In this paper, we consider a novel mobile relaying technique, where the relay nodes are mounted on unmanned aerial vehicles (UAVs) and hence are capable of moving at high speed. Compared with conventional static relaying, mobile relaying offers a new degree of freedom for performance enhancement via careful relay trajectory design. We study the throughput maximization problem in mobile relaying systems by optimizing the source/relay transmit power along with the relay trajectory, subject to practical mobility constraints (on the UAV's speed and initial/final relay locations), as well as the information-causality constraint at the relay. It is shown that for the fixed relay trajectory, the throughput-optimal source/relay power allocations over time follow a “staircase” water filling structure, with non-increasing and non-decreasing water levels at the source and relay, respectively. On the other hand, with given power allocations, the throughput can be further improved by optimizing the UAV's trajectory via successive convex optimization. An iterative algorithm is thus proposed to optimize the power allocations and relay trajectory alternately. Furthermore, for the special case with free initial and final relay locations, the jointly optimal power allocation and relay trajectory are derived. Numerical results show that by optimizing the trajectory of the relay and power allocations adaptive to its induced channel variation, mobile relaying is able to achieve significant throughput gains over the conventional static relaying.