Table DR1. Significant carnallitite occurrences worldwide, compiled from Warren (2010) and various key referencs as listed

Location, Country	Age	Brine source	Targeted mining unit	Comments/key Reference	Known igneous activity (syn- to post-deposition of salt sequences)
Potash in Congo and Gabon basins, Africa (Congo, Zaire, Angola)	Cret. Low.	Marine	Kouilou horizons	Carnallite, sylvinite in halite host, variable tachyhydrite (Aptian). Previously mined at Holle Mine (Republic of Congo) in 2 variable layers of 1.9 m and 3 m thickness (De Ruiter, 1979)	
Neuquén and Mendoza Basins, Andes, Argentina	Cret.	Marine	Potash interval	Possible future solution mine. Sylvinite ore divided into 2 zones, upper zone about 3 m thick and lower about 11 m thick. A 1000m depth and high formation temperature (>50°C) precludes conventional mine (Prud'homme and Krukowski, 2006).	Various phases of volcanic activity post-salt deposition from Eocene to Pliocene in Eastern Neuquén Basin (Urien and Zambrano, 1994)
Pripyat Depression, Belarus	Devonian, Upper	Marine	Liven and Elets horizons	Livet (Frasnian) interval is made up of four potash horizons with areas between 130 to 1500 sq. km. Sylvite ore with minor carnallite in beds 4cm to 1.5 m thick interbedded with muddy halite. Elets (Fammenian) interval > 60 potash beds over 5,000 sq. km at depth of 200 to 3,000m. (Zharkov, 1984)	Volcanic activity in basin syn-salt depositon, demonstrated by intercalation of tuff deposits with halite sequences (Petrova, 2010)
Sergipe Basin, Brazil	Aptian, Early Cret.	Marine	Ibera member	Taquari-Vassouras mine targets sylvinite beds in Muribeca Fm. found in association with halite host, variable carnallite, tachyhydrite (primary textures in unit up to 90 m thick) constituting some nine evaporite cycles deposited in an opening rift (Aptian). Tachyhydrite present. (Wardlaw, 1972)	Various phases of volcanic activity related to Aptian rift opening, and further post-salt deposition events in the Paleocene/Eocene (Mohriak et al. 2008)
Amazonas Basin, Brazil	U. Carb. - L Permian	Marine	Nova Olinda Fm.	Twosylvinite deposits (sylvite cap to uppermost of 7 evaporite cycle, also with caranallite) near Manaus ≈ 1000m depth , with average thickness of 2.7 m (Szatmari et al., 1979)	Various phases of volcanic activity related to Aptian Rift opening, and further post-salt deposition events in the Paleocene/Eocene (Mohriak et al. 2008)
New Brunswick Potash, Fundy Basin, Canada	Carboniferous	Marine	Cassidy Lake Fm.	Formerly mined at depths 300-100m in halokinetic salt wall, Mississippian sylvinite-halite sequence with local carnallite in Windsor Group in Moncton sub-basin. (Visean) (Anderle et al., 1979; Wilson and Roulston, 2006)	Fundy Basin underwent post-salt deposition Central Atlantic Mamatic Province (CAMP) volcanism in Jurassic/Triassic (Cirilli, 2009)
Alberta Potash Basin, Canada	Devonian, Middle	Marine	Prairie Fm	Actively mined, some ten mines (2 solution mines) at depths between 800-1000m, region is world's major supplier of potash ore. Three potash horizons (sylvite, carnallite, halite) 20-25m thick in upper part of Prairie Fm. (Esterhazy, Belle Plain and Patience Lake members). Dips gently to south at 1-8m/km with potash level some 600-2500m below surface. (Fuzesy, 1982)	
Dabuxum Lake (stratoid potash) Qahran Playa, Qaidam Basin, China	Quaternary	Nonmarine	Recent	Carnallite (via solar processing of lake brine along with bishofite). Transtensional basin at 2675m elev. (Warren 2010)	
Dallol Saline pan, Ethiopia	Quaternary	Marine	Houston Fm.	Three members; uppermost is sylvinite member up to 10 thick; intermediate is 3-24 m thick with carnallite throughout, (sylvite at its top and kainite at its base) and lower member is kainite that is 4-13 m thick. It is a Pleistocene marine-fed unit that now lies beneath continental halite in a subsealevel (-115 msl) hydrographically-isolated marine-fed rift valley, region of active volcanism and hydrothermal overprints. (Garrett, 1995, 2004)	Volcanically active to present day, including fissure (dike) fed volcanism (see main paper for refrences)
Mulhouse Potash Basin, Rhine rift, France	Eoene-Oligocene	Marine	Upper Salt Group	Main potash target is primary sylvite bed with carnalllite layers in Salt IV in Oligocene Rupelian succession at depths between 420 and 1100m. (Cendon et al., 2008)	Underwent volcanism post-salt deposition during mid-miocene (Kaiserstuhl volcanics) (Hinsken et al. 2007)
Zechstein Potash Basin, Germany	Permian, Upper	Marine	Zechstein Group	Actively mined at depths between 300-800m, Zechstein comprises four evaporite cycles, with potash (sylvite target/±carnallite gangue) as across five ore horizons in lower three (Thuringen, Hessen, Stassfurt, Ronnenberg and Riedel) (Tatarian). Tachyhydrite present in Stassfurt. (Smith and Crosby, 1979; Richter-Bernberg, 1986))	See Paper
Sicilian Basin, Italy	Mioc., Late	Marine	Solfifera Series	Mined but inactive since mid 1990s. Kainite was dominant ore mineral (manufactured potassium sulphate). Other minerals in ore were sylvite, kieserite, bischofite, and carnallite in 2-30m thick beds dipping to 60°.	
Pricaspian depression, Kazakhstan	Permian, Lower	Marine	"Potash interval"	Potash interval contains polyhalite-halite, bishofite-carnallite, carnallite-halite, interval is strongly halokinetic in central part of basin. Oil wells also intersected several potash horizons in this region. (Kungurian). (Volozh et al., 2003; Garrett, 2004)	
Solikamsk depression, Russia	Permian, Upper	Marine	Iren horizon	Bezeneski and Solimgansk mines. potash interval lies at depths of 200-500m and is divided into lower sylvinite and upper sylvinite-carnallite, little to no MgSO4 salts. Av. lower interval thickness 21 m, upper interval 60m.(Zharkov, 1984). Little published data available about geology of basin	
Eastern Siberia Potash Basin, Russia	Camb. Lower	Marine	Chara horizon	Potash (mostly sylvite/caranallite) lies at depths of 600-900m and contains some ore-grade sylvite intervals in Usolye and Angara Fm. (Zharkov, 1984)	Underwent extensive post-salt deposition volcanism from Permian - Triassic, as part of the Siberian Traps (Reichow et al., 2009)
Catalonia and Navarra Potash Basins, Spain	Eoc. Upper	Marine		Transitional from marine evaporite to continental, deposited in two depocentres in Southern Pyrenean foreland. Sylvite+halite at base of unit, carnallite + halite toward top (Bartonian). Lower sylvite member is ore bed. MgSO4-free. (Rosell and Orti, 1981; Cendon at al., 2003)	
Khorat & Sakhon Nakhon Potash Basins, Thailand, Laos	Cretaceous (Albian?)	Marine	Maha Sarakham Fm.	Possible sylvinite target on basin margin. Widespread massive halite, carnallite (with local zones of sylvinite), tachyhydrite and bischofite traces of priceite/boracite. Unconformable base, interbedded with three continental redbed successions and overlain by continental deposits. Variably halokinetic toward basin centre.(Hite and Japakasetr, 1979; El Tabakh et al., 1999; Warren, 2000, 2006)	
Carpathian foredeep, Ukraine	Mioc. Middle	Marine	Tyras Suite	Stebnik mine and Kalush-Golyn region. Four evaporite cycles upper three with potash ; exploited potash units composed of kainite, langbeinite, kainite–langbeinite, sylvinite and carnallite rocks with layers of rock salt or interbedded clays and carbonates. Fourth bed is polyhalite (Hryniv et al., 2007)	
Paradox Potash Basin, UT, USA	Carboniferous (Penn.)	Marine	Paradox Fm.	Solution mining of Paradox Fm. in converted conventional mine on Cane Creek anticline at a depth of 850 m. Middle Pennsylvanian collision basin related to Marathon-Ouchita orogeny, 18 of 29 halite cycles contain potash, mostly sylvite with carnallite. Tachyhydrite locally present. (Hite, 1961; Williams-Stroud, 1994)	Underwent post-salt depositon volcanism in Oligocene. Three large laccolithic intrusive bodies occur within the salt basin, and other near margins. USGS report mentions that igneous intrusion has occurred into Paradox Salt Formation, but no more details given (Baltz. 1957)
Salado Potash Basin, NM, USA	Perm.- Upp. Lower Trias.	Marine	Salado Fm.	Potash resource now largely depleted, 12 potash horizons in part of Delaware Basin known as McNutt Zone (sylvite ore), few mines still active. Ore zones contain sylvite, carnallite, lesser amounts of sulphate minerals such as polyhalite and langbeinite (Tatarian - Olenekian). (Lowenstein, 1988)	
Michigan Basin, MI, USA	Silurian, Lower	Marine	Salina A-1 Evap.	Sylvinite ore and carnallite within central part of an intracratonic sag basin. Potash zone > 30m thick in central part of basin but ore concentration is erratic (Matthews and Egleson, 1974)	

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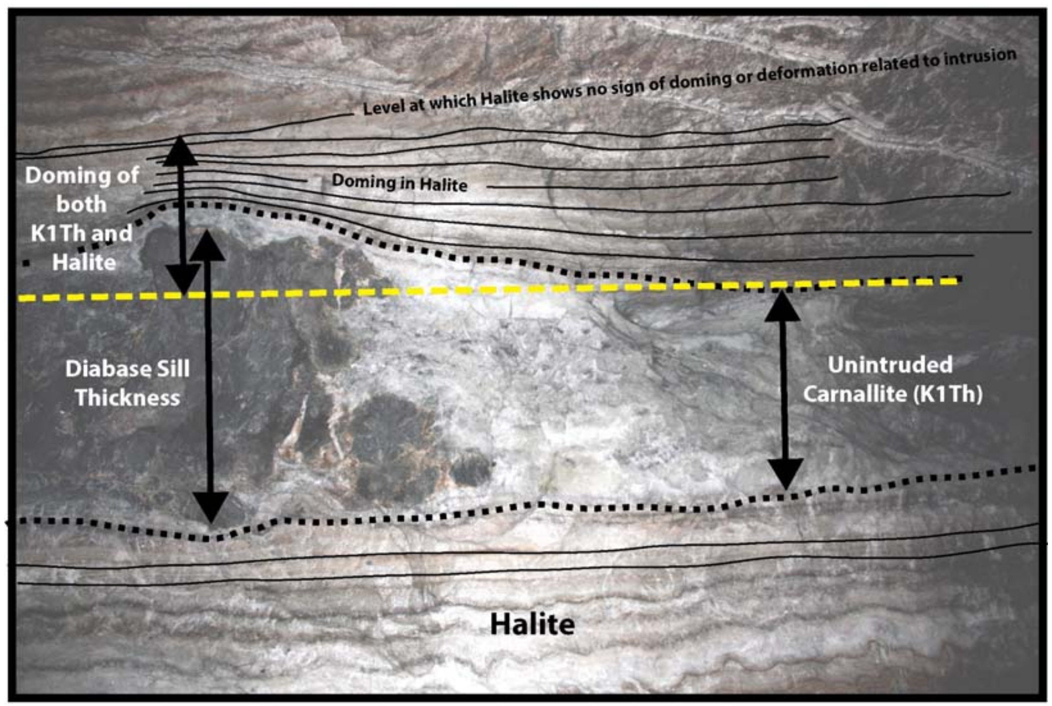

Figure DR1. nb. note all doming/deformation of Halite related to the sill intrusion is directed upwards

Figure DR1. Photo showing localized nature of the doming and host rock deformation which has accommodated sill emplacement.

Movie DR1