Appia and the demand for the critical Heavy Rare Earths

written by Jack Lifton | November 6, 2023

The rare earths necessary for the manufacturing of the magnets needed for the type of electric motors that can drive electric cars fall into two categories, the basic critical permanent magnet rare earths, neodymium (Nd) and praseodymium (Pr), and the critical, critical rare earths necessary for that purpose, dysprosium (Dy) and terbium (Tb). Without the addition of Dy and/or Tb to the alloy based on NdPr (a natural mixture called didymium) the magnetic material produced will not be able to maintain its (magnetic) strength at the high operating temperature and cycles of heating and cooling experienced daily by the electric drive motors to be used in EVs.

Unfortunately, while rare earth bearing deposits with NdPr contents of 16% to 25% of the total of rare earths contained are fairly well known, such deposits do not contain more than a "trace" of Dy and Tb. Dy and Tb, therefore, were laboratory curiosities until almost the end of the twentieth century when large areas of the formations known now as ionic adsorption clays were discovered in southern China's Jiangxi Province. These, at or near, surface formations are the result of the natural weathering (dissolution) of rare earth bearing granites by tropical (warm) rains, creating, after a few hundred thousand centuries, "deposits" of porous clays in which the rare earths have been chromatographed (partially separated) by atomic number.

The lower atomic numbered rare earths such as cerium and lanthanum are barely present in these clays. They do have substantial distributions though of the basic critical magnet rare earths, Nd and Pr, and surprisingly and luckily, the highest relative concentrations of the higher atomic numbered rare earths, such as Dy and Tb, known anywhere. In addition, the rare earth elements are “adsorbed” on the clay particles; not chemically bound, so that they can be extracted from the clays by a simple wash of the common agricultural chemical, ammonium sulfate in water solution.

The clays in China are processed “in situ,” i.e, in place, by pumping an ammonium sulphate solution through the clay and then collecting the solutions in downstream plastic tanks where the rare earths are then precipitated as water insoluble carbonates or oxalates for transport to a processing plant where they are separated from each other and ultimately become part of alloys that can be magnetized and can maintain their magnetization at high temperatures. These ionic clay formations containing, in China, perhaps 300-1000 ppm of rare earths were the only commercial sources known for the heavy rare earths until quite recently when similar deposits in southeastern Asia in line with those in China were discovered.

In particular, Myanmar, formerly known as Burma, has significant ionic adsorption clays bearing rare earths. But China has acquired the rights to all of those that are being mined in Myanmar today, perhaps to exhaustion, with the output going exclusively to China. So too, with the ionic adsorption clay deposit known as Serra Verde in Brazil. This is a very good clay deposit, and it is scheduled to produce 2000 tpa of NdPr and 200 tpa of DyTb annually. But like Myanmar, all of this material will go to China.

Enter now, Appia Rare Earths & Uranium Corp. (CSE: API | OTCQX: APAAF), and its PCH discovery in Brazil. This looks to be a true ionic adsorption clay with, perhaps, the highest known total adsorbed rare earths concentration, so far discovered, of all or the majority ionic adsorption clay on this planet. The juniors have now descended upon Brazil, and announcements of deposits of “heavy rare earths sourced from ionic adsorption clays” are the flavor of the month. I still think we may be looking, in the case of Appia’s PCH deposit at the best ionic adsorption clay deposit in the Americas in the sense that it can be easily extracted with legacy in situ processing. It is a key discovery that, if properly developed, will benefit greatly the EV industries of North America and Europe. There are few sure things in life, I admit, but this is likely to be one of them.

For those who want to argue that the Appia deposit is a mix of adsorbed rare earths and microcrystalline (chemically, covalently, bound rare earths) I will counter that it is the total cost of extracting the critical rare earths and the efficiency of that extraction that matters. Some of the “ionic clay” deposits require an acid leach after the aqueous leach to extract sufficient magnet rare earths; some of the “deposits” are simply too low a grade or the mix of magnet and non-magnet rare earths is skewed in favor of non-magnet rare earths. From the data that Appia has published, I believe that PCH is a major, economic, deposit with a very high recoverable grade of heavy magnet rare earths, and as such it is a key deposit for the re-development of a non-Chinese rare earth permanent magnet industry.