South African Concretions of Controversy

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Starting with popular articles, i.e. Barritt (1982) and Jimison (1982) published in tabloid magazines, fringe archaeologists have created controversy by misidentifying spherical to disk shaped objects collected from pyrophyllite deposits being mined by Wonderstone Ltd., near Ottosdal, South Africa as intelligently designed and manufactured artifacts. Although Cairncross (1988) and Pope and Cairncross (1988), correctly identified these objects as natural concretions, fringe archaeologists and UFO researchers have continued to argue that these concretions are either possible or actual artifacts of manmade or extraterrestrial origin, called "Out-Of-Place-Artifacts", and valid evidence of either billion-year old civilizations or extraterrestrial visitations in books (Cremo 1996, 1999), videos (BC video 1996), articles (Jochmans 1995), and Internet web pages. Given their age and folklore, which is still being globally published in popular books, articles, and Internet web pages, a more detailed discussion, than previously published, of the nature of these concretions was considered to be in order.

Occurrence

The Ottosdal concretions occur pyrophyllite, which is called "wonderstone", mined by Wonderstone Ltd. near Ottosdal, North-West Province, South Africa. Wonderstone consists of 89 percent pyrophyllite, 9.5 percent rutile and 1.5 percent unidentified mineral, which may be either chloritoid or epidote. Wonderstone is metamorphosed clay, very likely bentonite, which was created by the alteration of volcanic ash. The presence of ripple marks on some bedding planes within the Wonderstone indicates that it in part accumulated within some type of water body (Nel et al 1937, Keyser 1998, Jackson 1992).

The Wonderstone occurs, along with "pink tuff" and felsic porphry, interbedded as thin beds within a 2.7-kilometer thick pile of mafic to intermediate amygdaloidal lava, which is known as the Rhenasterhoek Formation. The lavas and felsic porphyries have been heavily altered by greenschist metamorphism, accompanying recrystallization, and replacement by silica and carbonates. The Rhenasterhoek Formation is estimated to have accumulated about 3,000 to 3,100 million years ago (Keyser 1998, Jackson 1992).

Methodology

I obtained from Dr. Susan J. Webb of the University of the Witwatersrand, Allan Fraser of Onlineminerals.com and Desmond Sacco a total of five specimens of these concretions. Their color was described using Munsell Color Company (1975) and their dimensions were measured. After photographing all of the specimens, three of these specimens were sliced on a trim saw. One specimen, Ottosdal-2, was analyzed using petrographic and X-ray diffraction techniques. Later, Mary A. Holmes of the Geosciences Department at the University of Nebraska at Lincoln analyzed two specimens, Ottosdal-2 and Ottosdal-4, using X-ray diffraction techniques.

Results

Contrary to the descriptions typically found in popular books and articles about them being singular and either "perfectly round" or "spheres", these concretions vary greatly in shape and are often intergrown (figure 1). The specimens, which I acquired, varied from either spherical to subspherical to either flattened disks or concretions intergrown together like soap bubbles. The specimens that were studied for this paper varied from 3.6 to 8.5 cm in length and 1.3 to 5.2 cm in height. The ratio of height to length of the five objects studied varied from 0.30 to 0.83. The color of these concretions, which were studied, ranged from dark reddish brown, red, to dusky red, as defined in Munsell Color Company (1975).

Some of these concretions exhibit one to three, poorly to well-developed longitudinal grooves. Photographs of three-grooved concretions obtained from the Klerksdorp Museum (van Heerden 2007) and exhibited on a web page (Anonymous 2002), show they are oval in form and can consist of two intergrown concretions.

The internal structure of these concretions shows features common to concretions. Each of three specimens, which were cut, exhibited well-defined internal radial structure and concentric layering. In addition, the ghosts of relict laminations inherited from sediments in which these concretions formed were also evident.

X-Ray diffraction and petrographic analyses found concretions composed of two different minerals. Specimen Ottosdal-2 consisted of pure hematite. Specimen Ottosdal-4 consists of wollastonite mixed with minor amounts of hematite and goethite. Observations by Cairncross (1988) indicate that some of these concretions also consist of pyrite.

Discussion

Fine internal radial structure of the hematite concretions suggests that the hematite is pyrite altered by oxidation. The hematite concretions likely are pyrite concretions, which Nel et al. (1953) and Cairncross (1988) reported as also occurring in wonderstone, altered by surficial (near surface) oxidation within it. The wollastonite, which comprises specimen Ottosdal-4, was likely created by the metamorphism of calcium carbonate in the presence of silica-rich fluids. The silica-rich fluids were generated by the alteration of volcanic ash to pyrophyllite. These silica-rich fluids also silicified lavas lying adjacent to the pyrophyllite beds. The internal structure, shape, and original carbonate and pyrite composition are all indicative of these objects being among the oldest known concretions.

As proposed by Cairncross (1988), the grooves exhibited by these concretions are natural in origin. The longitudinal grooves, which some of these concretions exhibit are inherited from finer grained laminations within the sediments in which they grew. Because of the lesser permeability and porosity of finer-grained sediments composing them, the growth of the concretions was inhibited within the finer grained lamina relative to the surrounding sediments created the grooves.

How this process can produce longitudinal grooves and ridges on spherical and sub-spherical concretions is well illustrated by innumerable iron oxide concretions found within the Navajo Sandstone of southern Utah called "Moqui marbles" (Chan et al. 2004). These concretions exhibit well-developed longitudinal ridges and grooves related to laminations in their host sediment. They are more pronounced and irregular than in Ottosdal concretions because they grew in sandstone, which is much more permeable than the fine-grained sediment in which the Ottosdal concretions formed.

Insert fig 1 here …………………..

Fig. 1: Examples of Concretions from the Ottosdal pyrophyllite deposits. A. Disk-shaped concretion. B. Spherical concretion with faint longitudinal groove. C. Sub-spherical concretion with poor developed longitudinal groove and scar with second concretion was attached to it. D. flatten specimen consisting of inter-grown concretions.

Insert fig 2 here …………………..

"Figure 2. Cut face of concretion showing typical internal structure of the Ottosdal concretions. Like some of these objects, this specimen consistsof two intergrown concretions. The specimen is 6.2 cm wide."

Specimen Ottosdal-4,

Specimen Ottosdal-2

Conclusions

As observed by Cairncross (1988), the numerous, often spherical and sub-spherical and grooved, objects, which have been recovered from the Wonderstone mines near Ottosdal are classical examples of natural concretions. The real importance of these concretions is their age. Being about 3000 to 3100 million years old (3.0 – 3.2 billion) they are among the oldest known identifiable concretions yet found. These concretions, if studied in detailed, might provide additional knowledge about the paleoenvironment at a time in Earth's distant Precambrian prehistory, from which little evidence has survived.

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