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*Waste Heaps in
Germany*

*Die Halden in
Deutschland,
6 814 million m³*

Lara Almarcegui

Waste Heaps in Germany (Die Halden in Deutschland) (2025) is an artwork that explores the future of waste and the topography created by mining activities. It involves identifying all the industrially deposited waste dumps throughout Germany in order to estimate the total volume of terrain that they form. Displayed as a 17-meter-long wall text at the Art Museum Moritzburg Halle (Saale), the work presents a calculation of the vast volume of waste generated by overburden rock over the last 175 years of German mining, raising questions about the future potential of recently formed terrain.

Recognizing that the total extension of waste ground remains unknown, and acknowledging the need for information to plan new uses, a collaboration between art and science was established. The reviews, data collection, and calculations were conducted by RBFK (Regional Society for Education, Research and Competence Development) on behalf of artist Lara Almarcegui. The multidisciplinary team included Andreas Kamradt, an economic geologist familiar with the Mansfeld mining district — an area with thousands of waste heaps resulting from copper mining. To support investigations into new applications, geologists analyzed the mineral constituents of the heaps to explore the potential of the former mining region. For the artwork production, volumetric data were requested from relevant State Offices and mining authorities. To calculate unavailable dump volume data, more hands-on calculations using 3D digital elevation models were necessary — as was the case for the Ruhr area, one of Europe's largest former mining regions.

DIE HALDEN IN DEUTSCHLAND

Figure 1: Die Halden in Deutschland wall text: list of identified waste heaps in Germany with their calculated volumes (Art Museum Moritzburg Halle (Saale), 2025)

BRAUNKOHLEBERGBAU Sorbianhöhe Hambach

Sophienhöhe, Hambach	200 000 000
Hochkippen Klettwitz 1008, Kostebrau, Lauchhammer	345 000 000
Außenhalde Bärenbrück, Jänschwalde, Cottbus	310 000 000
Vollrather Höhe, Garzweiler I	260 000 000
Hochhalde Ilmersdorf, Drebkau, Spree-Neiße	243 000 000
Fischbachhöhe, Bergheim	212 000 000
Wiedenfelder Höhe, Fortuna-Garsdorf	156 000 000
Halde Klobikau, Mücheln, Geiseltal	152 000 000
Glessener Höhe, Bergheim	137 000 000
Königshovener Höhe, Garzweiler I	100 000 000
Halde Trages, Mölbis, Espenhain	87 000 000
Mulkwitzer Hochkippe, Schleife, Spreetal, Bautzen	64 500 000
Neurather Höhe, Fortuna-Garsdorf	60 000 000
Außenhalde Reichwalde, Reichwalde, Weisswasser	59 500 000
Halde Beuna, Merseburg	47 800 000
Halde Nierchen, Inden	47 000 000
Kasterer Höhe, Garzweiler I	46 000 000
Außenhalde Nochten, Nochten, Weisswasser	38 000 000
Gustorfer Höhe, Garzweiler I	38 000 000
Außenhalde Burghammer, Spreetal, Bautzen	37 000 000
Röttgenhöhe, Frechen	33 000 000
Halde Pfännerhall, Braunsbedra	32 800 000
Außenkippe Göritz, Drebkau, Oberspreewald-Lausitz	30 000 000
Halde Lippendorf, Kieritzsch	22 000 000
Außenhalde Groß Beuchow, Lübbenaу	22 000 000
Außenhalde Buckow, Calau	18 500 000
Abtsbusch, Bergheim	17 000 000
Halde Vesta, Braunsbedra	16 200 000
Hochkippe Roßbach, Roßbach	11 250 000
Phönix-Nord, Falkenhain	9 600 000
Hochkippe Phönix Nord, Langendorf	9 600 000
Halde Blösien, Braunsbedra	7 500 000
Wilhelmshöhe, Frechen	7 000 000
Gürather Höhe, Fortuna-Garsdorf	6 000 000
Hochhalde Grube Marga, Ruhland, Schwarzeide	5 500 000
Stadthalde, Borna	2 800 000
Halde Großkayna, Braunsbedra	2 200 000
Crostewitzer Höhe, Auenhain	1 900 000
Halde Thräna, Wyhra	500 000
Halde Stöntzscher Höhe, Pegau	220 000
STEINKOHLEBERGBAU	
Bergehalde Emil Mayrisch, Baesweiler	65 000 000
Halde Monopol 1, Grillo I, II, Bergkamen	49 200 000
Spitzkegelhalde Reden, Landsweiler-Reden	45 000 000
Halde Nierchen, Eschweiler, Püttlingen	38 500 000
SKH Viktoria, Püttlingen	35 000 000
Halde Maybach, Friedrichsthal, Sulzbach	35 000 000
Halde Großes Holz, Bergkamen	33 380 000
Halde Haniel, Bottrop	32 600 000
Halde Norddeutschland, Neukirchen-Vluyn, Dinslaken	32 200 000
Halde Duhamel, Saarpolygon, Ensdorf	32 000 000
Halde Lydia, Fischbach	30 400 000
Halde Lohberg-Nord, Halde Erweiterung, Dinslaken	29 220 000

Spitzkegelhalde Götzelborn, Quierschied Halde Brinkfortscheide, Marl

Halde Brinkortsheide, Mari	27 500 000
Halde Rudolfschacht, Dickenberg	22 000 000
Halde Hopstener Straße, Dickenberg	21 600 000
Halde Rheinpreussen, Moers	21 100 000
Halde Hoppenbruch, Herkenrath	17 700 000
Halde Haus Aden 1, Halde Haus Aden 2, Bergkamen	17 000 000
Halde Schöttelheide, Bottrop	16 000 000
Halde Hoheward, Recklinghausen	15 690 000
Halde Oberscholven, Gelsenkirchen	15 300 000
Halde Sundern, Hamm	15 000 000
Goltsteinkuppe, Jülich	14 800 000
Halde Pattberg, Moers	14 400 000
Halde Westhofen-West, Dinslaken	14 270 000
Halde Osthalde Westfalen, Ahlen	13 050 000
Bergehalde Carl Alexander, Baesweiler	12 900 000
Halde Rungenberg, Gladbeck	10 830 000
Halde Beckstraße, Bottrop	10 800 000
Schurenbachhalde, Essen	9 640 000
Halde Ludweiler, Luisenthal	9 600 000
Halde Zollverein IV, V, XI, Essen	9 280 000
Bergehalde Carolus Magnus, Übach-Palenberg	9 200 000
Halde Sundern, Hamm	9 000 000
Bergehalde Anna, Noppenberg	8 100 000
Halde Kissinger Höhe, Hamm	7 200 000
Halde Brassert III, Marl	7 110 000
Bergehalde Anna 1, Alsdorf, Aachen	7 100 000
Halde Schleswig, Dortmund	7 100 000
Halde Tettenbachstraße, Dortmund	7 000 000
Camphausen, Fischbach	5 100 000
Bergehalde Maria Hauptschacht, Alsdorf, Aachen	4 970 000
Halde Graf Moltke III, IV, Halde im Brauck, Bottrop	4 800 000
Halde Scholwer Feld, Gelsenkirchen	4 590 000
Halden Minister Achenbach I, II, Lünen	4 360 000
Halde Radbod Ost, Hamm	4 110 000
Halde Lohmannsheide, Moers	4 100 000
Mottbruchhalde, Bottrop	4 010 000
Hermann, Völklingen	4 000 000
Halde Am Wilhelm-Schacht, westl., Zwickau	3 915 380
Halde Schacht II Karl Marx Werk, Zwickau	3 499 300
Halde Geisheck, Heinrichs, Neunkirchen	3 400 000
Kohlenhuck, Moers	3 200 000
Halde Rheinelbe, Gelsenkirchen	3 200 000
Halde Ewald, Recklinghausen	3 170 000
Halde Pluto, Wilhelm-Schacht II, III, VII, Herne-Wanne	3 090 000
Halde 22, Bottrop	3 050 000
Bergehalde Anna 2, Alsdorf, Aachen	2 900 000
Eyler Berg, Moers	2 450 000
Halde auf Flurstück 326/1, 327/2, Cainsdorf, Zwickau	2 400 000
Halde Rheinbaben, Gladbeck	2 400 000
Halde Tockhausen, Minister Achenbach IV, Lünen	2 300 000
Halde Viktoria-Schacht III, IV, Lünen	2 300 000
Halde nördl. v. Karl-Marx-Schacht I, Zwickau	2 164 800
Halde Prosperstraße, Bottrop	2 000 000
Halde Welheimer Mark, Bottrop	2 000 000

Figure 1a: Die Halden in Deutschland wall text zoom in - Part A
(Art Museum Moritzburg Halle (Saale), 2025)

Jaspersberg Maria I, Alsdorf, Aachen	1 900 000	Kettenberghalde, Freital, Dresden	105 000
Halde Knappenhalde, Oberhausen	1 700 000	Halde Voßnacken, Herne	100 000
Bergehalde Adolf, Merkstein, Herzogenrath	1 600 000	Halde Alte Haase I, II, Sprockhövel	100 000
Halde Schwerin, Castrop-Rauxel	1 600 000	Halde Zellstoffwerk, Zwickau	90 000
Halde Humbert, Hamm	1 500 000	Halde Windberg-Schacht, Freital, Dresden	90 000
Halde Gröhlingstraße "Elephant", Saarbrücken	1 500 000	Halde "Segen Gottes Schacht", Zwickau	80 000
Halde Franz, Hamm	1 500 000	Halde Wilhelm-Schacht II, nordost, Reinsdorf, Zwickau	71 970
Halde General Blumenthal I, II, VI, Recklinghausen	1 500 000	Halde Hasenwinkel, Bochum	70 000
Halde Rossenray, Moers	1 400 000	Karl-Marx-Schacht III, Zwickau	68 000
Halde 19, Bottrop	1 400 000	Halde Berglustschacht, Bannowitz, Freital	60 000
Halde Nordstern, Gelsenkirchen	1 300 000	Halde Neuhoffnung-Schacht, Freital, Dresden	60 000
Halde Fahrschulplatz Cainsdorf, Zwickau	1 200 000	Halde Arthur-Teuchert-Schacht, Freital, Dresden	60 000
Halde Ellinghorst, Gladbeck	1 200 000	Halde Marianne, Wuppertal	60 000
Halde Luisenthal, Völklingen	1 100 000	Halde Wilhelm-Schacht II, nordwestl., Reinsdorf, Zwickau	53 390
Halde Emscher, Gelsenkirchen	1 100 000	Halde, Karl-Marx-Schacht I, Zwickau	47 000
Halde Gotthelf, Dortmund	1 000 000	Halde "Segen Gottes Schacht", Zwickau	9 000
Halde Preußisch, Lünen	1 000 000	Halde Pauline, Werden-Heidhausen	8 000
Halde Hannover I, II, V, Bochum	900 000	Halde Wilhelminen-Schacht, Freital, Dresden	900
Halde Sachsen, Hamm	900 000		
Halde Groppenbruch, Dortmund	860 000		
Halde General Blumenthal VIII, Recklinghausen	850 000	KALIBERGBAU	
Halde Schachtanlage Gittersee, Freital, Dresden	824 000	Halde Heringen, Wintershall, Heringen	128 000 000
Halde am Wilhelm-Schacht, nördl., Zwickau	819 675	Monte Kali, Neuhof, Fulda	125 000 000
Halde Eickwinkel, Halde Hibernia-Dreieck, Essen	800 000	Halde Hattorf, Philippsthal	102 000 000
Halde Viktoria-Ost, Lünen	800 000	Halde Zielitz, Kalimandscharo, Wollmirstedt	68 000 000
Halde am Karl-Marx-Schacht III, Zwickau	743 400	Halde Menteroda, Volkenroda	45 000 000
Halde Wilhelm-Schacht II, Reinsdorf, Zwickau	716 358	Halde Bischofferode, Bischofferode	42 000 000
Halde Werne III, Bergkamen	700 000	Halde Bleicherode, Bleicherode	36 000 000
Halde Brockenscheidt, Waltrop	700 000	Halde Hugo, Lehrte	27 000 000
Halde Vereinsglück Schacht, Cainsdorf, Zwickau	690 000	Halde Sondershausen, Sondershausen	27 000 000
Halde am Karl-Marx-Schacht II, Zwickau	676 984	Halde Sigmundshall, Wunstorf	23 750 000
Gottes-Segen, Glückauf-Schacht-Halde, Bannowitz, Freital	640 000	Halde Sollstedt, Sollstedt	12 000 000
Halde 7 (Stinneshalde), Bottrop	600 000	Halde Niedersachsen, Wathlingen	11 700 000
Halde Ruhrgas, Gelsenkirchen	600 000	Halde Friedrichshall, Sehnde	9 500 000
Lothringen I, II, Hiltrop	600 000	Halde Hansa, Empele, Hannover	5 500 000
Halde Viktoria, Lünen	600 000	Halde Siegfried, Giesen	5 200 000
Halde am ehem. Augustusschacht, Zwickau	560 313	Halde Teutschenthal, Halle/Saale	3 500 000
Halde Hannibal I, III, Bochum	500 000	Halde Ronnenberg, Hannover	1 250 000
Halde Emscher-Lippe I, II, Datteln	500 000	Halde Wilhelm II-Schacht, Kochendorf, Heilbronn	140 000
Halde König, Neunkirchen	440 000	Halde Kalisalzwerk Buggingen, Buggingen, Freiburg	100 000
Halde Ickern I, II, Castrop-Rauxel	400 000	Halde Kalisalzwerk Heitersheim, Müllheim, Freiburg	60 000
Halde Centrum II, Wuppertal	400 000		
Halde Marienschacht, Bannowitz, Freital	393 000	URANBERGBAU	
Halde Hannibal IV, Bochum	300 000	Schmirchauer Höhe, Ronneburg	48 000 000
Halde Königsgrube, Bochum	300 000	Halde Seelingstädt, Seelingstädt	24 800 000
Halde Graf Moltke I, II, Bottrop	300 000	Halde Schacht 371/I, Schneeberg, Aue	9 390 000
Halde Segen-Gottes-Schacht, Freital, Dresden	260 000	Halde Beerwalde inkl. der Halden Drosen & Korbußen, Beerwalde	9 000 000
Spitzkegelhalde Dorstfeld I, IV, Dortmund	200 000	Halde Gauern, Gauern	7 500 000
Osthalde Bonifacius, Essen	200 000	Halde Schacht 186/366/383, Schneeberg, Aue	7 480 000
Halde Bergmannsfeld, Essen	200 000	Halde Schacht 38 neu, Aue	4 693 000
Halde Unser Fritz V, Herne	200 000	Halde Schacht 382, Schneeberg, Aue	4 210 000
Halde König Ludwig VII, VIII, Recklinghausen	200 000	Halde Schacht 66, 207, Schneeberg, Aue	4 060 000
Halde Beckerschacht, Bannowitz, Freital	175 000	Halde Schacht 371/II, Schneeberg, Aue	3 720 000
Halde Beharrlichkeitsschacht, Bannowitz, Freital	138 000	Halde Schlüsselgrund, Leupoldshain, Königsstein	3 500 000
Oppelschacht Halde 1, Freital, Dresden	125 000	Halde 382 West, Schneeberg, Aue	3 250 000
		Bergehalde Crossen, Zwickau	3 200 000

Figure 1b: Die Halden in Deutschland wall text zoom in - Part B
(Art Museum Moritzburg Halle (Saale), 2025)

Halde Schacht 235, Pöhl	2 700 000	Halde Schacht 36, Daniel, Filzteich, Schneeberg	75 000
Halde 371, Bad Schlema	2 000 000	Halde Schacht 204, Breitenbrunn, Erzgebirgskreis	75 000
Hammerberghalde, Schneeberg, Aue	2 400 000	Halde Jugendschacht, Schacht 150, Filzteich, Schneeberg	75 000
Dammhalde Steinsee, Johanngeorgenstadt, Erzgebirgskreis	2 250 000	Halde Schaaerschacht, Schacht 18, Johanngeorgenstadt	73 000
Damm Absetzbecken Borbachtal, Schneeberg, Aue	1 254 000	Halde "Hoh-Neujahr-Schacht", Johanngeorgenstadt	72 000
Halde 312, Schneeberg, Aue	1 230 000	Halde Schacht 317, Breitenbrunn, Erzgebirgskreis	72 000
Halde Gittersee, Freital, Dresden	1 200 000	Halde Stolln 3, St. Wolfgang, Breitenbrunn, Erzgebirgskreis	70 000
Halde Zentralschacht 347, Gottesberg, Schneckenstein	1 200 000	Halde Schacht 126, Johanngeorgenstadt	70 000
Halde Schacht 250, Schneeberg, Aue	1 040 000	Halde Stollen 165, 168, Johanngeorgenstadt	70 000
Halde Schacht 296, Schneeberg, Aue	952 000	Halde Schacht 280, Stalinschacht, Schneeberg, Aue	70 000
Halde Schacht 52, 227 (Zentralschachthalde), Johanngeorgenstadt	825 000	Halde Schacht 278, Schwarzenberg, Pöhl	70 000
Halde 381, Ronneburg	800 000	Halde Schacht 255, Markersbach, Pöhl	70 000
Halde Schacht 38 alt, Lichtloch 9, Schneeberg, Aue	560 000	Halde Schacht 60, Johanngeorgenstadt	66 000
Halde Schacht 310, Schneeberg, Aue	140 000	Halde Schacht 127, Schneeberg, Aue	65 000
Halde Schacht 13b, Schneeberg, Aue	268 000	Halde Schacht 75, Bergkappe, Schneeberg, Aue	64 000
Halde Schacht 362, Mechelgrün, Zobes	426 000	Halde Schacht 42, Johanngeorgenstadt	61 000
Halde Schacht 318, Schwarzenberg, Pöhl	400 000	Halde Schacht Uran & Tiefsch. 23, Breitenbrunn, Erzgebirgskreis	60 000
Halde Marienschacht, Dresden	393 000	Halde Schacht 33 (Bäuerin), Annaberg-Buchholz	60 000
Halde Schacht 65, Schneeberg, Aue	300 000	Halde Schacht 133b, Bärenstein, Sehmatal	60 000
Halde Schacht 248, Breitenbrunn, Erzgebirgskreis	300 000	Halde Schacht 208 W, Schneeberg, Aue	60 000
Halde an der Haberlandmühle, Breitenbrunn, Erzgebirgskreis	280 000	Halde 2 Schacht 311, Schneeberg, Aue	60 000
Halde am Schacht 294, Mechelgrün, Zobes	270 000	Halde Schacht 208 W, Schneeberg, Aue	60 000
Halde am Schacht 241, Schneckenstein, Muldenhammer	270 000	Halde II Schacht 387, Königstein/Sächs., Schweiz	53 000
Halde am Wintersportzentrum, Muldenhammer, Tannenbergsthal	270 000	Halde Markscheiderschacht, Breitenbrunn, Erzgebirgskreis	53 000
Dammhalde Trockenbecken, Johanngeorgenstadt	250 000	Halde auf Stollen 164, 233, Breitenbrunn, Erzgebirgskreis	50 000
Halde Schacht 64, Schneeberg, Aue	255 000	Halde Stolln 224, 8, Johanngeorgenstadt	50 000
Halde Schacht 78, Annaberg-Buchholz	250 000	Halde Steyerschacht, Johanngeorgenstadt	50 000
Halde Schacht 54, Johanngeorgenstadt, Erzgebirgskreis	240 000	Halde Schacht 338, Breitenbrunn, Erzgebirgskreis	50 000
Halde Schacht 18, 53, Johanngeorgenstadt, Erzgebirgskreis	240 000	Halde Schwarzwasserstollen, Johanngeorgenstadt	50 000
Halde Schacht 208, Schneeberg, Aue	205 000	Halde Stollen August Otto 2, Breitenbrunn, Erzgebirgskreis	50 000
Halde Schacht 51, Johanngeorgenstadt	200 000	Halde Nördl. Stollen 217, Bärenstein	50 000
Halde Jugendschacht 252, Muldenhammer, Tannenbergsthal	200 000	Halde Schacht 8, Aue	50 000
Halde am Maischacht, Gottesberg, Tannenbergsthal	200 000	Halde Schacht 256/1, Schneeberg, Aue	50 000
Schildbachhalde, Schwarzenberg, Pöhl	183 000	Halde Schacht 5b, Schneeberg, Aue	50 000
Halde Stollen 1, 8, 10, Schwarzenberg, Pöhl	160 000	Halde Schacht 50, Kinder Israel, Schneeberg, Aue	50 000
Halde Schacht 209, Bärenhecke, Glashütte	160 000	Halde 1 Schacht 8, Schneeberg, Aue	50 000
Halde Schacht 49, Konstantin, Annaberg-Buchholz	150 000	Halde Schacht 246, Schneeberg, Aue	50 000
Halde westlich Schacht 348, Dippoldiswalde, Schmiedeberg	150 000	Halden Wismutstollen, Schwarzenberg, Pöhl	50 000
Halde Schacht 254, Mechelgrün, Zobes	125 000	Halde Wäldel, Mähring, Tirschenreuth	8 000
Halde Schacht 281, Bärenstein, Oberwiesenthal	120 000		
Tafelhalde Schacht 116, Drei Könige, Annaberg-Buchholz	120 000		
Halde Weißer Hirsch-Fundgrube, Johanngeorgenstadt	120 000		
Halde Schacht 373, Schneeberg, Aue	110 000		
Halde Schurf 19, Johanngeorgenstadt	110 000		
Halde St. Andreas Fundgrube, Annaberg-Buchholz	100 000		
Halde Schacht 372, Schneeberg, Aue	100 000		
Halde Fröschgeschrei-Fundgrube, Schneeberg, Aue	100 000		
Halde Schacht 55, Johanngeorgenstadt, Erzgebirgskreis	100 000		
Halde Schacht 125, Johanngeorgenstadt, Erzgebirgskreis	100 000		
Halde 2 Schacht 127, Schneeberg, Aue	90 000		
Halde Stolln 2, 6, Breitenbrunn, Erzgebirgskreis	80 000		
Halde Schacht 33b/Neue Bäuerin, Annaberg-Buchholz	80 000		
Halde Schacht 169, 258, Bärenstein	80 000		
Zeppelinhalde, Annaberg-Buchholz	75 000		
Halde Schacht 314, Schneeberg, Aue	75 000		

Figure 1c: Die Halden in Deutschland wall text zoom in - Part C
(Art Museum Moritzburg Halle (Saale), 2025)

Halde Lichtloch 28 Z, Gerbstedt, Hettstedt	235 000	Halde "Trost-Israel-Flachen", Weissenborn, Freiberg	60 000
Halde Martins-Schacht 2, West, Hergisdorf	137 000	Halde Schacht 137, Schacht Johann, Wolkenstein, Marienberg	60 000
Halde Lichtloch 23 Z, Welfesholz	120 000	Terrakonikhalle Schacht 116, Annaberg-Buchholz	50 000
Kleinhalde Norden & Westen Mansfelder Becken, Hettstedt	100 000	Halde Schreiberschacht, Grosschirma, Freiberg	50 000
Halde Lichtloch 26 S, Großörner	50 000	Halde Sauschwart Fundgrube, Filzteich, Schneeberg	50 000
Halde Martins-Schacht 2, Süd, Hergisdorf	330	Halde Grube Weißer Hirsch, Herzberg, Goslar	50 000
BERGBAU AUF POLYMETALLISCHE ERZE		Halde 3 Gruben Hausherzberger Gangzug, Clausthal-Zellerfeld	50 000
Glückauf-Schacht & Neue Fundgrube, Hütschental, Goslar	1 000 000	ZINN-WOLFRAM-BERGBAU	
Halde am Davidschacht, Freiberg	900 000	Spülhalde 2, Ehrenfriedersdorf	1 000 000
Halde 7 Lichtloch, Johannisberg, Halsbrücke	800 000	Haldenkomplex am Sauberg, Ehrenfriedersdorf	150 000
Haldenkomplex Neuunverhofft Glück, Niederschlag, Bärenstein	750 000	Spülhalde 1, Ehrenfriedersdorf	100 000
Halde Grube Treu Freundschaft, Johanngeorgenstadt	750 000	Halde Arno Lippmann Schacht, Altenberg	80 000
Halde "Johannes-Schacht", Brand-Erbisdorf, Freiberg	720 000	Halde Geyer Binge, Gottesberg, Schneckenstein	80 000
Halde "Frankenschacht", Brand-Erbisdorf, Freiberg	720 000	Halde Schurf 24, Schwarzenberg, Pöhl	56 000
Halde Schacht Reiche Zeche, Freiberg	700 000	Teilhalde Schacht 235, Schwarzenberg, Pöhl	55 000
Halde Grube Himmelsch Heer, Schacht 28, Annaberg-Buchholz	500 000	BLEI-ZINK-(SILBER)-BERGBAU	
Halde des Ludwig-Schachtes, Halsbrücke, Freiberg	500 000	Halde Ottiliaeschacht, Clausthal-Zellerfeld	1 000 000
Halde Kappel Erzwäsche, Stolberg, Freiberg	500 000	Halde Baiertaler Stollen, Wiesloch, Heidelberg	500 000
Halde 1 Gruben des Hausherzberger Gangzug, Clausthal-Zellerfeld	500 000	Halde Silbersegen Schacht, Rosenhof, Clausthal-Zellerfeld	500 000
Halde Silbernaal, Meding-Schacht, Bad Grund, Göttingen	500 000	Halde Westschacht, Bad Grund, Göttingen	250 000
Halde Schacht Uranus II, SCT 21, Annaberg-Buchholz	400 000	Halde Schacht "Haus von Sachsen", Clausthal-Zellerfeld	100 000
Halde "Constantin-Schacht", Freiberg	320 000	Halde Grube "Maaßen", Lautenthal, Goslar	75 000
Halde "Schacht Sonnenwirbel", Brand-Erbisdorf, Freiberg	300 000	Halde Theodor Richtschacht, Bobritzsch-Hilbersdorf, Freiberg	55 000
Halde Schindlerschacht, Schacht 72, Filzteich, Schneeberg	250 000	Halde Grube "Güte des Herrn", Lautenthal, Goslar	50 000
Halde Neubulach, Wildberg, Calw	250 000	Halde am Kreuteck, Goslar-Hahnenklee, Goslar	20 000
Halde "Lade-des-Bundes Schacht", Brand-Erbisdorf, Freiberg	225 000	SILBERBERGBAU	
Halde am Abraham-Schacht, Freiberg	216 000	Halde "Vertrau-auf-Gott-Schacht", Brand-Erbisdorf	960 000
Halde "Reicheltschacht", Brand-Erbisdorf, Freiberg	200 000	Halde am "Glückauf-Schacht", Brand-Erbisdorf	800 000
Halde Bergsegen 3, Zschorlau, Erzgebirgskreis	200 000	Halde Schacht Alte Elisabeth, Freiberg	250 000
Halde Schacht Pechtsgrün, Lengenfeld, Erzgebirgskreis	200 000	Halde Neuer Abraham-Schacht, Marienberg, Erzgebirgskreis	200 000
Schacht "Reicher Bergsegen", Brand-Erbisdorf, Freiberg	200 000	Halde "Alte Mordgrube", Brand-Erbisdorf	60 000
Halde an der Halsbrücker Esse, Halsbrücke, Freiberg	170 000	Halde 152, Grube Vater Abraham, Marienberg, Erzgebirgskreis	50 000
Halde "Röschen-u. Kunstschacht", Freiberg	150 000	EISENERZBERGBAU	
Halde Schacht 11, Neujahr, Filzteich, Schneeberg	150 000	Halde Burgstall, Wasseraufingen, Aalen	150 000
Halde Schacht 200, Grube Gesellschaft, Filzteich, Schneeberg	150 000	Halde Knollengrube im Hübicentral, Bad Lauterberg	100 000
Halde Perlischachtrevier, Dippoldiswalde, Schmiedeberg	150 000	Halde Tiefer Stollen, Wasseraufingen, Aalen	70 000
Halde Luftschacht 189, Bärenstein, Sehmatal	150 000	ANDERE ROHSTOFFE	
Halde Hörnig Schacht", Brand-Erbisdorf, Freiberg	128 000	Monte Kaolino, Kaolin, Hirschau, Amberg-Sulzbach	14 000 000
Halde Schacht 29, Große Malwine, Annaberg-Buchholz	125 000	Haldenkomplex Schieferloch, Schiefer, Löbnitz, Erzgebirgskreis	300 000
Halde Schacht 29, Malwine, Annaberg-Buchholz	125 000	Rote Halde, Ölschiefer, Wehingen, Tuttlingen	100 000
Halde Schacht Beihilfe, Halsbrücke, Freiberg	120 000	GESAMT m³	6 814 141 800
Halde Schacht 76, Filzteich, Schneeberg	100 000		
Halde Pucherschacht, Filzteich, Schneeberg	100 000		
Halde Schacht 24, Beust, Filzteich, Schneeberg	100 000		
Halde Ernst-August Schacht, Wildemann, Goslar	100 000		
Halde 2 Gruben des Hausherzberger Gangzug, Clausthal-Zellerfeld	100 000		
Halde Heimberg Stollen, Wolfshagen, Goslar	100 000		
Halde Rammelsberg, Goslar	100 000		
Halde Alte Hoffnung Gottes, Großschirma, Freiberg	98 000		
Halde Schacht 31, 245, Bärenstein, Oberwiesenthal	95 000		
Halde Schacht 44, Wolkenstein, Marienberg	87 000		
Halde Schacht 10 Siebenschlehen, Filzteich, Schneeberg	80 000		
Halde Ritterschacht, Schacht 25, Schneeberg, Aue	80 000		
Halde Schacht 29, Bärenstein, Oberwiesenthal	75 000		

Figure 1d: Die Halden in Deutschland wall text zoom in - Part D
(Art Museum Moritzburg Halle (Saale), 2025)

What is the volume of all the waste dumps in the Mansfeld area? And in Saxony? Or throughout the whole country? The work *Waste Heaps in Germany* is a calculation of the volume of displaced ground forming new landforms — conical or flat waste dumps. It proposes a visualization of the displaced material while raising questions about the potential of the newly generated landscapes that represent the legacy of centuries of large-scale mining.

Building on an extensive art practice focused on the material origins of construction and the relationship between cities, resource ownership, and the land they occupy, Lara Almarcegui's recent artistic research has expanded into the study of newly generated materials — waste — and the landscapes they create. Almarcegui focuses on the study of waste to reflect on the material's future, how its ownership is organised, and the implications for both architecture and the planet.

In geology, mineral exploration phases often imply claiming ownership over these natural resources. However, when dealing with materials that did not previously exist, their distribution and ownership are central questions that can be addressed through an entirely new approach. Much of the waste produced today could be considered a new resource, but the use and ownership of waste remain undefined.

Old mining waste can now be analysed using contemporary technology. While Geoscience departments like the one at Montana University (Leoben) are focusing on the exploration of landfill mining; the Austrian Ministry of Science, Research and Economy, as well as the German regional mining authority, contemplate granting exploration mining rights for waste areas.

While undertaking preparatory work for an artwork that could address how extraction shapes the landscape, the focus shifted towards recent materials and ground formations that were not yet fully defined. Ground that was not there before. The resulting project extends the study of waste into the field of large-scale mining and land use. Initiated during an art residency organised by Werkleitz in Halle, Lara Almarcegui's research began by looking into the mining waste dumps of the Mansfeld copper district. The composition of Mansfeld waste heaps remains largely unknown. In the 1970s, following the gradual closure of the large copper mine shafts between 1962 and 1967 and the shift of extraction to the Sangerhausen district, reports were produced to identify and estimate the mineral content of the dumps. However, this information is widely dispersed, lacks official archiving, and is not easily accessible.

Some waste heaps in the Mansfeld district have been remediated and now support natural habitats. The largest slagheaps, the so-called "Mansfeld Pyramids", have become prominent landmarks and have been designated as cultural monuments. However, most of these recently generated landforms do not yet have a defined identity or function; in the meantime, some are being used by companies to extract low-cost construction materials. The site of the former Krughütte smelter in Wimmelburg features

a huge slagheap, now operated by a construction company extracting material for road use. Commercialized at 2 euros per ton, the material is inexpensive and lighter than natural rock such as granite or greywacke. In the search for more economical applications, Krughütte is currently being analyzed with newer technology, enabling ongoing sampling to assess the potential of slag as a future cement filler, an alternative to conventional cement aggregates.

Recently, a joint research project has been researching the composition and potential uses of the Mansfeld-Sangerhausen dumps. The Regional Society for Education, Research and Competence Development (RBFK) is conducting scientific studies focused on the utilization of mineral raw materials and the potential of former mining sites. Researchers have accessed nine copper waste heaps around Eisleben, dating from the 1870s to the 1940s, and have established pilot tests at two sites.

DIE HALDEN IN DEUTSCHLAND (SINCE 1850)

Calculation methodology

A shared interest sparked the idea of a collaboration combining artistic and scientific approaches, leading to the launch of an ambitious project to identify each and every waste heap in Germany, resulting in the 17-meter-long artwork shown in Figure 1. A painstaking counting process was carried out based on a framework and methodology developed in collaboration with RBFK scientist Andreas Kamradt. One key decision was to include only waste dumps created from around 1850 onwards. This date marks the beginning of large-scale mining in Germany, driven by technological advances and the corresponding increase in waste production. As Kamradt noted, 1850 marks the start of the industrial mining era, characterized by large-scale operations and well-documented waste dumps.

Two types of waste produced in large volumes that shape landforms are overburden (or mother rock) and slag—a differentiation made by the heaps' material composition. The calculation includes only Abraumshalden, barren waste rock dumps consisting of leftover host rock after ore extraction. Schlackehalden, or slag dumps, which are residues from mineral processing, are excluded because they have undergone chemical and mechanical alterations, losing the original properties of the original ore rocks. Significant effort and geoscientific expertise were invested in identifying the host rock of each extracted material to estimate the composition of the dumps accurately. In cases where data for a dump were unavailable, a digital elevation model (DEM) was imported into the open-source tool QGIS. The dump's base was digitized using XY coordinates. The DEM data were then adjusted and clipped to the dump's area, including a 200-meter buffer (DEM with dump). A second DEM representing the terrain without the dump (DEM without dump) was created by interpolation. Finally, a differential calculation between the two DEMs was performed to find the final dump volume, which was converted into cubic meters.

LIGNITE DUMPS

Dumps of lignite, a soft brown coal, that were formed after the 1950s, constitute the largest waste heaps in Germany. Known as Höhe, these flat-shaped formations are designed to appear natural, resembling plateaus with broad, rounded contours. They are composed of soft, shallow sedimentary rocks — sand, clay, and silt — that serve as the host material for the lignite.

Sophienhöhe, located at the Hambach mine within the Rhenish mining region, is the largest lignite dump in the country, comprising of 2 200 million m³. It is also the largest waste dump of any kind in the country. For many who encounter it for the first time, its sheer size radically alters their perception of extraction, revealing the true terraforming scale of its impact. While measurements are available for Sophienhöhe, the volumes of the other major lignite heaps in the Rhenish mining region had to be calculated using hands-on digital analysis. While geological authorities are responsible for mine residues, collecting data from certain regions proved difficult. In cases where no official information was available from surveys, waste volumes had to be determined through a semi-automated process. A Geographic Information System (GIS) expert supported the project by processing digital elevation model (DEM) data at a 1 m resolution to compute the missing volumes.

Völlrather Höhe, with an estimated volume of more than 260 million m³, is part of the Ganzweiler I lignite mine, an exploitation that has generated three additional large waste dumps: Königshovener Höhe, 100 million m³; Kasterer Höhe, 64 million m³; and Gustorfer Höhe, 38 million m³. All of which accounts for a total of 444 million m³ displaced ground.

The Fortuna-Garsdorf exploitation created three waste dumps: Neurather Höhe, 60 million m³; Gürather Höhe, 6 million m³; and Wiedenfelder Höhe, 156 million m³. Bergheim exploitation created the dumps known as Abtsbusch, 17 million m³; Glessener Höhe, 137 million m³; and Fischbachhöhe, 212 million m³. In Frechen: Röttgenhöhe, 33 million m³ and Wilhelmshöhe, 7 million m³. And finally the only dump in Inden, Halde Nierchen, 47 million m³. A total of 1 119 million m³ of sedimentary displaced material.

The Saxon State Office for Environment, Agriculture and Geology provided very accurate data. The Central German Lignite Mining District in Saxony includes seven large waste dumps. The largest is Halde Trages in Mölbis / Espenhain, 87 million m³. The smallest, Halde Stöntzscher Höhe in Pegau, 0.22 million m³. A total of 124 million m³ of displaced material. The Saxony-Anhalt part of the Central German Lignite Mining District has larger dumps including seven that form a total volume of 269.75 million m³. The largest dump, Halde Klobikau from the Mücheln / Geiseltal mine, contains 152 million m³. Halde Blösien, Halde Großkayna, Halde Vesta, and Halde Pfännerhall together form 58.7 million m³ and are all located near Braunsbedra.

In Brandenburg, large-scale mining—which began after the Industrial Revolution—is well documented. Their waste dumps are thoroughly described and often correspond to the names of villages dismantled due to extraction. The Lusatia mining area in Brandenburg

includes some of the largest heaps, some of which are part of ongoing operations in Drebkau / Spree-Neiße. The enormous Hochhalde Ilmersdorf has a volume of 243 million m³, and the Außenhalde Reichwalde contains 59.5 million m³. Other major dumps include Hochkippen Klettewitz 1008, with 345 million m³; Außenhalde Bärenbrück in Jänschwalde / Cottbus, holding 310 million m³; Mulkwitzer Hochkippe, with 64.5 million m³; Außenhalde Burghammer in Bautzen, containing 37 million m³; and the smaller Außenkippe Görlitz, with 30 million m³.

According to the project's calculations, brown coal mining in Germany has displaced a total of 4 895 million m³ of material, accounting for 79% of Germany's total ground. The largest lignite heap, Sophienhöhe, is partially landscaped, although exploitation remains active in its eastern section. It reflects Kamradt's observation that the largest dumps are the newest—those from the late 20th century and those still being formed today.

HARD COAL DUMPS

Hard coal (Steinkohle) extraction has displaced 988 million m³, the second largest volume of subsoil moved by mining activities in Germany. The resultant dumps are composed of hard coal host rock, mainly sandstone, with minor subsidiary siltstone, claystone, and the non-extractable coal layers.

The largest hard coal dump, Bergehalde Emil Mayrisch, is made up of 65 million m³ of material removed from the mines in Baesweiler, located in the Wurm coalfields within the Aachener coal basin. The same mine also formed the Bergehalde Carl Alexander dump, 12.9 million m³. In Alsdorf (part of the Wurm coalfields), there are four waste heaps: Bergehalde Anna, also called Noppenberg, with a volume of 8.1 million m³, is the largest. At Übach-Palenberg / Heinsberg, there is the enormous Bergehalde Carolus Magnus, measuring 9.2 million m³. Part of the Inde coalfields, Halde Nierchen in Eschweiler has a volume of 38.5 million m³, and Goltsteinkuppe in Jülich measuring 14.9 million m³.

In the Ibbenbüren hard coal basin, there are two waste dumps, Halde Rudolfschacht and Halde Hopstener Straße in Dickenberg, containing 22 and 21.6 million m³ of material respectively.

Exploitation of the Rhenish-Westfalen hard coal basin has produced many large dumps. Seven are situated in Bottrop: the largest, Halde Haniel has been calculated at 32.6 million m³ and Halde Schöttelheide, 16 million m³. The Dinslaken area has three dumps: Halde Wehofen-West, with a volume of 14.27 million m³; Halde Lohberg-Nord + Erweiterung, 29.22 million m³; and Halde Norddeutschland, 32.2 million m³. Recklinghausen's three dumps have a combined volume of 19.71 million m³. The Halde Großes Holz dump in Bergkamen is 33.38 million m³ in volume and Halde Brinkfortsheide in Marl, 27.5 million m³. At the Zollverein Coal Mine Industrial Complex in Essen, a UNESCO World Heritage Site, Halde Zollverein IV / V / XI holds 9.28 million m³ of pit waste, and the nearby Schurenbachhalde, 9.64 million m³.

Many more hard coal dumps were identified through the research than initially anticipated, and much of the

data from Nordrhein-Westfalen proved inaccessible. Attempts to obtain information from Ruhrkohl AG and other recent operations were unsuccessful. As a result, 44 dumps had to be assessed using more labor-intensive methods. The largest dump is Monopol 1 (Grillo I / II) in Bergkamen with a volume of 49.2 million m³. Other large dumps in Bergkamen include Halde Haus Aden 1 and Halde Haus Aden 2, with a combined volume of 17 million m³. In Dortmund, the largest waste heap is Halde Schleswig, which measures 7.1 million m³. Essen, Bochum, Gelsenkirchen, Hamm and Lünen all have many dumps, although they are somewhat smaller. The largest among them is Halde Viktoria III / IV in Lünen at 2.3 million m³. Halde Knappenhalde in Oberhausen has a volume of 1.7 million m³.

In other coal mine districts dump data was more readily accessible. In the Saar hard coal basin, there are thirteen waste dumps. SKH Reden waste dump in Landsweiler-Reden is the largest at 45 million m³. Also on a large scale, the Viktoria dump in Maybach, measures 35 million m³. Duhamel in Ensdorf / Saarpolygon holds 32 million m³. Lydia and Camphausen in Fischbach comprise 30.4 million m³ and 5.1 million m³ respectively. SKH Göttelborn in Quierschied contains 28 million m³. Halde Ludweiler in Luisenthal, 9.6 million. Hermann in Völklingen, 4 million m³. Halde Geisheck in Heinitz / Neunkirchen measures 3.4 million m³.

In Saxony, the mining authorities shared a comprehensive database which included nearly 4 000 objects, including dump objects with a volume of 500 m³ or less. During the selection of dumps across all states, only the largest were included. In the Zwickau-Oelsnitz hard coal basin, there are 17 waste dumps. The Halde Am Wilhelm-Schacht westl. is the largest, at 3.9 million m³, followed in volume by Halde Schacht II des Karl-Marx-Werks, with a figure of 3.5 million m³.

Information provided by the Saxony mining authorities for the Döhlen hard coal basin included 11 waste dumps, each relatively small, around Freital, Dresden, and Bannewitz. The largest dump is Halde Schachtanlage Gittersee with a volume of 0.8 million m³. The smallest is Halde Wilhelminen-Schacht with only 900 m³.

POTASH DUMPS

Potash dumps are composed of mother rock salt, with minor amounts of gypsum and clays. Made of fine grains, the steep conical dumps resemble pyramids. Potash mining has produced large waste dumps — 672 million m³ in total — second only to those generated by coal mining. In terms of volume, potash and fertilizer production are central to understanding ground displacement and the formation of new terrains in Germany.

The Werra Potash District in Hessen produced the largest waste heaps, with three exceeding 100 million m³ each, all part of still-operating mines: Halde Heringen / Wintershall, which amounts to 128 million m³ — one of the oldest still-active potash mines in the world — Monte Kali, 125 million m³, and Halde Hattorf, 102 million m³.

In the Central German Potash District, the enormous Halde Zielitz — known as Kalimandscharo because of its white-pink color, was reported to hold 68 million m³. Extraction remains active, and the plant is considered one of the largest and most modern potash plants in the world. Approximately 12 million tons of crude salt are extracted per year. Halde Teutschenthal, which is part of an active mine, is made up of 3.5 million m³ of material.

In the Thüringen Potash Mining District, the largest dump, Halde Menteroda in Volkenroda, totals 45 million m³. Halde Bischofferode, 42 million m³. Halde Bleicherode, 36 million m³. Halde Sondershausen, 27 million m³. Halde Sollstedt, 12 million m³.

URANIUM DUMPS

To Uranium ore extraction is the fourth-largest cause of ground displacement in Germany, and it is the metal extraction activity that has generated the most waste volume. The type of material removed varies depending on the geological formation. In central Saxony and Thuringia, uranium is partly found in sandstone, while in southern Saxony, in the Erzgebirge (literally “Ore Mountains”) occurs within various types of slate.

Data are available from the former SAG/SDAG Wismut, the state-owned company that operated during the Cold War (1947–1990), a period when it was the world's fourth-largest uranium producer. In the Ronneburg–Seelingstädt Mine District, five large waste dumps composed of sandstone amount to a total of 90 million m³. Among them, Schmirchauer Halde is the largest, at 48 million m³. The waste dumps in Königstein (Elbsandsteingebirge) are also composed of sandstone; the largest, Halde Schlüsselgrund, holds 3.4 million m³.

In the Aue–Bad Schlema Mining District (Erzgebirgskreis), the dumps consist of quartzite, phyllite, and slate. The 35 dumps collectively contain 53 million m³, most located in Schneeberg and Aue. The largest are Halde Schacht 371/I, at 9.9 million m³, and Halde Schacht 366 / Betriebsfläche 186/366/383, at 7.48 million m³. In Annaberg-Buchholz, Halde Schacht 38 Neu contains 4.69 million m³.

The dumps in Johanngeorgenstadt (Erzgebirgskreis) are primarily composed of phyllite, amphibolite, and granite. A total of 29 dumps amount to a volume of over 6 million m³. The largest, Dammhalde Steinsee, holds 2.25 million m³.

The six dumps around the Pöhla Mining District (Erzgebirge) consist of skarn, a calcareous-silicate rock. Halde Schacht 235 is the largest at 2.7 million m³, followed by Halde 371 in Schlema, with 2 million m³. Together they account for more than 5 million m³ of excavated material.

The host rocks of uranium extraction in the Schneckenstein Mining District (Erzgebirge) are contact metamorphic rocks: quartzite, hornfels, phyllite, schists, and metabasite. A total of 3.7 million m³ is distributed across 13 dumps. The largest, Halde Zentralschacht 347 in Gottesberg/Schneckenstein, totals 1.2 million m³.

COPPER DUMPS

Twentieth-century copper mining dumps have a conical shape, though they often overlie older, flat-shaped dumps, also known as tabular dumps. All major waste heaps are located in the Mansfeld–Sangerhausen Mining District. With 55.9 million m³ extracted, copper and silver mining is the second-largest cause of ground displacement by metal mining in Germany. These dumps mainly consist of host rock limestone (90%), with smaller amounts of Kupferschiefer (carbon-rich copper-bearing mudstone), gypsum, and sandstone.

Zirkel-Schacht-Halde in Klostermansfeld, containing 3.3 million m³, is listed as a cultural monument and is covered with naturally developing ruderal vegetation. Ernst Thälmann-Schacht-Halde in Hübitz holds 9.6 million m³, and Otto Brosowski-Schacht-Halde in Augsdorf contains 5.7 million m³. Thomas Münzer-Schacht-Halde in Hohe Linde, Sangerhausen, also listed, contains 7.3 million m³. The company Kutter HTS held a permit to extract road construction material from the large Fortschritt I-Schacht dump in Volkstedt. Likewise listed as a cultural monument, it is calculated at 8.5 million m³. The Saxony-Anhalt Mining Authority's Geological Service keeps a directory of companies with active extraction permits in the Mansfeld area as of 2017. The Martin Wurzel construction company operated Halde Freies Leben-Schacht in Mansfeld. At the same time, Bau-Rec Baustoffrecycling held rights to four dumps around Eisleben, two of which are waste rock dumps: Halde Hermann-Schacht, with 4.4 million m³, and Halde Martinschacht, measuring 0.137 million m³.

POLYMETALLIC ORE DUMPS

The total volume of material displaced by polymetallic ore extraction amounts to 14.6 million m³. The overburden includes volcanic rocks such as granite, greisen, porphyry, quartz porphyry, and rhyolite; sedimentary rocks including breccia, sandstone, dolomite, greywacke, and chert; and metamorphic rocks such as amphibolite, biotite gneiss, mica schist, phyllite, skarn, and clay slate.

In the Harz Mountains, ore vein deposits formed through different fluids complicate the identification of the overburden material. Polymetallic metals were extracted mainly from greywacke and clay slate. The largest dump, Halde Glückauf-Schacht und Neue Fundgrube im Hütschental, in Wildemann / Goslar, totals 1 million m³. Together with eight additional dumps, their combined volume reaches 2.5 million m³.

In the Erzgebirge, polymetallic ores were mined in the Schneeberg Mining District in host rocks consisting of mica schist, skarn, and granite, forming nine waste dumps with a total volume of 1 million m³. The heaps in Schmiedeberg and Bärenstein are primarily made up of gneiss and rhyolite, and amount to 0.47 million m³. Amphibolite, mica schist, porphyry and skarn constitute the waste dumps Halde Schacht 44 and Halde Schacht 137 (Schacht Johann) in Wolkenstein / Marienberg, making a total amount of 0.147 million m³.

Around Freiberg and Halsbrücke (Erzgebirge), polymetallic ores were mined in porphyry, gneiss, and brec-

cia, forming seven dumps with a total volume of 3 million m³. The largest, Halde am Davidschacht, is measured at 0.9 million m³. Five waste dumps in Brand-Erbisdorf, made of gneiss, form a dump with a volume of 1 million m³. Gneiss occurs alongside mica slate in dumps at Annaberg-Buchholz and Großschirma, measuring 0.68 million m³, and with skarn at the larger Halde Schacht Uranus II (SCT21) at Annaberg-Buchholz, with a volume of 0.4 million m³. Gneiss with breccia makes up a 0.7 million m³ dump in Halde Schacht Reiche Zeche in Freiberg. Gneiss occurs together with dolomite and chert in Annaberg-Buchholz, at Halde Schacht 29 (Große Malwine and Malwine), and Halde Schacht Beihilfe in Halsbrücke / Freiberg. The dumps of Zschorlau and Lengenfeld in Erzgebirgskreis, measuring 0.4 million m³, are made of greisen and granite.

LEAD, ZINC, AND SILVER MINING DUMPS

There is little knowledge about the dumps from historic mining in the Harz Mountains. Early extraction sites — such as iron and silver in the Harz or cobalt and silver in the Erzgebirge — had to be excluded from the calculation, despite their significant role in developing Germany's mining industry, advancing geological and mining techniques, and shaping the landscape on a large scale, not only nationally, but globally.

However, modern extraction of lead, zinc, and silver is well documented. The host rock primarily consists of carbonate rocks (e.g., limestone) and clay slate. The largest dump, Halde Ottiliaeschacht in Clausthal-Zellerfeld, contains 1 million m³. Together with three dumps in Oberharz Mining District and three dumps in the Rammelsberg Mining District, the total volume of waste heaps in the Harz Mountains amounts to approximately 2 million m³.

In the Erzgebirge Freiberger Basin, the Halde Theodor Richtschacht is composed of granite, with a volume of 0.055 million m³ (55,000 m³). By contrast, silver was extracted from the mica schist host rock, leaving behind six dumps totaling 2.32 million m³. The largest of these are Halde Vertrau-auf-Gott-Schacht and Halde Glück-Auf-Schacht, located on the site of the former Himmelsfürst Mine in Brand-Erbisdorf in Saxony.

Tin and wolfram were extracted in the Erzgebirge from granite and gneiss-mica slate formations near Ehrenfriedersdorf. The largest waste dump, Spülhalde 2, contains 1 million m³ of material. The other six smaller dumps around Altenberg, Schwarzenberg, and Gottesberg amount to 0.5 million m³.

A KAOLINITE DUMP: MONTE KAOLINO

The list of dumps only includes one waste heap resulting from kaolinite extraction: Monte Kaolino, an enormous heap of 14 million m³ composed of quartz sand. Located in Hirschau, Bayern, Monte Kaolino is partly landscaped and has been transformed into a recreational area with an amusement park that fully utilizes the topography, featuring installations such as a sand skiing piste, a pool, and camping facilities.

The company operating the mine has grown significantly since operations began in 1901, thanks to the high-quality kaolin deposits commercialized for ceramic production. Figures from 2012 indicate that approximately 2 million tons of sand were excavated that year to produce approximately 400 tons of kaolin.

Dr. Bodo-Carlo Ehling (LAGB); Stefan Kreisel (RBFK); Laura Linsing (production, Werkleitz Gesellschaft); Floor Komen (graphic design); Max Andrews and Mariana Cánepa Luna, *Latitudes* (English edition); Andreas Kamradt (data collection and handling); Fabian Groscurth (DEM work); Vincent Jäckel (Excel work).

CONCLUSIONS

Waste Heaps in Germany exposes the potential of these newly generated landforms by offering detailed information on the geological composition of each site of displaced material. It supports a broader understanding of their future by making visible what was previously undocumented. The volume calculations provide new data for each dump — information that can be meaningful for those who live alongside these sites or are otherwise connected to these distinctive places. Moreover, analyzing the dumps individually and assessing their volume by material enables a granular understanding of the long-term consequences of mining — insights that are particularly urgent in the case of the largest dumps, especially those produced by currently active lignite and potash operations.

One of the findings of the dump volume analysis is the identification of the still active and largest dump, Sophienhöhe. With more than 2 200 million m³, and growing, the existence of Sophienhöhe should logically lead to questioning the legal basis for the displacement of material. Likewise, the overall result of the calculation, more than 6 814 million m³ of displaced ground in Germany, should also lead to questioning the mining legislation responsible for it. Each m³ of geological material displaced matters enormously when considered from the perspective of the mountain, its vegetation, or its inhabitants.

However, the long-term ambition of this work goes beyond merely criticizing past and present mining activities. It should serve as an invitation to a more detailed examination of the future of the materials in these dumps, with the goal of rethinking mineral resources in a way that differs from the definition provided by the German Mining Act. The applicable mining law (§ 3 BBergG), which regulates and promotes the exploration, extraction, and processing of mineral resources, defines 'mineral resources' (Bodenschätze) as follows: "Mineral resources are, with the exception of water, all mineral raw materials in solid or liquid form and gases that occur in natural deposits or accumulations in or on the earth, on the seabed, in the subsoil of the sea, or in seawater." ("Bodenschätze sind mit Ausnahme von Wasser alle mineralischen Rohstoffe in festem oder flüssigem Zustand und Gase, die in natürlichen Ablagerungen oder Ansammlungen (Lagerstätten) in oder auf der Erde, auf dem Meeresgrund, im Meeresuntergrund oder im Meerwasser vorkommen.")

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REFERENCES

Balzer, G., C. Gauert, and R. Simon. 2018. Verzeichnis der Gewinnungsstellen und Betriebe. (Steine- und Erdenindustrie, Stand: 31.10.2017). Rohstoffbericht 2018. Landesamt für Geologie und Bergwesen Sachsen-Anhalt, Band 19, p. 87.

Felix, M., et al. 2009. Kurzbericht zu den Forschungsberichten 2005 bis 2007 zur Thematik Gefährdungspotenzial Steinkohlenhalden Zwickau/Oelsnitz. Herausgegeben vom Landesamt für Umwelt, Landwirtschaft und Geologie Sachsen.

Fritsche, R., et al. 1996. Bestandsaufnahme von Rückstandshalden aus Bergbau und Erzaufbereitung in Baden-Württemberg: Band I-III. Forschungszentrum Karlsruhe GmbH.

Gauert, C., R. Simon, and D. Wolf. 2022. "3.1.2.2 Hartgestein (Gebrochener Naturstein)." In Rohstoffbericht 2022. 20 Jahre LAGB – Rohstoffwirtschaft in Sachsen-Anhalt: Sachstand und Perspektiven, Band 21, p. 60. Landesamt für Geologie und Bergwesen Sachsen-Anhalt.

Geographische Kommission für Westfalen, Landesverband Westfalen-Lippe. 1991. Geographisch-landeskundlicher Atlas von Westfalen – Themenbereich VII Gewerbliche Wirtschaft – Doppelblatt Abfallwirtschaft.

Kamradt, Andreas. 2021. "Chapter 15: Characterization and Mineral Processing Options of 'Kupferschiefer'-Type Low-Grade Black Shale Ore from Mining Dumps in Central Germany." In Industrial Waste: Characterization, Modification and Applications of Residues, edited by Herbert Pöllmann, 455–504. Berlin, Boston: De Gruyter. <https://doi.org/10.1515/9783110674941-015>

Kamradt, Andreas, et al. 2012. "An Integrated Process for Innovative Extraction of Metals from Kupferschiefer Mine Dumps, Germany." *Chemie Ingenieur Technik* 84 (10): 1694–1703.

Koch, L. 2022. Quo Vadis Mansfeld: Tradition, Future Strategies and Recommendations for Action for the Economic Exploitation of Existing Raw Material and Geothermal Potential in the District of Mansfeld-Südharz. Regional Society for Research and Competence Development e. V., p. 23.

K+S Minerals and Agriculture GmbH. (n.d.). K+S Minerls and Agriculture. <https://www.kpluss.com/en-us/index.html>

KuLaDig – Kultur. Landschaft. Digital. (n.d.). KuLaDig-Karte. <https://www.kuladig.de/Karte>

Mineralienatlas. (n.d.). Mineralienatlas. <http://www.mineralienatlas.de>

Ruhrgebiet Industriekultur. (n.d.). Industriekultur im Ruhrgebiet. <https://www.ruhrgebiet-industriekultur.de>

"Ski-Spaß auf Sand gebaut." BSZ Bayerische Staatszeitung, Munich, May 21, 2014.

Topographic Map of Germany. (n.d.). Deutschland. Retrieved June 30, 2025, from <https://de-de.topographic-map.com/map-95z57/Deutschland/>

Wikipedia contributors. (n.d.). Liste der Hochkippen im Rheinischen Braunkohlerevier. Retrieved June 30, 2025, from https://de.wikipedia.org/wiki/Liste_der_Hochkippen_im_Rheinischen_Braunkohlerevier Online Sources

FIGURE REFERENCE

Figure 1, 1a, 1b, 1c, 1d:
Die Halden in Deutschland
wall text: list of identified
waste heaps in Germany
with their calculated
volumes (Art Museum
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Almarcegui. Volumetric data were requested from State Offices
and federal mining authorities. Some of the documents provided
are not openly accessible. Where existing data were lacking for a
dump, a digital elevation model (DEM) was imported into the
open-source tool QGIS by Fabian Groscurth. The dump's base
was digitized using XY coordinates. The DEM data were then
adjusted and clipped to the dump's area, including a 200-meter
buffer (DEM with dump). A second DEM representing the terrain
without the dump (DEM without dump) was created by
interpolation. Finally, a differential calculation between the two
DEMs was performed to find the final dump volume, which was
converted into cubic meters.

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Use of AI

The author did not use generative AI tools in the preparation of
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