By minimal $N$-partition of a given planar domain $E$ we mean a partition which consists of $N$ sets (cells) with equal area, that minimize the total perimeter (that is, the length of the union of the boundaries of all cells).

T. C. Hales proved in 2001 that if $E$ is a flat 2-dimensional torus, then a regular hexagonal $N$-partition (if there is any) is minimal. It is then interesting to understand what happens for a planar domain $E$ that does not admit a regular hexagonal $N$-partition; in particular the following questions naturally arise: Are the cells asymptotically hexagonal as $N$ tends to infinity, and to which extent the partition looks locally hexagonal? Is the partition rigid, in the sense that the orientation of the cells is (essentially) the same through the domain?

In this talk I will describe some results obtained in these directions together with Marco Caroccia (Politecnico di Milano) and Giacomo Del Nin (University of Warwick).