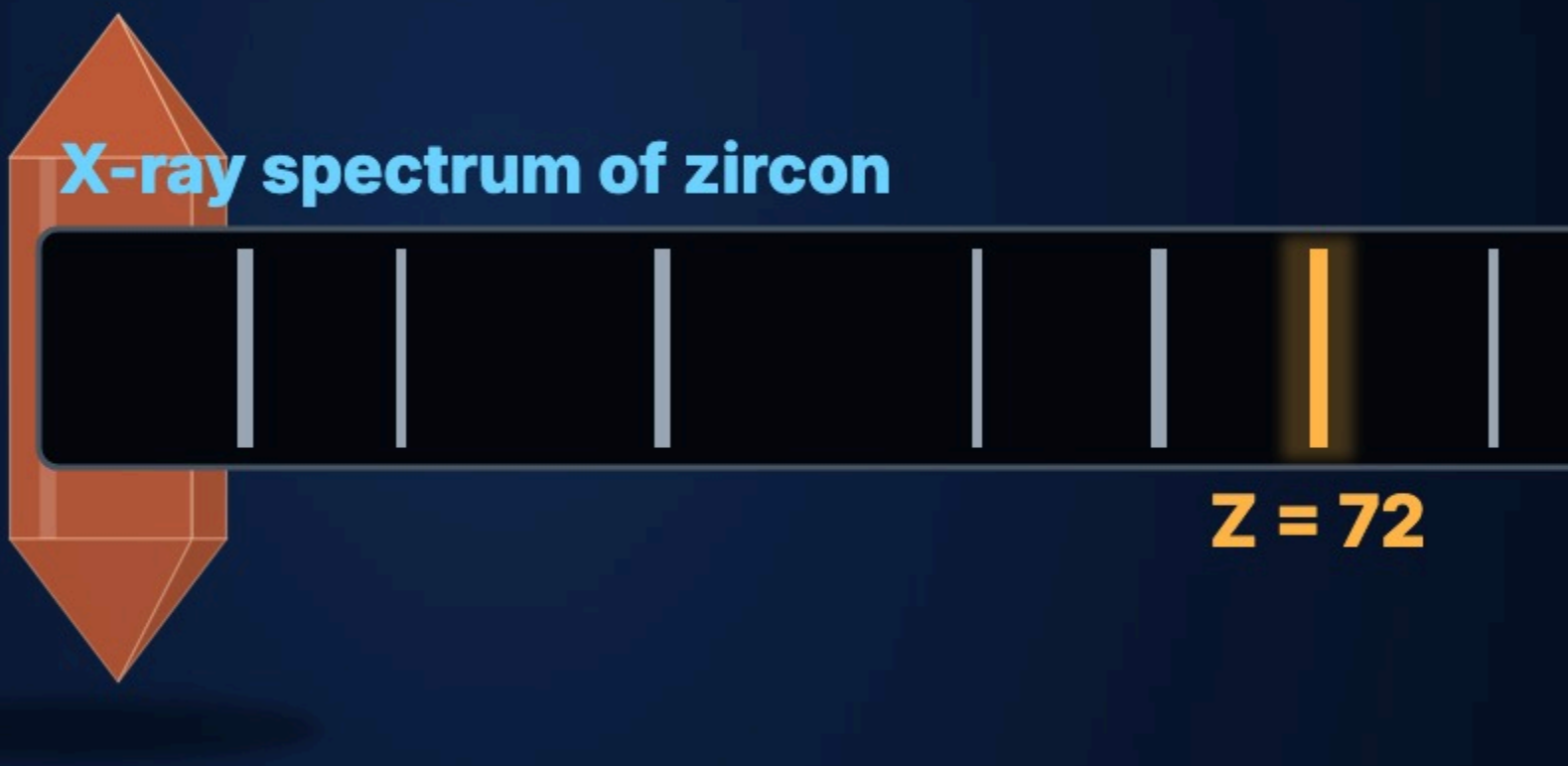
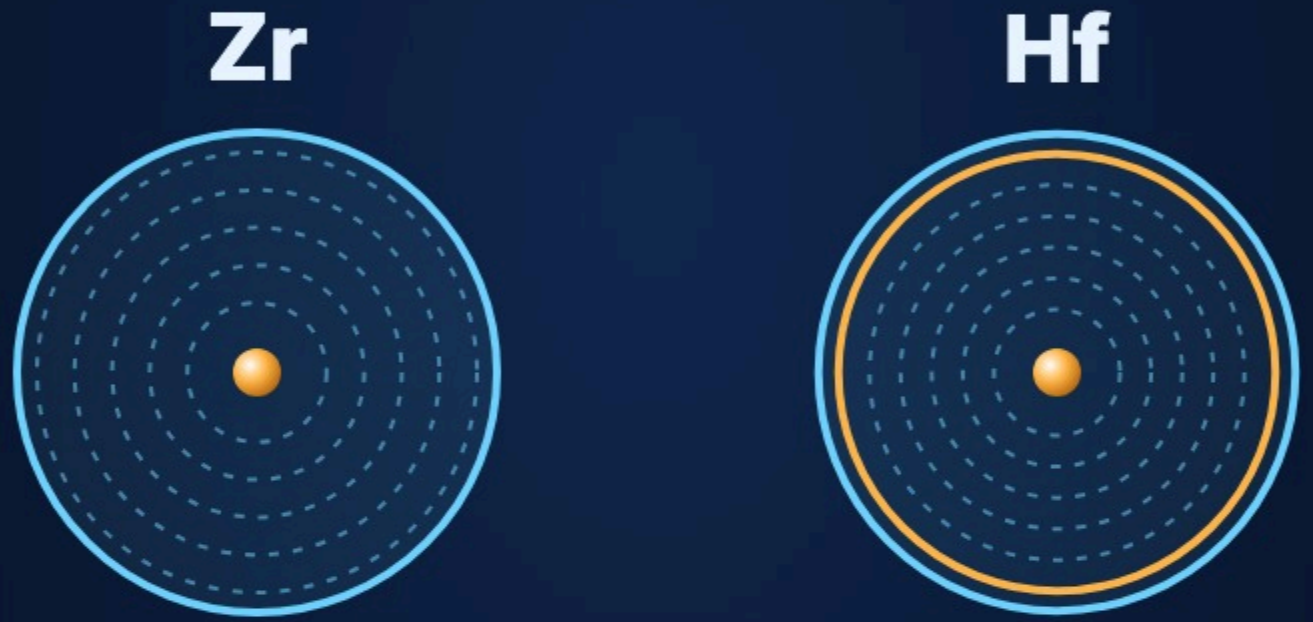
The element that hid



Zirconium was found in zircon in 1789.

Hafnium, hiding in the same mineral, was found only in 1923 (by X-rays).

Same size, despite +32 electrons



Hf has **32 more electrons and one more shell** than Zr.

Yet its radius is **159 pm vs 160 pm**.

Down group 4 the line goes flat



Ti → Zr: radius **increases** (new shell).

Zr → Hf: expected to grow, but **stays the same**.

Lanthanoid contraction



La^{3+} 103 pm → Lu^{3+} 86 pm

Across the 14 lanthanoids (between La and Hf) the size **steadily decreases**.

This steady shrink is the **lanthanoid contraction**.

Why: 4f shields poorly



shielding: s > p > d > f

Each step: **+1 proton**, and the new electron goes into **4f**.

4f shields the outer electrons poorly, so they are **pulled in**.

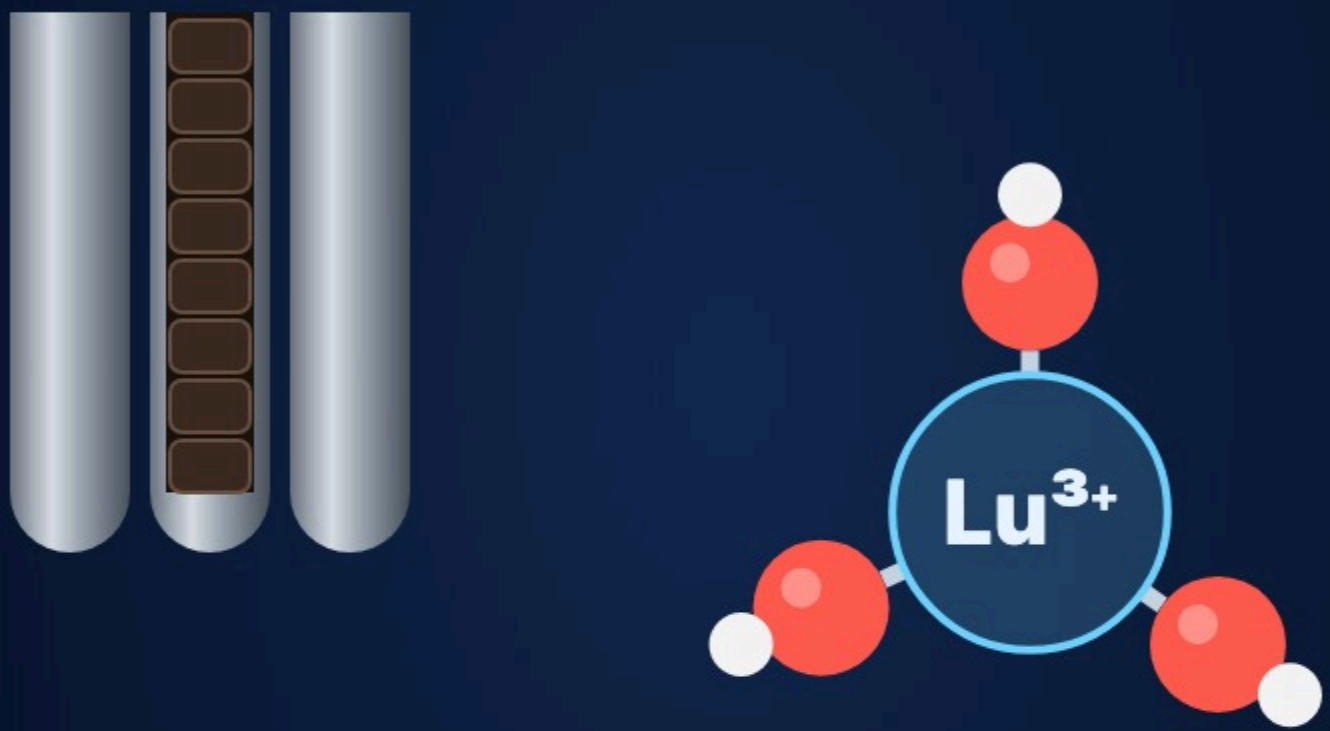
It adds up: twins

Zr ≈ Hf	Nb ≈ Ta	Mo ≈ W
160 · 159 pm	146 · 146 pm	139 · 139 pm

14 small shrinks **cancel** the extra shell of period 6.

So 4d and 5d pairs (Zr/Hf, Nb/Ta, Mo/W) are **almost the same size**.

Consequences



Zr and Hf occur together and are **very hard to separate**; Hf absorbs ~600× more neutrons, so reactor Zr must be Hf-free.

Basicity of $Ln(OH)_3$ **decreases from La to Lu.**

Remember



Poor 4f shielding → steady shrink La → Lu → Zr ≈ Hf, hard separation, basicity ↓.

Your case: Y^{3+} is the size of Ho^{3+}. Which elements does yttrium hide with?