

Global urbanization - the evolution of the Astysphere

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Within Earth's history, urbanization is a new phenomenon without any former historical analogy. Extended human settlements developed about more than 10,000 years ago. Today, more than half of the global human population is living in urban areas. During the same period the average material consumption per person is estimated to have increased from 6 t/a to 100 t/a [1]. Human beings learned to produce new chemical compounds and to manufacture them in vast amounts. Today, geogenic and anthropogenic material flows already occur in comparable scales [2]. The lion's share of human material consumption and accumulation is caused to maintain urban systems. Material flow is nothing else than chemical element flow, which is a substantial subject of geochemistry. In geochemistry, the concept of spheres was invented by Goldschmidt and Vernatzky to describe the distribution of chemical elements in the Earth system. Later, the term anthroposphere was introduced [3] to define the system of anthropogenic influence on element fluxes. Within the anthroposphere two main element flow determining human activities and living modes can be distinguished, agriculture and urban space. The balancing zone for chemical element flows in agriculture is called Agrosphere [4] and in urban space Astysphere [5]. In the Astysphere, chemical elements are enriched and occur in ratios never possible without human activity. Various, partly very different processes and element flows accumulate here, such as construction and traffic activities, chemical reactions in the urban atmosphere, waste disposal and decomposition or production of alloys and organic chemical compounds creating chemical element distributions worth to be explored in detail by geochemistry to comprehensively understand the global element fluxes, discover resources and to analyse environmental pollution. More detailed examples are part of the presentation elucidating the unique element distribution within the Astysphere and its fundamental meaning for geochemistry.

- [1] Decker EH, Elliott S, Smith FA, Blake DR, Rowland FS 2000, *Ann. Rev. of Energy and the Environment* **25**, 685-740.
[2] Heinloth K 2003, *Die Energiefrage*. Vieweg. Wiesbaden.
[3] Baccini P, Brunner PH 1991, *Metabolism of the Anthroposphere*. Springer. Berlin. [4] Krishna KR 2003, *Agrosphere. Science Publ., Enfield*. [5] Norra S 2009, *Environmental Science and Pollution Research* **16**, 539-545.