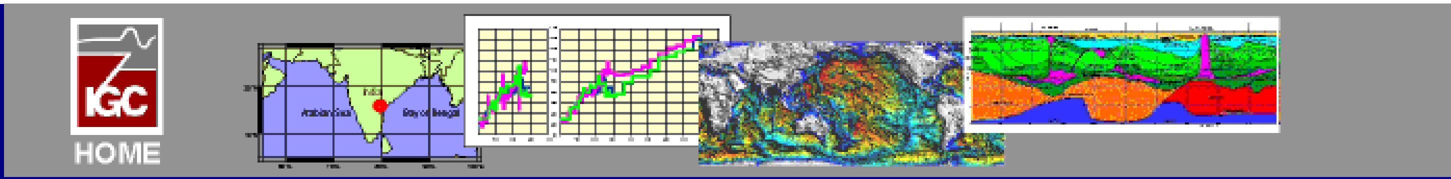

Footnotes on Interpretation

Magnetic Susceptibilities of Sedimentary Rocks

Introduction

The last footnote (Pawlowski, 1996) in this series illustrated the wide variety of geological features within the sedimentary section which can give rise to detectable magnetic anomalies. In this companion footnote, we present the results of a "fast survey" of the published literature on sedimentary magnetic anomalies, summarizing in table form reported magnetic susceptibility values for various sedimentary rocks around the world. We envision this information being a helpful starting point for the interpretation and modeling of sedimentary magnetic anomalies.

Sedimentary Magnetic Properties

The magnetic properties of sedimentary rocks have been documented on a worldwide basis. Table 1 represents a brief compilation of sedimentary magnetic properties from some of the pertinent literature on the subject.

Table 1 illustrates that it is common for sand and shale sequences to have magnetic susceptibilities in the range of at least 25-75 micro-cgs units. These susceptibilities give rise to induced magnetic anomalies of the same order as those which can arise from sedimentary remanent magnetization (see for instance Flanagan et al., 1988). Hence, if information regarding magnetic remanence in the sediments is available, then it should also be used in analyzing the observed sedimentary magnetic anomalies. Usually though, such information is a luxury and an interpreter typically considers him/herself exceedingly fortunate to have information on magnetic susceptibility alone, not to mention magnetic remanence.

Sedimentary magnetic properties vary widely. For instance, some sandstones are more magnetic than many shales, whereas some shales are more magnetic than many sandstones. Thus no hard and fast rules exist which allow an interpreter to use a single characteristic "textbook" susceptibility value for sandstone, and a different characteristic "textbook" susceptibility value for shale. However, it can be reasonably expected that a negative susceptibility contrast will always exist between salt features and sediments. Similarly, carbonate sequences are often less magnetic than shale or sand sequences, shales are often more magnetic than sandstones. Exceptions to these generalizations certainly abound.

Sedimentary magnetic susceptibilities, like those in Table 1, are typically one or two orders of magnitude lower in value than those of crystalline basement and igneous rocks. This explains the historical and more common use of aeromagnetics for basement/igneous studies since, magnetic anomalies from features of the latter type are one or two orders of magnitude larger in amplitude and thus more readily recognized than those due to sedimentary features.

TABLE 1

Literature Survey Of Reported Sediment Magnetic Susceptibilities

Investigator(s)	Year Of Published Results	Location	Unit Or Formation	Approximate Lithology	Susceptibility (micro-cgs units)
Broding, Zimmerman, Somers, Wilhelm, & Stripling	1952	East Texas, U.S.A. East Texas, U.S.A. East Texas, U.S.A. East Texas, U.S.A. N. Mexico, U.S.A.	Sparta Austin Chalk Eagle Ford Weches Rosy Quartz Sand	Sandstone Chalk Shale Sand & Clay Sandstone	2.5 5 20 50 100
Dobrin	1960	Worldwide Worldwide Worldwide Worldwide Worldwide	Phanerozoic Phanerozoic Phanerozoic Phanerozoic Phanerozoic	Salt Dolomite Limestone Sandstone Shale	-0.8 8 (Average) 23 (Average) 32 (Average) 52 (Average)
Fishman, Reynolds, Hudson, & Nuccio	1989	Wyoming-Idaho Thrust Belt, U.S.A.	Middle Jurassic Preuss	Sandstone	0.8-716

Flanagan, Davis, Campbell, & Doughtie	1988	Gulf Of Mexico Offshore, U.S.A.	Pleistocene Nebraskan Aftonian Yarmouth Illinoian Sangamon	Clastics	26 74 55 86 76
Flanagan, Davis, Campbell, & Doughtie	1988	Gulf Of Mexico Offshore, U.S.A.	Pliocene Lower Middle Upper	Clastics	89 46 65
Gay & Hawley	1991	Northwest Nebraska, U.S.A.	Miocene Monroe Creek-Harrison	Eolian Volcaniclastic Silty Sediment	16-188 160 (Average)
Gay & Hawley	1991	Utah Kaiparowits Plateau, U.S.A.	Upper Cretaceous Kaiparowits & Canaan Peak	Sandstone	150 (Average From Modeling)
Gay & Hawley	1991	Southern Belize, Central America	Lower Eocene Toledo	Sandstone	220
Reynolds, Fishman, & Hudson	1991	Alaska North Slope, U.S.A.	Pleistocene Gubik Upper Cretaceous Seabee & Ninuluk	Clay, Silt, Sand, Gravel Siltstone, Mudstone, & Sandstone	Whole Rock Values Not Reported

Saunders, Burson, & Thompson	1991	East Texas Basin, U.S.A.	Surface Soil Surface Soil Surface Soil Surface Soil		15-74 36.8 (Off-Field Average) 17-422 27.9 (Off-Field Average) 24-67 29.9 (Off-Field Average) 25-262 23.3 (Off-Field Average)
Telford, Geldart, Sheriff, & Keys	1976	Worldwide Worldwide Worldwide Worldwide	Phanerozoic Phanerozoic Phanerozoic Phanerozoic	Dolomite Limestone Sandstone Shale	10 (Average) 25 (Average) 30 (Average) 50 (Average)
Zhang	1994	Sichuan Province, China	Middle Jurassic Shaximiao	Sandstone	100
Zhang	1994	Sichuan Province, China	Lower Triassic Feixianguan	Marls And Shales	200-600 High As 1000

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