Meteorite impacts in West African Craton

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Meteoritic impacts are one of the most important geological processes affecting composition, stucture, energy budget and evolution of planets. Following the differentation of the Earth, the impact of asteroids and comets contributed to build the reservoir of water in the mantle (Daly and Schultz, 2018). The are also likely involved in explaining the present concentation of siderophile elements in the mantle (Willbold et al., 2011), which later concentrated in the crust, foming ore deposits of economic interest. Though the impact flux decreased with time, meteoritic impacts affected the entire history of the Earth. Impact structures are the most obvious indications of these asteroid impacts. There are 190 known impact stuctures on Earth, which document the last 2 billions years of cratering history (Impact crater database, consulted on August 27th, 2018, http://www.passc.net/EarthImpactDatabase/). Older events have been likely erased from the surface of the Earth, by the combined action of tectonic deformation and erosion, but have left possible traces in the sedimentary records, such as the Archean spherules (Simonson and Glass, 2004).
Some of the preserved impact stuctures (about 1/3rd) are associated with mineral deposits (e.g., Cu-Ni, PGE, Zn, Au, Pb) or hydrocarbons (Koeberl and Henkel, 2005). A fraction of these deposits are or have been exploited (e.g.; Ni-Cu-PGE in Sudbury, Gold in Vredefort are the most famous examples). Some of the known impact stuctures are also sites of geotourism, and may represent a local source of income. Impact structures have their intrinsic scientific value. They are considered as analogues for planetary impacts. Understanding geophysical, geochemical, or mineral signatures associated with impacts on other planets (e.g., geophysical signatures of impact basins on the Moon, or secondary phases associated with impact-hydrothermalist on Mars) lead to planetary scientists to carry specific investigations on terrestrial impact stuctures.
Known impact structures are not homogeneously distributed at the surface of the Earth. Large impact structures are preferentially found in Archean and Paleoproterozoic units. The distribution of known impact structures also depend of the number of trained geologists who know the criteria to recognize shock metamosphism in the field (shatter cones), or under the microscope (shoked minerals).
The West Africa Craton hosts several potential impact stuctures, and known impact structures, which are underexplored. We will review in this presentation the most outstanding questions regarding impact structures in the West African Craton, and the current effort of training for the training of students in this field of research in West Africa. This current effort is part of the Africa Initiative for Planetary and Space Science (http://africapss.org), which has been endorsed by many institutions, and scientists in Africa and outside Africa.
Many of the potential structures are currrently situated in unsafe areas in Mauritania, Mali, and Niger, and their exploration is – at best – very challenging. For these stuctures, preparatory work may be carried out, such as compilation of existing remote sensing and geophysical data, and field mission planning, to be ready when conditions of exporation will hopefully become safer. One important potential impact stucture is the depression of Velingagara in Casamance (Senegal). Covered with sediments, the next step here requires a drilling program in the center of the basin. Known impact craters in the West Africa craton have been investigated a various levels, but, west African geologists were not often associated to these investigations. There is room for research programs based on the known west African impact record involving students and researchers in West Africa. For instance, current research are being conducted about the radiometric signature of the Bosumtwi impact structure (Baratoux et al., in revision) and about the associated field of tektites in Ivory Coast (Avo et al., this abstract volume) and future work will also focus on the Mauritanian impact record.

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