have counterpart radicals for both "water-world" and "ammonia-world".

Summary: This eighth Concise Atlas of the Solar System deals with geochemistry and exciting new chemical discoveries of the planetary science. Our goal is to recognize and understand the factors determining the chemical processes. Although they are episodes these chapters may orient students' interest toward planetary petrographic and geologic works and they give new approach possibilities to their chemical and geochemical studies. At the same time it gives new ideas to develop experiments to the Hunveyor [11] and its Husar rover robotic construction program.

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