How the Rota Period Handles Some Periodic Table Anomalies

These anomalies are discussed in Professor Eric Scerri's Book: The *Periodic Table, Its Story and Its Significance,* Chapter 10, 2007. This is not a criticism of his book. It is a launch pad for explaining the benefits of the Rota Period, based upon one chapter of Scerri's book. It is an attempt at explaining some of the questions people have about the periodic table, while presenting a new one.

As Scerri says: "Nothing is ever simple as far as the elements are concerned."

1. Diagonal Behavior (pages 265/266)

- Li and Mg and related diagonally
- Beryllium and Aluminum are related diagonally
- Boron and Silicon are related diagonally.

Comments: the Rota Period does not explain this anomaly, but it is easy to see these relationships. In today's PT it is only a little harder to see the anomaly because of the gap between Beryllium and Aluminum. I am now wondering how many scientists have stopped looking for more elements that show this anomaly because of that gap?

While I am not the right person to do the following research, here are my predictions for other elements that **might** display this behavior: Na and Ca, Mg and Sc, Al and Ti, Zn and Yt, Ga and Zr, Ag and Cd, Cd and La, Hg and Ac, Tl and Th, Au and Pb.

2. n, n+10 (pages 267/268)

Comments: The n, n+10 anomaly does not really work with the Rota Period because the anomaly is based upon the group structure of today's periodic table; however, some of the discussion points leading up to this anomaly support the Rota Period.

For example: I would expect Mg and Zn to show similarities because they both can be 2+, not because of n, n+10.

The reference to Fathi Habashi's Al + Sc article (page 267). In my opinion there is nothing really amazing about his discovery aside from pointing out that today's PT does not handle this well. Habashi made the case that Aluminum and Scandium are similar so should be closer together (this is shown in the Rota Period which essentially combines Group 3 and 13 into one group). Scerri gives more evidence about the similarities between Aluminum and Scandium. I see nothing that suggests this is an n, n+10 result – since both Al and Sc can be 3+. As for the unusual case of Boron (dissimilar to Al and Sc), I would suggest this is because it has a low atomic number.

Later on in Chapter 10 Scerri mentions the particular halides of Al, Ga and Sc. The question is, are they similar or not? The Rota Period suggests the halides of Al and Ga are similar because they are both 3+ **and** because they both occur at the end of a period (relatively near to their respective halogens). Although Al is positioned at the end of a period, it also positioned at the beginning of a period, which makes it very unique – only the first two period elements have this as a possibility, whereas the 3+ of Scandium occurs at the beginning of a period, but not at the end of a period (relatively further away from the halogens). I do not know why being positioned at the beginning/end of period demonstrate uniqueness (probably has to do with atomic numbers), only that it can be seen easily using my periodic table.

Prediction: if you use atomic numbers as the basis for n, n+10 (instead of groups, simply count forward 10 after the element in question), the Rota Period suggests the following elements **might** also show similarities: Au (Ac), Ca (Zn), Sc (Ga), Ti (Ge), Zr (Sn), Hf (Pb). I suggest this is not because of n, n+10, but because they all have the same valence and happen to be 10 elements apart. It also predicts the n=5, n=6, n=7 and n=8 similarities that Scerri refers to.

In summary I am suggesting that the n, n+10 anomaly is rooted in atomic numbers, not groups (assigned by IUPAC).

3. Copper Silver and Gold

Scerri states that these elements are similar to each other and not similar to Group 1 elements (even though they may contain the same valence as Group 1); but he does it in response to the n, n+10 anomaly, which (as mentioned above) I believe is biased because it is based upon the group structure of today's PT and not upon something physical, like atomic numbers. I think this anomaly probably has nothing to do with n, n+10 and should be considered a new anomaly on its own right.

Comments: In my opinion there is no reason to expect Group I (IUPAC Group 1) to be similar to these elements, because the elements in question are all Transition Elements (they occur in the middle of a period), so while they share valence with Group 1 they are not directly related to Group 1. This is easily seen in the Rota Period.

4. Groups 4, 5 and 6 (page 270)

Scerri points out that a number of anomalies/analogies have been noted between Th being similar to Ti, Pa similar to V, and U similar to Cr. I reproduce his page 270 Figure 10.10 here with the addition of showing valence:

Valence	4+	5+	6+
Group	4	5	6
	Ti	V	Cr
	Zr	Hb	Mo
	Hf	Ta	W
	Th	Pa	U

I agree with Scerri in explaining that this anomaly/confusion was caused by the evolution of today's PT (Figure 1.9, Chapter 1, page 23), caused by the Lanthanides (at the time called Rare Earth Metals) and Actinides (new) and how to position them. They ended up as a separate table in today's PT, which makes it a little hard to see valences (i.e., it is hard to follow the logic of a separate table). I am sure many teachers have experienced students who lose the logic when they encounter the L & A Series.

There is no confusion in the Rota Period – they are all grouped according to their valence and the Lanthanide & Actinide Series are incorporated (which is one of the biggest benefits of the Rota Period). I go further and suggest that Ce and Rf (4+), Pr and Db (5+), Nd and Sg (6+) may also exhibit similar characteristics to their primary valence group. Not only are the secondary characteristics of some of these elements unknown, the valence of Sg is not known at all. Perhaps Sg is not a 6+!

The Rota Period lists these unknown valence elements as a list of Unknown Valence Elements instead of trying to place them in the periodic table. This might encourage students: they could be the ones who discover the characteristics of these elements. In today's periodic table (while confusing) it looks like it has already been figured out, when it has not.