ABSTRACT

The oocyte-to-zygote transition represents the only physiological event in mammalian life cycle, during which a differentiated cell is reprogrammed to become pluripotent. For its most part, the reprogramming relies on the accurate post-transcriptional control of maternally deposited mRNAs. Therefore, understanding the mechanisms of post-transcriptional regulation in the oocyte will help improve our knowledge of cell reprogramming. Short non-coding microRNAs have recently emerged as an important class of post-transcriptional regulators in a wide range of cellular and developmental processes. MicroRNAs repress their mRNA targets via recruitment of deadenylation and decapping complexes, which typically accumulate in cytoplasmic Processing bodies (P-bodies). The presented work uncovers an unexpected feature of the microRNA pathway which is found to be suppressed in fully-grown mouse oocytes and through the entire process of oocyte-to-zygote transition. This finding is consistent with the observation that microRNA-related P-bodies disassemble early during oocyte growth and are absent in fully-grown oocytes. Some of the proteins normally associated with P-bodies localize to the oocyte cortex. At the final stage of oocyte growth, these proteins, together with other RNA-binding factors, form subcortical maternal mRNA storage domains. Furthermore, we find that components of the decapping complex are encoded by dormant maternal transcripts and their activation during meiotic maturation is a prerequisite for the initial wave of maternal mRNA clearance. Together, these data contribute to our understanding of maternal mRNA regulation by elucidating some of the mechanisms responsible for the maintenance of mRNA stabilizing environment during mouse oocyte growth and the switch to mRNA degradation during meiotic maturation.