THE STOLPEN VOLCANO IN THE LAUSITZ VOLCANIC FIELD (EAST GERMANY) – VOLCANOLOGICAL, PETROGRAPHIC AND GEOCHEMICAL INVESTIGATIONS AT THE TYPE LOCALITY OF BASALT

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The Stolpen Castle Hill, which was designated in Germany as a "national geotope" in 2006 represents the type locality for the rock name basalt (Fig. 1). Agricola had used und published this term the first time in connection with Stolpen in the year 1546 in his publication "De natura fossilium". The presentation looks more closely at the origin of the term basalt, which stretches back to Antique time, especially to Gaius Plinius Secundus (Pliny the Elder, AD 23–79). Agricola (1546) does not call Pliny, but the content clearly follows Pliny (ca. 77: Naturalis historia. – Issue XXXVI, Chapter 58). Violently discussed was considered the term basalt since the first use in the early modern period by Agricola (1546).

Fig. 1 Stolpen Castle Hill with inclined basaltic columns at the western edge – the type locality for the term "basalt".

Various source analyses in antique writings and the find of a new hand written copy from Pliny (ca. 77) in the year 1851 makes it probable, that Pliny had not use the term *basaltes*, but instead the term *basanites* [1]. It is probably an emendation! Beside this scribal error by the handmade copies of the original manuscript, also the rock type described by Pliny is not clear. Probably it was not basalt in today's sense, because Pliny does not mention the typical columns, in contrast to Agricola, he described only the strong hardness and the grey colour like iron. Therefore, various other rock types are also considered in the literature, e.g. lydite or greywacke. Also the regional localization of the "basalt" from Pliny in Egypt and/or Ethiopia is not helpful for the determination of the described rock by Pliny, because she is to general and the text translation is ambiguous (it could also mean Egyptian instead of Egypt). Also not the mentioned sculptures and buildings, which Pliny connected with his "basalt" description, can help, because these objects exist not today or probably only as copy (for the last three topics see among others [2]). For the reasons mentioned above, it is difficult today to determine the linguistic origin and the rock type, which Pliny has originally meant. Presumably, that can barely satisfactorily clarified today. Nethertheless, Acrigola had descripted a basaltic rock with the use of the term basalt at first time from the Castle Hill Stolpen in Saxony (East Germany).

Since Agricola (1546) many different investigations took place at the basaltic Stolpen Castle Hill. But physical-volcanological reconstructions are rare; they are only essentially made by [3] and by [4]. These authors interpret the former volcanic edifice from Stolpen as volcanic plug or (intrusive) lava dome. A geological mapping since 1994 of almost 100 temporary outcrops and recent field observations could give a new and different view [5]. After them, two phases of the volcano formation and a third phase with a morphological overprint of the volcanic edifice can be distinguished (Fig. 2). The first phase creates an over 1000 m deep maar-diatreme structure as result of a phreatomagmatic eruption. The maar crater was located in the Cadomian granodiorite with about 450 × 300 m in size at the former earth surface, the elongated shape is the result of the granite tectonics with main joint direction in NE–SW. After them arose a small scoria cone at the north-western margin of the maar crater and initiates the second phase. The final lava of the phreatomagmatic scoria cone filled the whole maar crater; the scoria wall was almost completely destroyed und float up in the basanitic lava lake. An in situ remnant of a scoria ash tuff between the granodioritic frame and the basaltic lava body and several single scoria inclusions in the basaltic lava of the Castle Hill indicate this scoria cone phase. Both volcanic phases are closely linked in terms of genetic and time, so that

the Stolpen Volcano can be described as a monogenetic or monocyclic volcano.

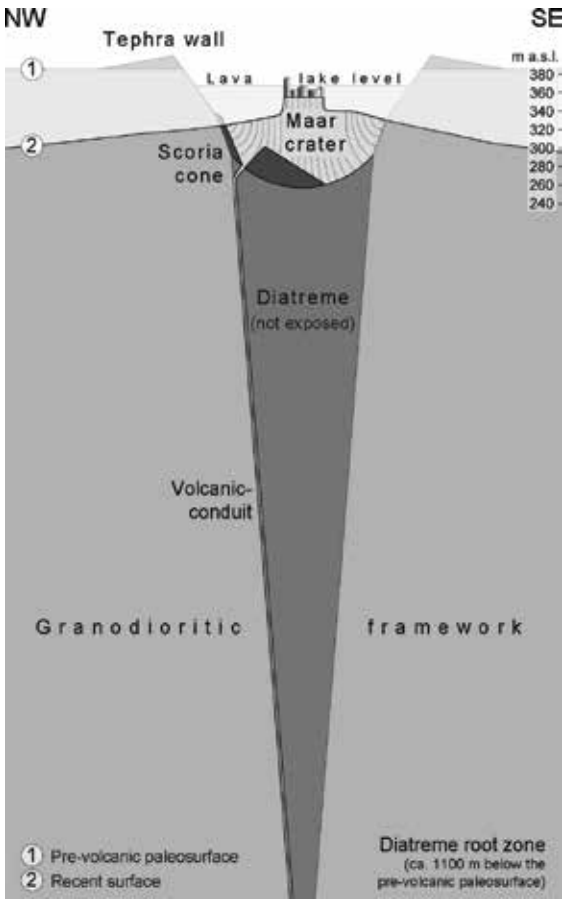

Fig. 2 Geological cross section (in scale 1:1) of the Stolpen Volcano with the estimated erosion parts since volcanic time (light).

The age is after one K–Ar-isotopic determination 25.3 ± 0.5 Ma [6], but K–Ar isotopic age determinations in the Lausitz Volcanic Field [7] suggest an older age of about 30 Ma. Much later, the uplift processes of the Lausitz Block, especially during the Pleistocene, began 1.3 Ma to denudate the granodioritic rock frame and the lava body was morphologically exposed and dominate the landscape as isolated hill today. The minimum denudation amount can be estimated at 100–150 m. Thereafter, the erosion and uplift rate can be calculated of 3.3 mm up 5 mm/kyr since the volcanic time before 30 Ma, which confirms the previous data for the Lausitz Block [8].

In addition mineralogical (QAPF) and geochemical (TAS) research into the petrography of the Stolpen lava rock was undertaken [9]. The results reveal that, in the context of present rock nomenclature, the rock at Stolpen Castle Hill is not basalt and is rather best described as basanite with tendencies towards nephelinite, a typical rock type in the Lusatian Volcanic Field (Fig. 3). Therefore and based on the further demonstrated inhomogeneities in the Stolpen lava rock, the Stolpen Castle Hill is not in a scientific sense a suitable type locality for basalt or basanite. However, outcropping volcanic rocks as well as its scientific historical importance undoubtedly give Stolpen relevance as a type locality for volcanic rocks.

The example of Stolpen poses the question of to what extent historical type localities can be combined with present day rock nomenclature. And furthermore, the question arises whether the definition of type localities for natural rocks makes sense, because these often show transitions and convergences; homogeneous rock bodies occur rarely or not at all in nature.

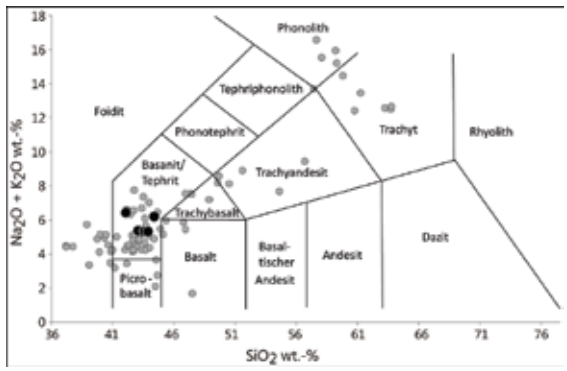

Fig. 3 TAS diagram of lava rocks from Stolpen Volcano (black) in compraision with the Lausitz Volcanic Field (grey); [7], [9].

References: [1] Krafft F. (1994) Scientific Conference "Georgius Agricola – 500 Jahre" Chemnitz, Saxony, 105-115. [2] Humboldt A. (1790) Schulbuchhandlung; Braunschweig: 9–74. [3] Klemm G. (1890/92) Sheet Stolpen 1:25000; Geological map and explanations, Leipzig. [4] Koch E. et al. (1983) *Abh Staatl Mus Mineral Geol Dresden* **32**, 1-144. [5] Tietz O. et al. (submitted) 800 years Stolpen – town Chronicle 2018 (own publishing Scholle/Stolpen). [6] Pfeiffer, L. et al. (1984) *Freib Forsch.-H. C* **389**, 93-97. [7] Büchner J. et al. (2015) *Int J Earth Sci* **104**, 2057-2083. [8] Tietz, O. & Büchner J. (2015) *Z Dt Gesell Geowiss* **166**, 125–147. [9] Büchner J. et al. (in press) *Ber Naturf Ges Oberlausitz* **25**