Supporting Information

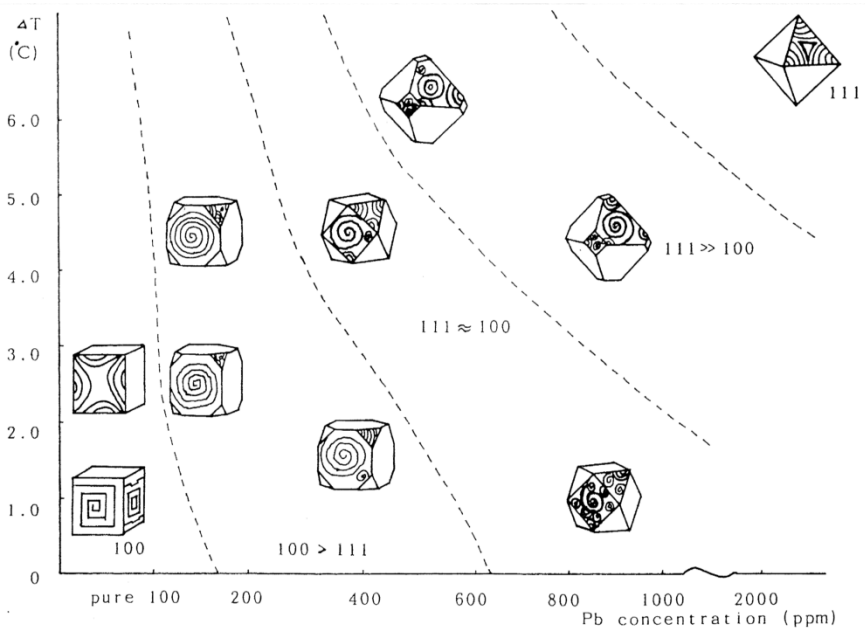

Fig. 1 (S.I.) Morphodrome of KCl crystals growing at different supersaturation values and under different Pb concentration (ppm) in solution. This is the original Figure that can be found in the paper: Lian, L.; Tsukamoto, K.; Sunagawa, I.; J. Crystal Growth 1990, 99, 150. Surface patterns are drawn in detail on different as grown surfaces. σ (%) represents the supersaturation, while ΔT is the corresponding temperature difference from the equilibrium (saturation) temperature.
Fig. 1 in the main text has been inspired from Fig. 1 (S.I.) and redrawn for the sake of clarity.

Surface patterns of KCl (cube + octahedron) grown in the presence of Pb.

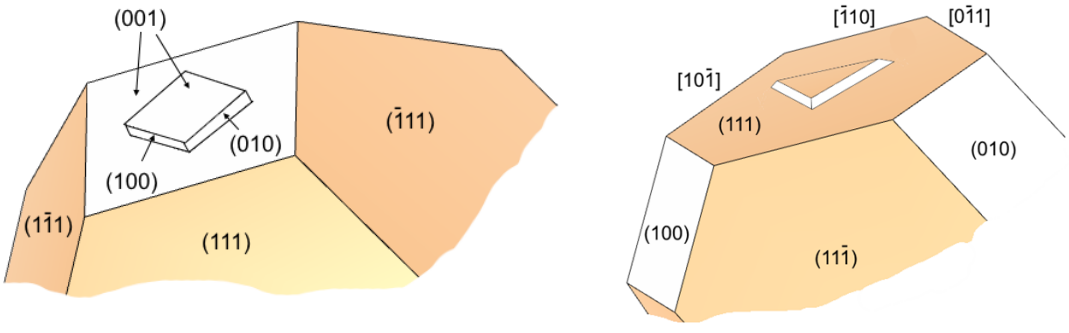

Fig. 2 (S.I.) Scketch of the surface patterns observed on KCl crystals grown in the presence of Pb, as shown in Fig. 4. Left side: the cube face, let's say (001), is limited by four equivalent <110> edges and is populated by growth islands limited by macrosteps having the structure of the cube faces (100) and (010), while the terrace of the island has the structure of the (001) substrate. Right side: onto a (111) octahedron face, limited by six equivalent $<\bar{1}10>$ edges, the growth islands are defined by macrosteps having the structure of the faces (100), (010) and (001); the terrace of the island has the structure of the underlying (111) face. White color stays for cubic surface structure, while orange color stays for the octahedral one.

Surface structures of some crystal forms of Cotunnite-$PbCl_2$

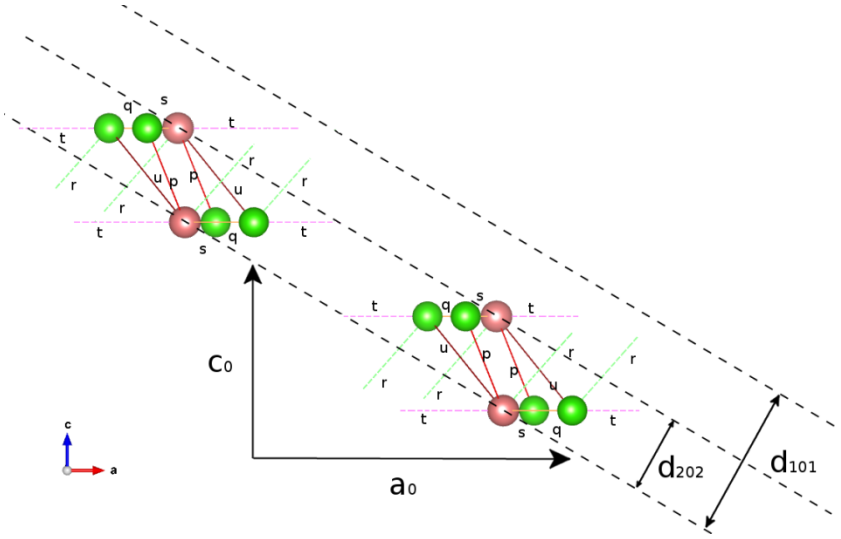

Fig. 3a (S.I.) Projection along the [010] direction of the $PbCl_2$ structure. The composition of a slice with thickness d_{202} shows that the PBCs running along the [010] direction are not connected within the slice thickness. Since the slices of thickness d_{101} are not allowed, owing to the extinction rules, the character of the corresponding {101}form is decidedly stepped. According to the Hartman-Perdok method, {101} is a S form.
Chlorine atoms- green color

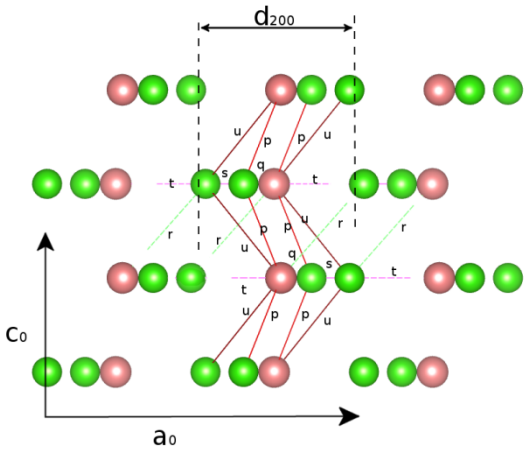

Fig. 3b (S.I.) Projection along the [010] direction of the $PbCl_2$ structure. The composition of a slice with thickness d_{200} , allowed by the extintion rules, shows that the PBCs running along the [010] direction are connected within the slice thickness. Thus, according to the Hartman-Perdok method, {100} is a F (flat) form. Nevertheless, the figure shows that the {100} surface profile is markedly wavy, even if the face character allows that this form can grow layer by layer (of minimum thickness d_{200}).
Chlorine atoms- green color

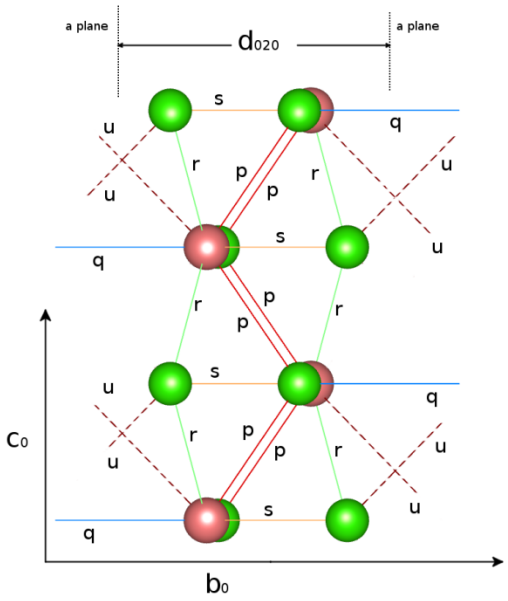

Fig. 4 (S.I.) Projection along the [100] direction of the $PbCl_2$ structure. The composition of a slice with thickness d_{020} shows that the PBCs running along the [100] direction are strongly connected, within the slice thickness, by 2p(2.873 Å) and 2r(3.072 Å) bonds. Each d_{020} slice is confined within two *a*-glide planes, which render non-polar the {010}surfaces that, in turn, do not need to be reconstructed.
Chlorine atoms- green color.

The reference frame we adopted for $PbCl_2$, in order to improve the PBC analysis carried out by Woensdregt – Hartman (1988), was that determined by Y. Z. Nozik, L.E. Fykin, L.A. Muradyan, Soviet Phys. Crystallography 21 (1976) 38-40; Krystallographia, 21 (1976) 76-79

Then, we used, for $PbCl_2$: a_0 = 7.615 Å, b_0 = 9.022 Å, a_0 = 4.514 Å, associated to the orthorhombic space group *Pnam* and to the following atomic positions

atom	Fractional coordinate (x/a_0)	Fractional coordinate (y/b_0)	Fractional coordinate (z/c_0)
Pb	0.2607	0.0955	0.25
Cl_1	0.8575	0.0745	0.25
Cl_2	0.4773	0.8379	0.25

The symmetry operations related to the *Pnam* setting were: x,y,z; -x, -y, (½+z) ; (½+x), (½-y), z; (½-x), (½+y), (½+z). The glide planes *n* and *a* are located at x=(1/4), (3/4) and y=(1/4), (3/4), respectively. The mirror planes *m* are located at z=(1/4), (3/4).

To help the reader, in the following Table the atoms belonging to the $PbCl_2$ elementary cell are labelled, along with their fractional coordinates.

	x	y	z			(½+x)	(½-y)	z
Pb_1	0.2607	0.0955	0.25		Pb_3	0.7607	0.4045	0.25
Cl_{11}	0.8575	0.0745	0.25		Cl_{13}	0.3575	0.4225	0.25
Cl_{21}	0.4773	0.8379	0.25		Cl_{23}	0.9773	0.6621	0.25
	-x	-y	(½+z)			(½-x)	(½+y)	(½+z)
Pb_2	0.7393	0.9045	0.75		Pb_4	0.2393	0.5955	0.75

Cl_{12}	0.1425	0.9255	0.75		Cl_{14}	0.6425	0.5745	0.75
Cl_{22}	0.5227	0.1621	0.75		Cl_{24}	0.0227	0.3379	0.75

In the following Table, the interatomic Pb-Cl bonds are labelled along with their length (Å). Besides the label δ_i , the symbols used by Woensdregt –Hartman are also indicated (in parentheses).

Bond label	Bond length (Å)	Atoms involved	Bond disposition
δ_1 (s)	2.845	Pb_1 - Cl_{21} $[0\bar{1}0]$ Pb_2 $[0\bar{1}0]$ - Cl_{22} Pb_4 - Cl_{24} Pb_3 - Cl_{23}	z = 1/4 z = 3/4 z = 3/4 z = 1/4
δ_2 (p)	2.873	Pb_2– Cl_{11} [010] Pb_3 – Cl_{14} Pb_4 – Cl_{13} Pb_1 – Cl_{12} $[0\bar{1}0]$	all bonds connect atoms at z = 1/4 with atoms at z = 3/4
δ_3 (q)	3.066	Pb_1 – Cl_{13} Pb_4 – Cl_{12} Pb_3 – Cl_{11} Pb_2– Cl_{14}	z = 1/4 z = 3/4 z = 1/4 z = 3/4
δ_4 (r)	3.072	Pb_2– Cl_{21} Pb_3 – Cl_{24} [100] Pb_1 – Cl_{22} Pb_4 – Cl_{23} $[\bar{1}00]$	all bonds connect atoms at z = 1/4 with atoms at z = 3/4
δ_5 (t)	3.076	Pb_1 – Cl_{11} $[\bar{1}00]$ Pb_2 – Cl_{12} [100] Pb_3 – Cl_{13} Pb_4 – Cl_{14}	z = 1/4 z = 3/4 z = 1/4 z = 3/4
δ_6 (u)	3.628	Pb_1 – Cl_{24} Pb_4 – Cl_{21} Pb_3 – Cl_{22} Pb_2 – Cl_{23}	all bonds connect atoms at z = 1/4 with atoms at z = 3/4

Laurionite PbCl(OH)

We used, for PbCl(OH) : a_0 = 9.6987 Å, b_0 = 4.0203 Å, a_0 = 7.111 Å, associated to the orthorhombic space group *Pcmn* and to the following atomic positions

atom	Fractional coordinate (x/a_0)	Fractional coordinate (y/b_0)	Fractional coordinate (z/c_0)
Pb	0.0877	0.25	0.79736
O	0.0422	0.25	0.12230
H	0.1100	0.25	0.22300
Cl	0.8202	0.25	0.55640

The symmetry operations related to the *Pcmn* setting were: x,y,z; -x, (½+y), -z; (½+x), (½+y), (½-z); (½-x), (½-y), (½+z). The glide planes *c* and *n* are located at x=(1/4), (3/4) and z=(1/4), (3/4), respectively. The mirror planes *m* are located at y=(1/4), (3/4).

In the following Table the atoms belonging to the PbCl(OH) elementary cell are labelled, along with their absolute coordinates (Å) .

	x	y	z			(½+x)	(½+y)	(½-z)
Pb_1	0.85057	1.005	5.67002		Pb_3	5.6999	3.0152	4.99647
O_1	0.40928	1.005	0.86967		O_3	5.25863	3.0152	2.68582
H_1	1.0668	1.005	1.58575		H_3	5.9162	3.0152	1.96974
Cl_1	7.95487	1.005	3.95656		Cl_3	3.10552	3.0152	6.70994
	-x	½+y	-z			(½-x)	(½-y)	(½+z)
Pb_2	8.84812	3.0152	1.44097		Pb_4	3.99877	1.005	2.11452
O_2	9.28941	3.0152	6.24132		O_4	4.44006	1.005	4.42517
H_2	8.63184	3.0152	5.5252		H_4	3.78249	1.005	5.14125
Cl_2	1.74382	3.0152	3.15444		Cl_4	6.59317	1.005	0.40106

Challacolloite $KCl{\cdot}2PbCl_2$

In the following Table the four sets of atoms belonging to the $KCl{\cdot}2(PbCl_2)$-challacolloite elementary cell are labelled, along with their fractional coordinates.

	x	y	z			-x	-y	-z
K_1	0.0151	0.0429	0.8295		K_2	0.9849	0.9571	0.1705
Pb_{11}	0.5054	0.9863	0.1736		Pb_{12}	0.4946	0.0137	0.8264
Pb_{21}	0.2429	0.9353	0.4937		Pb_{22}	0.7551	0.0647	0.5063
Cl_{11}	0.0413	0.3082	0.0715		Cl_{12}	0.9587	0.6918	0.9285
Cl_{21}	0.4660	0.3455	0.1011		Cl_{22}	0.534	0.6545	0.8989
Cl_{31}	0.2555	0.1471	0.3110		Cl_{32}	0.7455	0.8529	0.6890
Cl_{41}	0.2728	0.5306	0.4873		Cl_{42}	0.7272	0.4694	0.5127
Cl_{51}	0.2175	0.6941	0.2195		Cl_{52}	0.7825	0.3059	0.7805
	x	½ - y	½ + z			-x	½ + y	½ - z
K_3		0.4571	0.3295		K_4		0.5429	0.6705
Pb_{13}		0.5137	0.6736		Pb_{14}		0.4863	0.3264
Pb_{23}		0.5647	0.9937		Pb_{24}		0.4353	0.0063
Cl_{13}		0.1918	0.5715		Cl_{14}		0.8082	0.4285
Cl_{23}		0.1545	0.6011		Cl_{24}		0.8455	0.3989
Cl_{33}		0.3529	0.8110		Cl_{34}		0.6471	0.189
Cl_{43}		0.9694	0.9873		Cl_{44}		0.0306	0.0127
Cl_{53}		0.8059	0.7195		Cl_{54}		0.1941	0.2805