



# China Clay

## Minerals Safeguarding DPD Evidence Report

### December 2018

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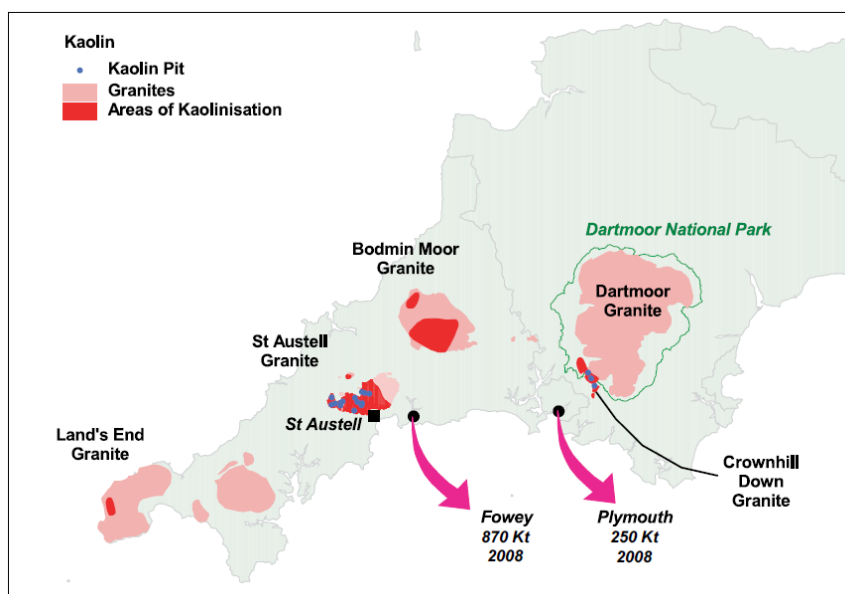
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# 1 Geology of China Clay (Kaolin)

1. China clay (or kaolin) is a product of altered granite, which has been affected by an interaction of the groundwater with the feldspar minerals within the granite to form kaolinite.
2. Cornwall has five large bodies ('plutons') of granite and many smaller outcrops rising from a large parent body, the Cornubian Batholith, which is mainly concealed by Devonian and Carboniferous strata. These were formed from molten rocks deep in the earth's crust, during and after the period of Variscan earth movements, between 300 and 270 million years before the present.

**Figure 1 Granite Outcrops in SW Britain<sup>1</sup>**



3. In the case of Cornwall's granite deposits, the alteration is patchy in quality and spatially. The kaolinised zones within the granite tend to be funnel-shaped or trough-like in cross section, several hundreds of metres across at outcrop, and narrowing downwards. Some of the kaolinised bodies are very extensive and deep-seated, with the stems of more than 300m below surface. Kaolinised granite is more friable and generally softer than unaltered rock and consists mainly of quartz or mica, unaltered feldspar (potassium feldspar tends to be less readily altered than the plagioclase feldspars) and kaolinite.
4. China clay resources are found within 3 of the larger granite bodies namely the Land's End peninsula, Hensbarrow (north of St Austell) and Bodmin Moor, and in smaller bodies at Godolphin/Tregonning and Belowda.

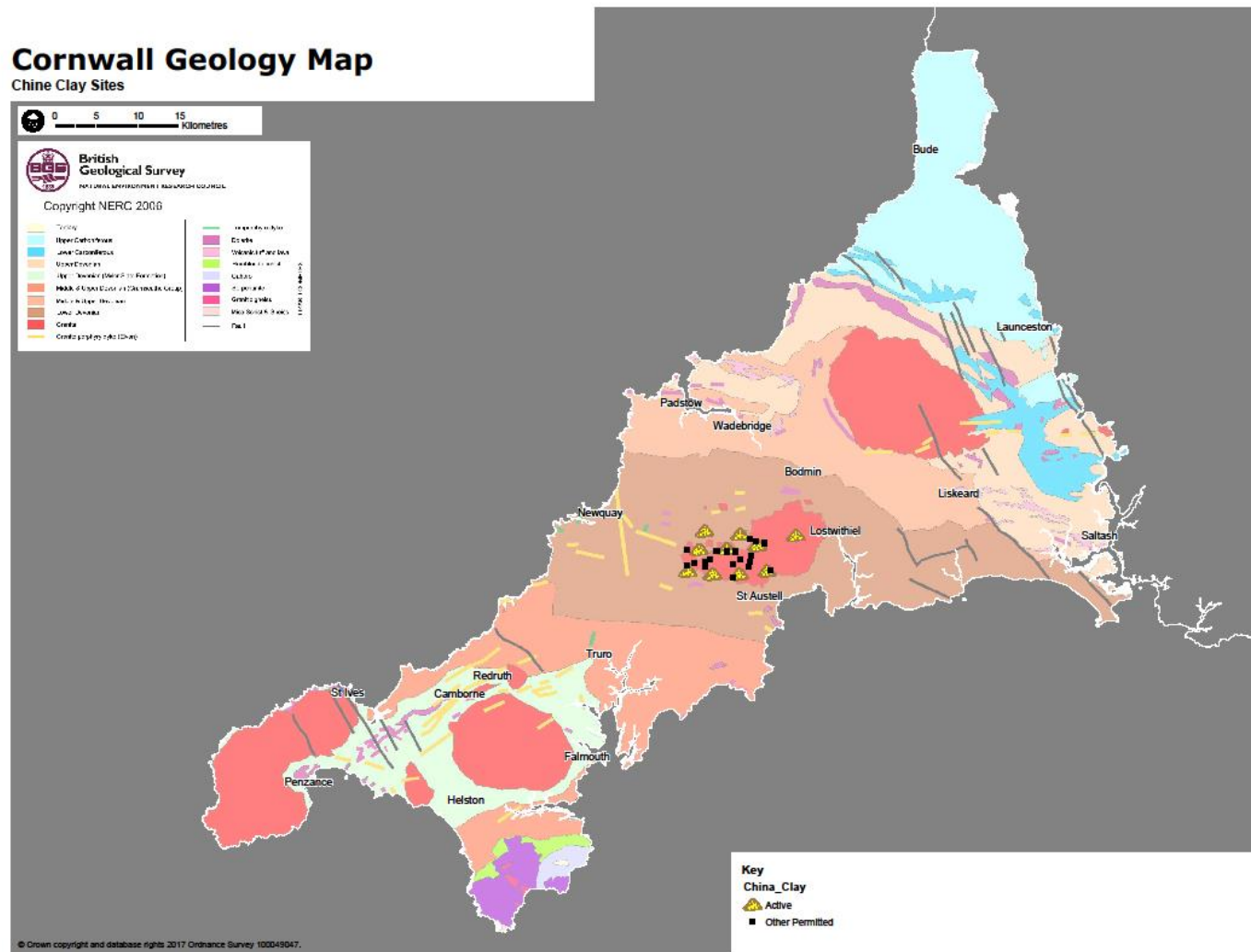
<sup>1</sup> Source: Mineral Planning Factsheet Kaolin, BGS 2009  
<https://www.bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html>

5. Further information about china clay (kaolin) can be found in the British Geological Survey Mineral Planning Factsheet [bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html](https://bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html) and the BGS "Mineral Resource information for Development Plans, Cornwall: Resources and Constraints 1997".

## **2 Current production and reserves of china clay**

6. The primary china clay (kaolin) deposits of south-west England are world class in terms of their size and quality. They have yielded over 165 million tonnes of marketable clay since production began in the middle of the 18<sup>th</sup> Century. Although significant quantities were extracted from the Bodmin Moor and Land's End granites in the past, production has recently ceased in these areas. Commercial exploitation of the china clay in Cornwall is now confined to the western and central parts of the Hensbarrow (St Austell) granite, as shown in Figure 2 Geology, Currently Worked and Other Permitted China Clay Sites.

### Figure 2 Geology, Currently Worked and Other Permitted China Clay Sites



7. Extensive planning permissions for winning and working of china clay in the St Austell (Hensbarrow) area extend to some 88 square kilometres, although the area of active extraction, tipping, handling and processing sites is much smaller.
8. Table 1 Status of permitted china clay extraction sites in Cornwall by Operational Area show the existing planning consents for china clay extraction. The planning permissions are subject to Periodic Reviews under the Environment Act 1995 and the majority of these permissions are due to expire in 2042.

**Table 1 Status of permitted china clay extraction sites in Cornwall by Operational Area**

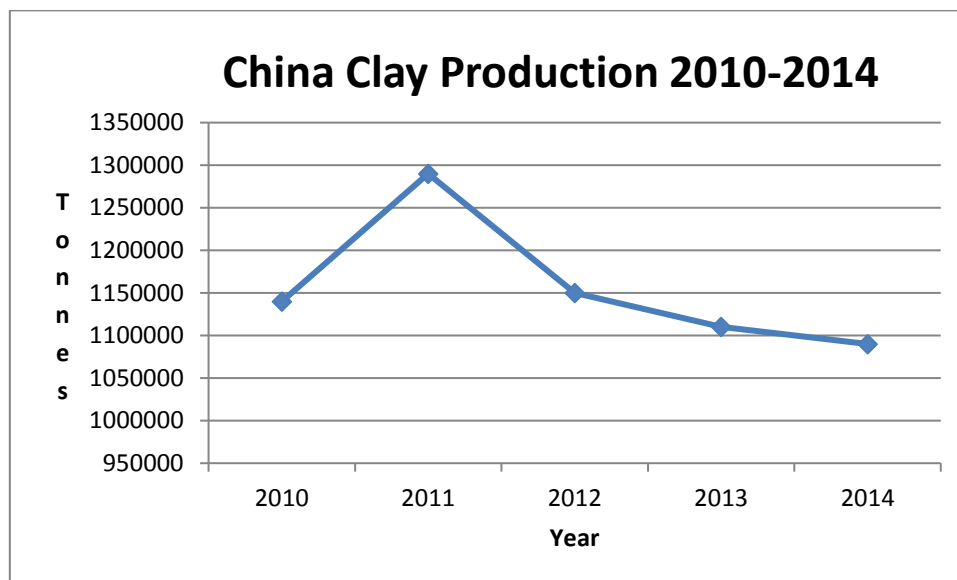
Site	Status
OA1 Fal	Active
OA2 Kernick	Active (mica dam)
OA3 Treviscoe	Active
OA4A Trelavour Downs	Active (not currently working)
OA4B Rostowrack	Active
OA4C Goonvean	Active
OA5 Trelavour Works	Active (not currently working)
OA6 Bloomsdale (Goonmaris)	Not currently working (Long Term Working Area)
OA7 Capalla	Not currently working (Cessation of Mining Operations identified November 2011)
OA8 Goverseth	Active
OA9 Hendra	Active
OA10 Gothers	Not currently working (Long Term Working Area)
OA11 Gilleys	Active
OA12 Karslake	Active
OA13 Blackpool	Active (not currently working)
OA14 Burngullow	Active (not currently working)
OA15 Gover	Not currently working (Long Term Working Area)
OA16 Trethowel	Not currently working (Long Term Working Area)
OA17 Greensplat	Active
OA18 Wheal Martyn	Active
OA19 Gunheath	Active
OA20 Wheal Prosper	Active (not currently working)
OA21 Goonbarrow	Active (not currently working)
OA22 Hallow	Active (not currently working)
OA23 Rosemellyn	Not currently working (Long Term Working Area)
OA24 Molinnis	Not currently working (Long Term Working Area)
OA25 Rocks	Active
OA26 Lantern	Not currently working (Long Term Working Area)
OA27 Singlerose	Active (not currently working)
OA28 Penhale	Active (not currently working)
OA29 Baal	Active (not currently working)

Site	Status
OA30 Garker	Not currently working (Long Term Working Area)
OA31 Bodelva	Active (not currently working)
OA32 Wheal Rashleigh	Not currently working (Long Term Working Area)
OA33 Luxulyan	Not currently working (Long Term Working Area)
OA34 Innis Moor	Not currently working

*Note: Under the Review of Mineral Planning Permissions, Environment Act 1995: Sites defined as "Active" may be worked without further determination of planning conditions, subject to the provisions of the Environment Act 1995; sites defined as Long Term Working Areas may not be worked unless a scheme of working and restoration and new conditions has been approved by the Mineral Planning Authority.*

9. The BGS Minerals Yearbook, 2015<sup>2</sup> estimated that production of china clay in 2014 amounted to 1,090,000 tonnes (dry weight). Figure 3 China Clay Production shows the level of china clay production in the UK since 2010 and a gradual decline in china clay production since 2011.

**Figure 3 China Clay Production**



10. A decline in UK production from its peak in 1988 of 2.78 million tonnes could be due to the increased competition in Western Europe paper markets resulting from imports, particularly from the Amazon basin and from alternative white pigments such as calcium carbonate.
11. The British Geological Survey Mineral Planning Factsheet on Kaolin<sup>3</sup> indicated that Cornwall produced 88% of the total kaolin sales in 2008 (sales of kaolin were 1.36 million dry tonnes in 2008) and that, at current rates of production, there are proven reserves in and around existing pits to sustain production for at least 50 years. Using this information it is estimated that Cornwall's reserves of china clay exceed 60 million tonnes.

<sup>2</sup><http://www.bgs.ac.uk/mineralsuk/statistics/UKStatistics.html>

<sup>3</sup> [www.bgs.ac.uk/downloads/start.cfm?id=1362](http://www.bgs.ac.uk/downloads/start.cfm?id=1362)

12. Traditionally, china clay is extracted from the kaolinised granite by “wet mining”. High pressure jets of water (‘monitors’) are used to erode the working faces and wash out kaolin in suspension. The slurry produced gravitates to the base of the pit from where it is pumped to the surface for processing. Ripping, drilling and blasting of the granite are also used to access the reserves and improve yields, with unaltered granite removed for tipping or processing into aggregate. Recently, dry mining has been introduced in some areas, with the intention of allowing more selective extraction, reducing energy costs and improving yields. In this technique, the kaolinised granite is extracted by shovel and truck and is transported to a primary screening plant to remove oversize material. The undersize fraction is disaggregated by high pressure jets of water for subsequent processing in the conventional way.
13. Processing of china clay is essentially based on wet refining and thickening in which fine kaolinite is removed from coarser impurities such as quartz, using the different settling velocities associated with specific gravity and particle size. Kaolinite is concentrated in the finer particle size fractions and settles much more slowly than silt or sand-size particles. The cut between commercial kaolin and waste is normally at <15 microns, but there some loss of coarser kaolinite particles with the oversize fraction. Froth is now increasingly used to selectively remove coarser kaolinite particles; this is followed by grinding to break down the kaolinite aggregates and to produce the desired particle size distribution. The introduction of flotation technology has improved kaolinite recovery and has also allowed the retreatment of mica waste residues, into which coarser kaolinite previously had been lost. Clays from different areas are blended at the refinery to meet the requirements of specific customers
14. The refined clay is thickened in settling tanks and pumped, in slurry form, to the drying plant. It is then filter pressed to remove more water before progressing to the energy intensive drying process. Modern drying plant use natural gas to provide heat and power for a number of drying units, being located close to dryers and enclosed in buildings which provide sound insulation. The exhaust heat is ducted in large insulated pipes to the dryers and this reduces the emissions of greenhouse gases as well as reducing the energy costs, which constitute a significant element of clay production costs. Alternatively tube presses can be used which produce clay at 18% moisture which requires no heat.
15. On average, the material extracted from the pits contains 12 to 15% of commercially-saleable clay, the remainder being regarded in the past as waste which needed to be tipped on adjacent areas, thus impacting upon the local environment. However, it is now a widely recognised secondary aggregate. Further information on the use of china clay by-products as secondary aggregate is available in the Council’s annual Local Aggregate Assessment.



### **3 Markets, transport and use of china clay**

16. Refined china clay has many industrial uses grouped into three main markets. Firstly, about 50% of the annual UK production is used as filler and, more recently at a much reduced level, as coating for paper. Secondly, the ceramics industry accounts for some 30% of production exported mainly to Europe, the Middle East and Asia. The clays of the western Hensbarrow area are important for the production of ceramics, having suitable standards of brightness, strength and flow. Thirdly, the remaining 20% of production is used for other industrial processes especially in paint, rubber and plastics.
17. Britain is the one of world's largest producers of china clay, after Brazil, USA and China. In 2014 approximately 8.5% of the total china clay produced was exported with exports being valued at £116,105,000. China clay sales have been on a declining trend since a peak output of 3.26 million tonnes in 1988 to most half that level in 2008.
18. Clays are sold in slurry form, as dried pellets, in powder form, and as a loose product.
19. About 77% of the china clay produced is exported to market by sea (until recently from the Ports of Fowey and Par, but the latter closed at the end of 2007). It is delivered to the Port of Fowey mainly by rail or via a private haul road linking the Ports of Par and Fowey. About 13% of clays are transported to market entirely by rail. About 10% is delivered by road.

### **4 Future supply**

20. Increased competition in the global markets for paper clays (since the 1990's) has reduced profitability for many producers. The industry has responded by effecting structural change and investing in more efficient production methods. Recent years have seen closures in the US and UK and expansion in Brazil. Brazil has enormous deposits of high quality china clay in the Amazon basin, and low production costs, making it highly competitive globally, despite the additional shipping costs.
21. It is thought that growth in the ceramics market will expand most rapidly in Asia and Latin America with their growing populations and economies. Other growing markets are likely to include use in the oil and gas industry, where it is used in hydraulic fracturing; and in fibreglass industry where it is used as a re-enforcing agent. Markets in refractory clays in developed countries are likely to decline because of substitute materials.

### **5 Government policy and guidance for china clay**

22. The background to government policy in the St Austell China Clay Area can be traced back to the post war years when the national government set a high priority upon reconstructing the nation's economy. China Clay was considered to be a strategic mineral of national importance and its exploitation was considered to underpin the economy of Mid Cornwall. The government set up a Standing Conference for China Clay in 1949 to "co-

ordinate the views of the local planning authorities, the industry, the China Clay Council and Government departments on matters such as development plan provision for china clay working, waste disposal and the problems encountered with the granting of planning permissions". The findings of the final report of the China Clay Conference were used in the development of planning policy for Cornwall since the mid-1950s.

## **5.1 National Planning Policy Framework**

23.The National Planning Policy Framework (NPPF) includes a section on minerals and makes specific reference to ensuring there is a sufficient supply of minerals and also to defining Mineral Safeguarding Areas for minerals of national and local importance, including kaolin.

24.The NPPF requires local planning authorities to include policies for local and nationally important mineral resources and to safeguard those resources. Great weight should be given to the benefits of mineral extraction including to the economy.

## **5.2 Cornwall local policy development history for china clay**

25.Since the incorporation of the recommendations of the findings of the China Clay Conference in the mid-1950's, the development plan for Cornwall defined areas believed to contain deposits of china clay and associated minerals and areas intended for the working of china clay.

26.Subsequently further work by the china clay companies and local highways and planning authorities resulted in the Long Term Strategy for the St Austell China Clay Area and Short Term Plans. The 'Long Term Strategy' identified the existing and proposed areas for china clay pits, china clay waste tips and micaceous waste disposal areas as well as "Island Settlements" (11 settlements to be the focus of community growth and to be excluded from china clay working). The Long Term Strategy for the St Austell China Clay Area and Short Term Plans were used as material planning considerations prior to the adoption of Structure and Local Plans.

## **5.3 Cornwall Minerals Local Plan 1997**

27.The Cornwall Minerals Local Plan (CMLP) adopted in 1997 contains planning policies for the development of china clay and related development. The primary aim of the CMLP is to ensure the stable and long term production of the Cornish mining and quarrying industry. Chapter 7 is dedicated to china clay. The saved policies which are not due to be replaced by the Local Plan – Strategic Policies document are as follows:

- E3 – Landscape
- S1 – Mineral Safeguarding
- CC3 – Areas of Special Environmental Concern
- CC5 – Protection of Settlements
- CC6 – Safeguarding of Existing Routes
- CC7 – Railway Routes

28. These policies will be reviewed as part of the production of the emerging Minerals Safeguarding DPD.

## **5.4 Cornwall Local Plan 2016**

29. The Cornwall Local Plan was adopted in November 2016 and contains two strategic mineral policies. Policy 17 aims to maintain a sufficient supply of indigenous minerals to achieve sustainable and economic growth, whilst encouraging the use of recycled and secondary materials. Policy 18 sets out policy for the identification of safeguarding areas for mineral resources, as well as for key mineral infrastructure through a Minerals Safeguarding DPD.

30. A number of policies in the 1997 Minerals Local Plan continue to form part of the development plan, although they will be reviewed as part of the Minerals Safeguarding DPD.

## **5.5 St Austell China Clay Tipping and Restoration Strategy**

31. The St Austell China Clay Tipping and Restoration Strategy was prepared jointly by the mineral planning authority and china clay industry for the period up to 2050 and beyond and was adopted as supplementary planning guidance by Cornwall County Council in 2000.

32. A Geographical Information System was used to develop and examine different tipping scenarios (with a range of tipping profiles) to accommodate the predicted levels of solid china clay waste (above that which could be sold for secondary aggregates or backfilled in exhausted pits or parts of pits) on land with lesser environmental and operational constraints. A range of adopted environmental and operational objectives were used to test the scenarios and identify a number of Preferred Tipping Areas (PTAs) to accommodate the china clay industry's future tipping needs with least impact upon the areas of environmental designations/notifications. The Preferred Tipping Areas were located as close as possible to the pits generating the china clay waste. The Tipping and Restoration Strategy is available at <https://www.cornwall.gov.uk/planning-and-building-control/planning-policy/adopted-plans/st-austell-china-clay-restoration-and-tipping-supplementary-planning-document/>

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