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# Columnar jointing pattern: characterization and interpretation

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Columnar Jointing (CJ) is commonly observed in slowly cooling lava bodies. The characteristic diameter of the columns is thought to depend on the cooling rate, faster (respectively slower) cooling resulting in larger (smaller) thermo-elastic strain yielding more slender (stout) columns. One of the goals of our CJ project is to analyse whether the characteristic diameter of the columns is also dependent on other factors, such as the chemical composition of the lava and the setting of the cooling lava body. While the laboratory measurements are finished and the bibliography compiled, we present our field measurements including photos, methods and first results.

In order to compare different CJ sites, we develop a procedure to quantitatively characterize the columns. On the field, we collect photos with a well visible scale, either perpendicular or parallel to the columns. Then we use a self-developed, interactive software that processes the photos and performs statistical analyses on the average length of a side (L), on the average cross-sectional area (A), and on the number of sides of columns (N). Using these values, the parabolic relation between A and $L^2$ is determined as a function of N, and compared to ideal polygons. Data from 25 sites across Europe show that the observed areas are smaller than those of the ideal polygons by about 7%. To be able to use photos taken from the side, we calculate the ratios of the distance to the $2^{nd}$ and $3^{rd}$ vertices to L, again as a function of N. The averages of these ratios are as those of ideal polygons, but their standard deviations suggest that the geometry of individual column cross-sections is anisotropic in a random direction. This explanation also underlines the previous result of smaller areas compared to ideal, and suggests that for a given area, the total length of joints is not fully minimized. This is in line with earlier and also present observations that the average number of sides at any CJ site is less than 6.

Preliminary results show that CJ sizes are not directly dependent on chemical composition. The range of L at most sites varies between $8\pm3$ cm to $50\pm15$ cm, although we observed a few sites with column sizes in the order of 1-3 m. The major element composition measurements on rock samples from site where this information was previously not available will help to conclude on this question. Composition, however, may play an important role in an indirect way on the size of CJ. Our field observations show that CJ occurs in different geological settings (lava flow, lava lakes, necks and dykes), and that these might strongly influence the size of CJs by defining the boundary conditions of the cooling lava body. Compilation of our observations and further reading on visited CJ site geology will allow concluding on this question.