Preparation of new high resolution regional and global magnetic anomaly field models from aeromagnetic and marine compilations (e.g., Australian AWGS and Fifth edition magnetic maps, NAMAM2008, WDMAM, and EMAG2 datasets) and CHAMP satellite based MF6 and MF7 models represent significant advances in our ability to map and interpret regional geologic provinces around the world. Significant advances have also occurred in regional interpretation techniques such as mapping Curie temperatures/magnetic bottom of lithospheric magnetic layers, which in turn allow us to constrain lithospheric temperatures and mineralogy/petrology. Regional reconnaissance magnetic methods have been developed to quickly surmise the thickness of the non-magnetic sedimentary layers on top of magnetic crystalline basement. Integrated interpretations of magnetic, seismological, gravity, magnetotelluric, heat flow, and geological data sets have been used to evaluate seismic hazard and tectonics. These and other important individual magnetic anomaly level methodological advances are discussed in this review.