An algebraic structure is finitely related if its clone is determined by a finite set of finitary relations. In this thesis we examine graph algebras in order to determine which of them have this property. We provide a brief summary of a background theory and we present an overview of known results, in particular, we emphasize the relation between finitely related algebras and Mal'cev conditions. Further we present basic results about the structure of graph algebras. The main part of this thesis is a partial classification of finitely related graph algebras. We provide proofs for various classes of graph algebras, for example for algebras defined by connected bipartite graphs or algebras defined by graphs containing certain subgraphs, although several cases are missing to complete the classification.