The presence of near-surface magnetic anomalies over oil and gas accumulations and their contribution to exploration remain somewhat controversial despite encouraging results and an improved understanding of genetic links between hydrocarbon seepage-induced alterations and near-surface magnetic minerals. This controversy is likely to remain since the cause of shallow-sourced sedimentary magnetic anomalies may well be microseepage related, but could also result from other sources such as cultural features and detrital magnetite. The definite way of discriminating between them remains a challenge. In this paper we examine means to deal with this particular purpose using a Bayesian technique known as 'Weights-of-Evidence'. The technique is implemented in GIS to explore spatial associations between known hydrocarbon fields within the central Triassic province of Algeria and sedimentary residual magnetic anomalies. We use the results to show possible application of the method to the recognition of some characteristics (amplitude and width) of anomalies assumed to be induced by hydrocarbon microseepages. Our results reveal strong spatial association with certain typical class of anomalies, confirming therefore hypothesis that hydrocarbon microseepages may result in detectable magnetic anomalies. It is possible to use the anomalies occurring outside the known gas and oil fields to make informed decisions in the selection of new targets for more detailed hydrocarbon exploration.