On Her Majesty's Service

THE DIARY OF SIR JAMES HOPE

24th January-1st October, 1646

Edited by

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INTRODUCTION

The diary is contained in a small calf-bound volume exactly similar to the one whose contents (1646-54) were published under the same title in the Third Miscellany Volume of the Society (1919).[1] The text, which is unimpaired, occupies all but six of its 144 pages; five of the others are given over to various memoranda.

The author, Sir James Hope of Hopetoun (1614-61), was the sixth son of Sir Thomas Hope of Craighall, the eminent Lord Advocate. After graduating in 1635 at Edinburgh University (which possesses his lecture notes for 1633-34) he continued his studies at Orleans. Soon after his return he married, on 14th January 1638, Anna Foulis, who had inherited from her father Robert Foulis, advocate, the five merklands of Waterhead or Overglengonnar in Crawfordmuir, known also as Leadhill. The lands with their minerals were included in the marriage contract as security for the bride's promised dowry of £20,000.[2] A disputed claim to part of the estate by Sir William Baillie of Lamington delayed entry,[3] but in September 1641 a grant was made *de novo* to Sir James and his spouse under the Great Seal,[4] and two months later he took sasine of the lands and barony. In this same decisive year he was made Governor of the Mint and held that post with distinction till 1660.

From the first he devoted himself with enthusiasm to the development of this rich heritage, and by 1645 had entered on a five years' contract for the supply of lead ore to a firm of merchants in Zeeland. It was thus as producer and

[1] For the Hope family see Intro. to same.
[2] *Registrum Magni Sigilli*, ix, 902.
[3] *Register of the Privy Council, 2nd Series*, iv. 343; Edinburgh University Library, *Laing MSS., Div. II, 478* (7); *Diary of Sir Thomas Hope* (Bannatyne Club, 1843), 124-7-9, 148; *Registrum Secreti Sigilli*, 1639-41, 222v.-223. See also p. 190, n. 3.
[4] *R.M.S.*, ix. 981.

exporter that he now undertook a visit to the Low Countries, the record of which forms the major part of the diary or, as he calls it, 'Memoriall.' He wished to meet the friendly Dutch partners; he had in mind the provision of plant and—a recurrent problem in early Scottish industry—the recruitment of skilled labour. But he was a young industrialist with a lively spirit of scientific enquiry and, throughout his planned itinerary, every manufacturing process or device that caught his interest was closely observed and recorded. Two-fifths of the text is devoted to this quest. Cities and men, however, engaged him as well as metals and machinery, and the day-to-day background is progressively touched in.

When he made his first entry on 24th January 1646, he had already been about four months in London. With his wife he had left Scotland in the previous September, acting as escort to his sister, Mary, and her young son Charles. Her husband, Sir Charles Erskine of Alva, had in July 1644 been elected an additional Scots Commissioner to England, and was to remain there almost continuously till the dissolution of the Committee of Both Kingdoms. The family group was later joined by James's elder brother, Sir Alexander, cupbearer to Charles I. He and his wife had set out in August from Craighall and been captured by Parliamentary forces near Newark.[1] Though Sir Charles Erskine secured their release they lost all their money and valuables.[2]

The opening nine pages are occupied almost wholly with money matters, set down with the same nicety of detail that marks his technical recordings. We see at work the officialdom through which the army of the Covenant was being financed. In Robert Inglis and the Dutchman Tierens we note the rising class of merchant bankers; there is also the worthy burgh commissioner and ex-provost of Ayr, Hew Kennedy, ready to negotiate a short term loan. The extravagant Sir Alexander figures largely; after his recent misadventure he would be more than ever in need

[1] *Calendar of State Papers, Domestic, 1645-47*, 146, 148.
[2] *S.H.S., Miscellany Volume I*, 129.

of financial replenishment. Doubtless he had been receiving little if any salary, but he was fortunate in his far-sighted father and a loyal brother. In 1642 the Lord Advocate, as he records,[1] secured for him from James Livingstone, keeper of the privy purse, a guarantee of £2000 from that convenient stand-by, the King's annuity of teinds. When the only result was an accumulation of unpaid interest, it was Sir James who took over Livingstone's assignation and advanced cash for a paper expectancy.[2]

At last on March 7, having provided his wife with £95 stg. for use in his absence, he set out from London Bridge on his journey to Holland, accompanied by his man Robin Wilson. From Greenwich they rode on to Langley House, home of Sir Humphrey Stile, a fellow cupbearer of Sir Alexander (then resident there) and like him separated from the King still holding out in beleaguered Oxford.

On the way to Dover with Sir Humphrey and other country gentlemen the two brothers branched off to inspect the 'iron mills' at Barden, some four miles from Tunbridge Wells. The twelve pages that follow make a notable addition to the history of English iron-making, especially in the design of an early blast furnace. Hitherto a name only, Barden comes busily alive, a smallish site but engaged in the casting of cannon under John Brown of Brenchley, the leading gunfounder of the day. It is of note too that at Liège Sir James found little difference in plant and process from what he saw at Barden, except that there was no preliminary roasting of the ore, and lime was used as a flux.[3] There follows a long detailed description of the allied making of charcoal, this being still the indispensable fuel for the smelting of iron.

Hitherto the first known reference to a furnace at Barden is 1653. Schubert 367.

At Dover a small re-united company, strongly royalist, dined at the Castle with the governor Sir John Boys, and later at Deal fort with its captain, Vice-admiral William Batten, both strong for the Parliament. This friendly mingling of political opposites is significant; it exemplifies

[1] *D.T.H.*, 166, 180. [2] V. *post*, p. 144, n. 3. [3] V. *post*, pp. 148, n. 9; 172.

the widespread desire for an agreed settlement at this stage of the conflict.

In a States man-of-war, heading a convoy, master and man left Deal a week later. They soon had experience of the danger to shipping in these waters from the Dunkirk privateers; but this time ultimate victory had gone to the Dutchmen and our voyagers arrived at Flushing amid loud jubilation. Sir James made first for Middelburg, to meet and lodge with Francis Vanhoght, one of the contracting partners and an old importer. Eleven years previously he had come over to settle his lead ore and other accounts with Scottish merchants and been quarantined at Leadhill as a plague suspect.[1] On a similar visit in 1652 he fell ill and died at Sir James's home in the Cowgate.[2] He was now to act as interpreter and disburser on the coming expedition.

At the opening of his contract in 1645, Sir James had received an 'advancement' of 10,000 merks; he had also drawn, as agreed, £200 stg. each year on London through the firm's agent, Anthony Tirens.[3] In the year 1645-46 the Company had received no ore, a commentary on the disturbing effect of the 'troubles' on production and export both. His account was thus, as he says, no longer liquid, and no doubt the initial motive behind his journey so far was to reach a personal settlement. He began to export again in 1647, when, as can be inferred from his correspondence, 'all that they could crave of me' was being implemented.

At the end of his tour his indebtedness was further increased by incidental expenses, paid by Mr. Vanhoght, amounting to £300 great (or Flemish) and by a loan of about 250 guilders, in all some £170 to £180 stg. With the outstanding debt of nearly £1400 stg.[4] this was a goodly sum. The mutual goodwill and confidence shown in these transactions were the basis of an association which, through successive contracts, was to continue till the last years of

[1] *R.P.C., 2nd Ser.*, vi. 145.
[2] *S.H.S., Misc.* iii. 149, and MS. Letter Book.
[3] MS. Letter Book, 11/21 Jan. 1648. Hope's usual spelling of the name.
[4] V. Appendix p. 197.

his life. The customary gifts which he later distributed to the staff and families of the partners were both liberal and comprehensive.

These friendly duties fulfilled, it was but a step to the Staple port of Veere, with its unique community of Scots abroad. In its conciergery house we meet the forceful conservator, Cunningham, and the scholarly pastor, William Spang. Some comment on the inn and port would have been welcome, but for Sir James there was matter more deserving in the intricate oil-extraction plant of the factor, James Eleis. And so at Dort: the governor of the Scottish mint held professional discourse with the assay master there; at Gorkum it was the new Dutch ribbon loom that called for mention.

On the passage from Dort to Gorkum a young Scots student emerges for a brief moment in a considerable entry—one Archibald Erskine of Kirkbuddo in Angus. A younger son, and left with little means, he chose to 'follow his book,' in which he had 'profected well,' rather than accept the attractive offer of a career in the Hope lead business. There was hesitation both in making and refusing the offer, but 'Carbudoes son' was for the road to France, and trace of him is lost.

Amsterdam, reached viâ Utrecht, detained him for twelve days, an indication of the many-sided attractiveness of that flourishing city. He viewed the shipping, worshipped in the French and English churches, attended a service in the synagogue and went to the play. He purchased bibles and other books, but by trying to beat down the price failed to secure an assay balance and a sable muff for his wife.

Three episodes stand out. In Frans Rooy he met a former Dutch associate who had experimented in his laboratory at Edinburgh and, doubtless as a foreign expert, had made saltpetre in Scotland; now in Rooy's laboratory he saw an industrial chemist at work on his own ground. There was also his encounter with the German Peter Hexe who, acting for a group of Dutchmen, claimed a high silver content for the ore of a Cologne lead mine in which the Middelburg partners were being offered a quarter share.

Sir James's caution and careful experiment exploded this claim and saved his Dutch friends their guilders.

He dined, too, with a Jean Meinershagen, wine merchant and lead producer, also from Cologne. Three pages are devoted to this ore of Cologne, from its mining and smelting (with charcoal) to the type of furnace and the yield per cent. Sir James must have felt that this had been a most rewarding meal, as it also brought the promise to recruit workers, 'speciallie a good smelter,' for Scotland.

After Amsterdam Haarlem—mentioned merely in passing—then through Leyden and The Hague to Rotterdam. Leyden was the foremost of the Dutch universities, attracting both teachers and students from far and wide; it was then, and long afterwards, a favourite place of study for Scottish students of law.[1] Three young Scots came to meet this visitor from home. One would have liked to hear more of Professor Stewart, that doughty Presbyterian who earned the scornful notice of Milton. To Robert Baillie he would have been an ideal principal for St. Leonard's,[2] but Leyden held him till his death in 1654.

The Hague presents an unusual interlude, with palace interiors and groupings of the high-born around their dining tables. Of these the young Princess Royal dined alone and was served *à la reine*. Her aunt, the exiled Winter Queen, sat among her daughters; and there is a parting glimpse of Prince Frederick Henry, ageing now and worn, not to live to see his country's independence recognised on terms assured by his long and stubborn exertions.

Here, appropriately, passes were obtained from the Estates and from Brussels to enable the three travellers to reach the principality of Liège. 'At this time Spanish troops were stationed under the walls of Ghent, Bruges, Antwerp, Brussels, Namur and Mons to defend the chief cities as long as possible, and the Duke of Lorraine had placed his forces at the disposal of the Spanish government.'[3] They ran some risk, therefore, in venturing into 'the enemies country' but, apart from one or two

[1] Stair Society, vol. i, 233.
[2] *Letters and Journals*, iii, 7.
[3] Blok, *History*, iv, 126.

brushes with stray units, they were not seriously impeded.

Rotterdam seems more alive with Scots than Veere. So large was the number of settlers that on their petition to the presbytery of Edinburgh in 1642 to find them a minister, the Rev. Alexander Petrie was prevailed upon to become the first incumbent of this new Scottish charge. To his rigorous discipline Sir James bears witness. The church took root: it became the chief seat of worship for the Scots Brigade and it is still in communion with the Church of Scotland.

Before leaving Rotterdam he took the precaution of handing over to the resident Scots merchant, John Rind, money and personal effects which might have appealed to the roving soldiery. Also, during dinner he listened to the discussion of Mr. Vanhoght's proposal that the Middelburg and Rotterdam lead-importing firms should combine and so cut out competition. A decision was left over, but a merger later took place.

The way to Liège led through Hertogenbosch and Maastricht, both captured by Frederick Henry from Spain, strongly fortified, and each a check-point for passing travellers. In the former were stationed two of the many Scots of good family who found a career abroad in the Scots Brigade—Captain Bruce of Airth and Major Walter Murray, maternal uncle of the Earl of Lothian. After Sir James had paced and noted the dimensions of the recently built citadel, he left for Maastricht on 22nd April, 'a most stormie day for weette and wind,' and two days later was in Liège, arriving in 'a great boat drawn by four horses.'

The highly industrialised Meuse valley, from Liège to Namur, was his grand objective, and there both mind and eye found plentiful diversion. The amount of material he gathered in a week is astonishing in its variety and detail. It includes extended descriptions of an iron rolling and cutting mill; a coal-pit and its working; the mining of pyrites and alum stone, with the extraction of vitriol and sulphur and the excocting of alum; the casting of small shot and the refining of pig-iron. There are references also to three glass furnaces, the boring and adjusting of muskets,

a blast furnace (almost similar to that at Barden), a calamine work, and the utilisation of lead slag. In these crowded 23 pages the intense industrial activity of the region is forcefully conveyed. Strangely enough, in the quite large order he left for ironwork to be forwarded were 36 muskets.

At Namur, their faces now turned homeward, the travellers viewed with anxiety the prospect of private travel through the enemy occupied territory, but Brussels was reached safely under an escorting convoy. There the Kermesse, with its profanation of the Sabbath, is responsible for the only emotional trace in the whole book.

Antwerp, reached by a series of descending locks, was for him 'the sueetest toun that ever I was in.' He made purchases there amounting to £420 Scots, including, at last, an assay balance and, rather strangely, some 65 ells of various kinds of plush.[1] As at Namur, too, he was attracted by the imposing baroque interiors of the Jesuit churches. When they had crossed the Scheldt to Fort Lillo, they were back in Holland; thence by Rammekens to the starting-point.

He had now been away from London for two months and was evidently anxious to return. At Flushing he found a ship ready to sail and resolved to part at once. After a hurried reckoning of the expenses of the tour, including purchases by the way, and the adjustment by word of mouth of the terms of the five years' contract, he bade farewell to his good Middelburg friends and went aboard, leaving Robin Wilson to follow with his baggage. For fellow-passengers he had a variety of royalist agents and sympathisers, and we seem to step back at a bound into the political tangles of the time.

As on the outward journey to Flushing, there was a flurry of excitement during the crossing from Calais to Dover. On landing he went to 'the preaching' before settling about his pass—a revealing touch. The news heard at Calais of the King's surrender to the Scots no doubt lent urgency to his travel, and he reached his lodging in the Strand by Monday, the third day out from Flushing.

For over three weeks he remained in London, weeks taken

[1] V. Appendix, p. 195.

up with sight-seeing, hospitality, and money transactions, in which Sir Alexander was again a beneficiary. Then on 3rd June an impressive cavalcade passed out of London northwards—Sir James and his household in a coach drawn by six horses, Sir Alexander and his lady in their own coach, and on horseback Sir Charles Erskine and that able negotiator on behalf of the Crown, Sir Thomas Dishington. From Barnet next day the coach for Scotland went on alone; the others returned to London—Sir Charles to his duties as Commissioner, and Sir Alexander to rejoin the King in mid-July and be 'readmitted to his place.'

On the way north, Sir James was still on the outlook for workers and on this point and on details about the Derbyshire lead mines had long converse at Grantham with a skilled local miner. Newark was by-passed because of 'the seicknesse,' and there was a day's delay at York because of a broken axle. At Newcastle, 'where for the present the King was,' his habit of beating down a price lost him a valuable deal in horses and pistolets, at which he seemed unjustifiably aggrieved. Giving up his place in the coach to the wife of a friend, he took horse and arrived at Edinburgh four days later—from London seventeen days in all.

The few remaining pages are occupied with financial and family matters mainly; among these are the exoneration of Sir Alexander from the charge of betraying an official secret, and the author's attempt to purchase the silver-bearing lands of Hilderston from the Torphichen family. He failed at the time, but this was a property on which he had set his heart [1] and he finally succeeded.[2]

The death of his father,[3] with which the diary closes, is told with a quiet dignity. Sir Thomas had graduated at Edinburgh in 1592; he was 'of an age' with his friend, John Ker,[4] minister of Preston, born in 1576,[5] and so was now aged seventy at least. Of his numerous family only the debonair Sir Alexander came near that span.

[1] *S.H.S., Misc.* iii. 155. [2] *Acts of the Parliaments of Scotland*, vii. 361.
[3] See opening of *Diary* in *S.H.S., Misc.* iii.
[4] *D.T.H.*, 203. [5] *Fasti*, i. 388.

As for Sir James himself, we are left with the impression of a very companionable man, shrewd and hard-headed, but kindly-disposed; a man truly devout, yet no narrow precisian. His diary is a factual document, but it conveys a real sense of life and movement. Into the daily round the wars still lingering on at home and abroad enter scarcely at all; of personal opinion and political comment there is a cautious avoidance. Interesting as are its sidelights on contemporary society, the real significance of the record lies in its unique contribution to our knowledge of seventeenth-century technology. Within its smaller compass it provides, in the opinion of one authority, the most important compendium of industrial processes since Agricola's *De re metallica* (1556). In some of these also Sir James is known to have priority.

His description of Wealden iron-making provides an earlier and much fuller *locus* than that of John Ray in 1672;[1] his long exposition of charcoal-making in Kent comes well before that of John Evelyn in his *Sylva*. The first account of alum-making in England was by Daniel Colwall in 1678;[2] here, in 1646, the flourishing alum industry in the Liège area has authoritative notice. Apart also from a brief reference by Brereton in 1634[3] to the copperas work at Queenborough in Kent, Hope's long and precise description of the manufacture of sulphur and copperas seems to antedate any similar source in English. On these and other subjects such as the casting of sulphur into interlocking shapes, oil-seed crushing and a rolling and cutting mill, the diary is likely to interest researchers into this early industrial field.

Along with the diary there was originally a file of sketches or diagrams (variously called scenographe, icnographie) and several 'descriptions apart.' It is unfortunate that these appear to have been lost: they would have thrown light on the labour-saving oil-extraction plant at Veere (p. 158), where the seed was crushed, warmed and expressed

[1] Quoted in E. Straker, *Wealden Iron*, pp. 44-46.
[2] Royal Society, *Phil. Trans.*, xii. 1052-6; *ibid*, 1056-9, *re* copperas.
[3] *Travels*, pp. 2-3.

by only one man, or have given welcome particulars about the Gorkum ribbon loom. Apart from the 'scenographe' of Ham House, and notes on the sundials in the convent garden at Liège, the others were of decided technical interest—the windmill at Deal (p. 154), the furnace in the sulphur refinery at Noirivaux (p. 173), the drainage pumps at the alum mines near Jonky (p. 178), and the water-driven forge-hammer at Huy (p. 180). It is, in sum, an extraordinary harvest for a few short weeks.

While much of his observation had a bearing on his own lead-works, one may try to discern a motive for the wider sweep of his enquiries. It may be recalled, for example, that his wife's uncle, Sir David Foulis of Ingleby (d. 1642) was one of the guarantors of the so-called Alum Company formed in Yorkshire in 1607, and had a life-long interest in that trade. Also in 1620 Thomas Erskine, Earl of Kellie, a relative of Hope's brother-in-law Sir David Erskine of Cardross, had a thirty-one years tack of all the alum mines in Scotland,[1] with power to form a 'societie' for their exploitation and to bring in foreign labour. In the family entourage Sir James may have become familiar with these projects and studied the alum and allied chemical industries at Liège with a view to bringing back first-hand knowledge of their working. Whatever plans may have been forming in his mind, they were not to be realised. That he intended to strike out in other directions is apparent from his later acquisition of the Binnie silver mines at Hilderston—an old wish fulfilled—and, in 1659, of the copper mines of Airthrey, near Stirling.[2] Mining was to remain his ruling interest, but he died before he could develop either of these new properties.

In 1649, he became an ordinary lord of session, and for the next five years was diverted into the turbulent stream of contemporary politics. Like his father, he took a line of his own: he was rusticated in 1651 and finally, not having commended himself to Cromwell, was excluded in 1654

[1] *Hist. MSS. Comm., Mar and Kellie MSS.*, ii, 96, 169; *R.P.C., 1st Ser.*, xii, 231.
[2] *A.P.S.*, vii, 361; *Laing MSS.*, Div. II, 478 (10).

from the new commission for the administration of justice. On this the discriminating Nicoll remarks that 'the land suestnit much prejudice throw his removell for he wes a guid and upricht judge.'[1]

Even during these troubled years the mines were not neglected. His still extant letter-books, dealing with the export of his lead ore (or potloot) and covering the years 1648-53 and 1656-61, show a fluctuating but sustained output and shipment. In October 1661 [2] he made another visit to the Low Countries. From the letters it is now known what prompted that last expedition; there was a family as well as a business reason.

Sir James became a widower in 1656: in October of the following year, he married Mary, daughter and co-heiress of William Keith, seventh Earl Marischal.[3] (Like his two sisters he was now allied to the old Scottish nobility.) Of the twelve children of his first marriage all but two, John and Rachel, died young. In 1659, for reasons not specified, he sent John[4] to Leyden under a tutor and guardian, Andrew Ross, and both were entered on the matriculation roll of the University (23rd October). The strange thing is that John was then only in his tenth year.

In September 1661 his last six years' contract was due to expire; it was for an annual average of up to 400 tons with a maximum of 600 tons in any one year. He was anxious to renew the contract (at £8, 6s. 8d. stg. per ton, free on board) but found himself faced with an obstinate resistance from the combined importers on grounds of price, quantity and terms of payment.[5] The days of the happy Zeeland association were gone. In long detailed letters he briefed Ross, acting as his agent, on how to conduct negotiations, referring lovingly also to his son; 'my blissing to John' is a recurrent phrase. He was evidently bound up in the little lad, the precious survivor of a devastated nursery.

Ross got into some sort of trouble (never openly defined)

[1] *Diary of John Nicoll* (Bannatyne Club, 1836), p. 132.
[2] *R.P.C., 3rd Ser.*, i, 29.
[3] *Scots Peerage*, vi. 60, but G.E.C. *Complete Peerage*, viii, 483 has 'sixth'.
[4] Lost at sea, 1682; father of Charles, 1st Earl of Hopetoun, 1703.
[5] *MS. Letter-Book*, 23/13 Aug., 1661; to Rev. Alex. Petrie, Delft.

and withdrew from Leyden. John came under the care of the Rev. Alexander Petrie, minister at Delft, and son of that Alexander who had administered the Covenant and sacrament to Sir James at Rotterdam.[1] Petrie at his request intervened with the Company,[2] but came no speed, nor did the Leith manager, Alexander Tait, sent over with plenary powers to reach a settlement. So Sir James set out himself for the double purpose of arranging for his son's welfare, and coming to terms with the niggling partners. And there the record closes. Two days after his return he died on 23rd November of 'the Flanders sickness' in his brother Alexander's house at Granton, aged forty-seven.

Sir James was a man of many parts; judge and lead-master, scientist and administrator, he remains one of the outstanding personalities of that age. His untimely death was undoubted loss. In the more settled years ahead, with the increasing application of the scientific spirit to industry, the author of the diary could have spoken with knowledge and authority.

In this transcription punctuation has been clarified and the haphazard use of capitals avoided. Additions are shown in square brackets. Otherwise, apart from conventional extensions, the text is unchanged.

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P. MARSHALL.

[1] V. p. 167.
[2] Gerard Nienhove (Rotterdam) Jean Blondell (Middelburg) and Company.

a clocke and came to Canterberry to dinner at the Fleure de Lyce. From that wee came to Dover that night and lodged at the George in one Tourees house, a Scotshman who affirmed himselfe to be a brotherson of Enderleith.[1]

March 11. From a man of Sir Umphray Stylles's I informed my selfe of the forme of makeing of charcoall,[2] which is thus.

First they sett 3 stickes in triangle flatt upon the ground with halfe a foott of voyde in the midle, then to bigge[3] them about ane ell this high just as we euse to stacke dailles. Then they sett wood (all cutt of ane equall lenth about 3 foottes long) upon end about these so close as they can stand untill it be round about 10 foottes over or therby; then they putt a peece of wood in the midle hole of the lenth of the rest straight up, which they call the pinner, and about it they place uther wood of the same lenth close togither, first somewhat inclyning, and then straight upon end as before, untill ther be as many placed as will convenientlie stand above the former. Thus being pyled up tuo storie high, they cover it first with braickes[4] or fairnes or strae some 3 or foure inches thicke. Then they putt in some fyre at the midle hole (haveing pulled out the pinner) and when the fyre is once taken with, presentlie putt in the pinner againe, and when the fyre beginnes to crakle and er the flamme doe brake fourth, they throw upon the cheime[5] or tope of it some sand or moulding earth, and as it burnes fast or slow they cast it on the more quicklie, covering her dounewards untill shee be all once full covered so that ther be no smocke perceaved to come out. Then immediately (leist shee should be altogither extinguished) they give her way first at the top by thrusting in a staffe thorow the dust to give her vent, bot so that no flame ishew; and when shee is sufficientlie coaled, that is all become rid at the tope, which will be knowne by the blewness of the smocke, then

[1] On this claim he would be a nephew of Sir George Towers (Toures), laird of Inverleith.

[2] A closely parallel description is quoted *in extenso* by Straker, *op. cit.*, from Evelyn's *Sylva*, edn. 1679.

[3] build. [4] bracken. [5] Cf. Fr. cheminée.

they give her vent lower about halfe a footte, and when shee is coaled there also, ane uther halfe foott untill shee be coaled to the bottome. Note that these holes to give her way are made just round about the pyrimid, circle wyse, first about 1½ footte distant, therefter the further doune the thicker halfeway, thencefourth æquallie to the ground.

March 11. When the smocke is thus broght doune to the ground, then it is all coalled. So immediatlie they pull off all the strae and cover with a raicke, so cleanlie as can bee, that it mix not with the coalle. And immediatlie making the sand so cleane of all the burnt strae or other cover as can be (the heape in the meane tyme being all in a rid fyre) they throw on the sand againe as thicke as can be so that ther be no vent left at all, and within 12 houres therefter shee will be fullie extinguished and smuthered out. Then they gather off the sand as before varie carefullie and puttes it in litle heapes to be made use of againe, for lyke moulding sand the oftner it be used the better it is. Note that ther must be liewes or skonses[1] as we call them to sett betuixt the wynde and the pyle or fyre, for the least wynd will blow all the fyre to one syde and it will not burne æquallie, bot indanger the losse of all. Note that they measur ther timber (being cutt in peeces of 3 footte long) by cordes of 12 foottes long and 3½ foottes high. And fyve of thir cords will make a load, that is 60 seckes of charcoall, everie secke conteining 3 bushells. This charcoall is sold for 12d. a secke of that measure; so the load wilbe worth 3 lib. And the timber costs ordinarlie 5 or 6 ss. a cord, and the coalyer hes 4 ss. for his paines. So the halfe gained.

March 11. The aforesaid way is only for the charking of great coall or of wood half ane inch great and above. Bot for that which they call small coall they doe nothing bot efter that it is coalled (which it will be with the first fyre being confusedlie cast unto any heape) quench it with water.

This day also I gave ane note to Mr. Robert Steilles,

[1] wattle hurdles, shelter screens; V. lews, *Eng. Dialect Dict.*

toune to see the shippes without; and came to ane Isle called Waterland, and dyned in a village there.

8 Wednsday. I was conducted by Jacob Scott a Dutchman, bot who declares himselfe to be come of Scots parents of the Douglasses, to the house of one Peter Hexe a Germaine who is a refynere of metalls and tryell (*sic*) of mineralles, to whom he and some uther Dutchmen, intended partiners of a leidmyne discovered in Cologne, had given a peace of oare to be tryed. When wee came to his house wee found it dimolished and him about the rebuilding of it so that his workehouse was all out of ordor that I could see nothing. Only I observed in a barrell a great quantitie of brasse slagge, as he termed it; however it was slagge and lyklie also of that kind. He shewed me also severall peeces of oares whereof I did take some with me; amongst the which I had a peece of the aforesaid leidoare of Colone which he affirmed to hold 12 lottes of silver in 72 lib. weight. By his language, which was in Wallouns which I did not understand perfectlie, I could learne nothing; besydes that he was varie reserved, yet upon what I did see and heare I conjectured him to have skill.

9 Thurseday. I was invited to Thomas Mortounes house [1] to dinner, of whom I had gotten notice the day before only, and of Fr. Roy [2] the Dutchman that was in Scotland and made the salpeter and who had operat with me some chymicall preparations in my house in Ed[r]. I went to his fathers house without the ports, besyde the oxe market at the signe of the Salamander.

Apr. 9. There in his labaratore I did see him a makeing salpeter and places and toolles for refyneing of suggar and extracting of oyles and spirites, at which tyme he was only extracting of the oyle of vitriole; he worked all in earthen retorts and recipients of about gallon capacitie. This day efter dinner I went with Fr. Roy to a chamber of his in ane uther place there to make ane assay of the a foresaid oare of Coloine partelie for my owne, bot speciallie for Mr. Vanhoghts satisfactione, to whom with Mr. Lefebvre

[1] Scottish merchant resident in Amsterdam. V. Appendix.
[2] Frans Rooy.

was offered a $\frac{1}{4}$ part of those workes, to the which the[y] behoved to contribute presentlie 300 lib. flor.[1]

Of this oare I tooke tuo French ounces; with the one I mixed a litle salpeter and tarter brayed and prepared togither by burneing, with the uther I mixed none. This I putt first in a crusett before the bellies, bot efter a competent tyme being taken out, it was not seperat the recrement from the metaille. The uther I putt in and efter halfe ane houres blast being taken out, the metall was sufficientlie gathered because of the flux, and it did yeeld $\frac{3}{4}$ oz. pure leid. Of this, not haveing a center weight, I tooke tuyce 6 den[iers] weighing above a $\frac{1}{4}$ oz. the peace, and passed them upon tuo severall copelles in ane assay fornace which was there, of the which came tuo small graines of silver, which being compared togither weighed exactlie alyke, and togither did weigh the $\frac{1}{8}$ part of one of these assay grains wherof I had taken 12 deniers. So that of 2304 parts of leid it did conteine one part of silver only; whereas it was reported by Peter Hexe to conteine 12 lotes in the 72 lib. weight, which is just 2304 lotes at 32 lottes per lib.; so that by his report it should hold preceislie tuelve tymes more than I found it, which I ame confident was most exactlie performed; [2] of the which oare and leid I have as yet a litle remaineing.

10 Apr. Freidday. I was invited to dinner be Jacob Scott. Efter dinner I went to enquyre for a sable muffe for my wyfe, bot could find none extraordinarie good; yett for one that I did find I offerred 22 lib. great, bot they held it at 28 lib.[3]

11 Saterday. I went to the Assay Maisters of the banke of Amsterdame to buy a fornace and ane say ballance which with its piller and weights and corne tongs he esteimed at 50 florines or gilders. I gave ordor to Fra. Roy

[1] V. *post*, pp. 164, n. 1; 184, n. 2.
[2] Hope's calculation is based on 12 deniers, or $\frac{1}{2}$ oz., the equivalent of a *lote*. There are 2304 half-ounces in 72 lb., which amount of ore, Hexe claimed, would yield 12 lotes or 6 oz. of silver. Hope found only $\frac{1}{3}$ of a grain in his 12 deniers, which equals 4 grains in a lb. or $\frac{1}{2}$ oz. in 72 lb.—exactly $\frac{1}{12}$ of Hexe's estimate.
[3] Approx. £141 and £179 Scots.

grounds, or motione of a brasse circle with a pricke in it untill it have no shaddow. Some verses of the severall uses therof which I found there I copied, and intends to putt a large description therof by it selfe.

27 Apr. Moneday. I went and did see the boreing of musketts and the justing of them; three glasse fornaces for makeing of all sorts of glasses; and ane coalle worke 52 fathomes deepe, drawen by 3 horse with a great yron chaine about a statute exeltrie [1] of above 1 fathome diameter which haveing 3 toures of the chaine about it did as it drew up the one lett doune the uther end of the chaine, at 17 or 18 turnes, which wer directed just above the shacht [2] by tuo woden pullies excavat ½ foote and then fitted. This coalle is not above 3 foottes, and yett intertaines 70 workemen beneath, 12 or 15 above ground, with 6 horses divided into tuo shichts [3] from 4 to 4 a clocke.

25 Apr. I did see also upon Saterday ane yron fornace, wherein by discourse I could find no difference to bee in the proportione, nor way of workeing, betuixt it and that I did see in Kent, bot what I have interlyned in the descriptione therof the 9 March.

28 Teuseday. Wee hyred a boatt and went up the water of Wese [4] some tuo ligges, neere a village called Norva,[5] to see ane sulphur and coporose [6] worke. The earth worke hes no levell,[7] bot the water is drawen from it be water-milne pumpes whereof there are 3 wheelles, one of them moveing 8, ane uther 6, and a third 4 pumpes. They draw the water some 8 and some 10 fathomes deepe; for lack of water to move them they wer not now goeing, so I did not see the vaine nor how it lyes, only was informed that they find it within 2 or 3 fathomes of the superfice, and albeit they have gone doune 10 yett they have not come to the leager [8] or ground of it. It lyes flatte, and in the winter

[1] Here a drum or winch with horizontal axis.
[2] mine shaft.
[3] shifts. Cf. Ger. *Schicht machen*, to cease work.
[4] The Vesdre, which flows into the Ourthe above Liège.
[5] local patois for Noirivaux.
[6] older form of copperas, ferrous sulphate.
[7] adit. [8] Cf. *ligger*, p. 178, n. 1.

tyme when the milnes can goe, in tuo or three mounth they will land als much metall as will hold them workeing and excocting the rest of the yeere. Ther best sulphurous metaille is perfect yallow within lyke brasse, crustie, and without, tuberous lyke excrescences or great warts. There nixt best and more ordinarie is only lyke a blackish gray stonne spotted and starred with yallow spottes. All this sulpherous metall they call Kise.[1] They have some of it also mixed with leidoare, and some perfect leidoare in balles they find also amongst it, and the deeper the more. This leidoare they shedder [2] and separat from the sulphurus metalle, which they bette into crustes so bigge as my fist, and sends it to the refyneing house. There ther is ane fornace the icnographie whereof I have a part with the rest. It is some 15 or 16 foottes long and 5 foottes broad. It hes first levvell with the ground 8 fyre holles with ther branders, whereof the cinerices [3] are beneath the ground entering therto at the one end.

28 Apr. These foci or fyre holles are about 1½ foott large and 2 foottes long, ther mouthes all upon one front and range, ovenmouthed. Above thir wer tuo ranke of pottes layed upon ther broadsyd with ther mouthes the same way that the foci, tuo pottes one above ane uther directlie above each fyrehole, bot ther mouthes half a footte higher before than there bottomes (*above* inner endes) behinde for the letting the sulphur runne that way, where it passes thorow ane earthen canale halfe a foott square and 1 foott longe into ane sumpe of ane foott square ansuering to each of them behynd, in tuo ganges as the pottes; alonges the mouthes whereof there is water caried into 2 leid canalls open above and communicateing alwayes fresh water to the sumpes where it stands ane handbreadth deepe, which collecteth the vapours and distilling sulphur into ceakes. The fornace being thus prepared they have ane yron scoope of 1½ foott long and 8 inches broad, halfe cylindricke, whereof they putt tuo heaped measures of the metall into each potte everie three houres, voyding the excocted mater before they charge of new. Efter they have

[1] Du. *Kies*, pyrites. [2] crush. [3] ash-holes.

charged immediatlie they close the ostiole or potte mouth with a covert of clay, and throwes up ashes and coalle dust about it that no aire enter leist the mater inflamme and so consumme, for the avoyding whereof also the sumpe holes behynd are closed also, bot with clay about the covers because of the byrunning water, and that they are not opened bot once in 12 houres; in the which at everie opening, that is efter the excoctione of everie 3 charges or 6 of the aforesaids measures of metall, they use to have in the 15 sumpes (for the 16th had beene broken doune upon the failyie of the potte or some uther reason) betuixt 120 and 150 lib. of sulphur in all, everie sumpe yeeldeing its cake lyke ane cake of wax, some ane inch some 1½ inche thicke, yallow lyke wax, according to the different fynnes of the metall. Thir cakes being broken and taken out are caried to the refyneing house, whereof heire efter. At everie chargeing of the pottes the excocted metall is drawne out and receaved into ane yron hurellbarrow, in the which that of everie potte is caried out at one tyme to the backe of the worke house, and ther (rid hotte as it is) commixed with uther stuffe whereof heirefter, and orderlie built up in litle hillockes which will burne incessantlie for the space of 8 or 9 mounthes before the sulfurous mater resting in them be consumed, which doeth also prepare the metall for the excocting of the coporose, which is taken out efter that the sulphur is excocted, whereunto the fyre prepares it, and the longer it lyes in digestion therefter the better.

28 Apr. Of this mater thus prepraed they take and cast into maceratories [1] or square ditches full of water so much as they can convenientlie hold; where efter that they find the water strong aneuch with vitrioline substance which it attracts out of the aforesaid metall, they convoy it by open canalles of woode to be concocted as heirefter. If the water become not strong aneuch efter one commixture, they remove the old and castes in new earth. This earth is casten up againe into heapes, and being dry is that stuffe with the which the metall comeing from the pottes (the

[1] Cf. Fr. *macérer*.

sulfur being alreddie excocted) is comixed, and it will yeeld thus vitriolle better the 2 then 1 commixtion, and being cast up in heapes againe efter the second tyme will in a competent tyme acquyre new strenth and more vitrioline substance againe. This water thus convoyed into the workhouses againe is receaved into a large cisterne out of the which it is cast into leid cathernes,[1] of the which there were 4 or 5, where it doeth seath some 24 houres, and therefter is cast into cisternes wherein there are branches of wood and roddes to the which the vitriole congealles and adheares, and the lixive remaineing is rapported to the cathrones [1] againe to be recocted, which is reiterat so long as it conteines any strenth in it.[2] This vitriol is sold for about 5 florines the 100, which is 94 Amsterdame weight. As to the way of the refyneing of the sulfur I did not see it, for they wer not workeing; bot I did see the formes in the which ther were some of it cast and a cooling (and they said they used no ingredients). They wer about 3 foott long and 1 foott broad everie boord, whereof 7 being joyned togither made a full square; the inner 5 of thir 7 wer excavat on both sydes, bot on the one into 6 and on the uther into 5 concaveties, the convexes of these 5 of the one syde falling betuixt the convexes of the 6 on the uther that the formes might be the more compact, but the exterior boords wer only excavat on the one syde, the one into fyve and the uther into 6. So that everie square mould did cast 33 battones of sulfur of 1½ foott at a tyme.

28 Apr. Thir moulds wer joined and made fast togither with tuo square yron girthes and wedges, and wer so framed in the over end with a litle ledgeing or eminencie about, the wholle being joyned that the wholle mould might be filled at a tyme. This sulfur is sold for betuixt 15 and 17 florines ther 100, which is bot 94 lib. Amsterdame weight, and there 15 florines (as the monies now goes) not worth above 10 gilders Holland mony. Thir workes have

[1] cauldrons or evaporating pans.

[2] Cf. the similar process in 'a most ingenious copperas work' at Queenborough, Isle of Sheppey, briefly described by Brereton, *Travels*, 1634, p. 3.

severall partiners, whereof one Mr. Wingett [1] of Liege, marchand, is ane of the cheiffe, who was ther and intertained us varie kyndlie for his cousines cause with whom wee lodged. The workes are called in Liegois Lusin, i.e. ouvrages, de la blanch plumbier.

29 Apr. Wednsday. I did see the way of the casting of small dregie or drope,[2] which is done by casting a litle auripigment [3] in the leid when it is molten, and lett it stand so long as it lowes or flammes; then with one ladle to poure it into ane uther full of small holles of the bignes of a small preen [4] head or litle more, thorow the which the leid passing does granulat. The one ladle must alwayes feed the uther that the leid coolle not and stope the holles, for if the holles stoppe all must be throune into the potte againe, whereas utherwyse thogh the leed coolle at the first inpoureing or efterwards about the edges, yet the holles in the midle may be made or still held open and runeing by the feedeing with hote leed.

29 Apr. The leed most be bot temperatlie hotte, which is best found out by tryell. The laidle with the holles must be held above a veshell with water (which the deeper the better) within ane handbroad of the superfice therof, bot this distance, as the temper of the leede, must be sought by tryell; for albeit I had no satisfactione theranent from him that shewed it me, yett I found them to have ane proportionall correspondence so that the one did rectifie the uther, the great distance the hotte leed et contra. Nather did I receave satisfactione anent the proportione of leed and auripigment, only one oz. to 6 lib. of leed not serving, he took 2 oz. and I thoght it a litle too much.

This day also about 1 a clocke in the efternoone wee parted from Liege towards Namure, bot in respect there

[1] The de la Vignette family belonged to the large-scale merchant and industrial class in mid-17th century Liège. Jean and Gilles, sons of Conrard de la Vignette, along with their brother-in-law Nicolas de Limburg, were then (1646) partners in a company working the minerals and the important industrial plant of La Blanche Plombière at Prayon, on the Wese (Vesdre). J. Yernaux, *La métallurgie liégeoise au XVII^e siècle* (Liège, 1939), pp. 43-4.

[2] small shot.

[3] orpiment, to harden the lead.

[4] pin.

wer some alme workes to bé seene by the way within tuo ligges, wee would not goe in the ordinarie boatt bot resolved to take a walke a footte. All this tyme that I was at Liege I remained by Mr. Vanhoghts enforcement in a couzine germanes house of his called Catharine Vanhoght and her houseband, ane yron marchand named Dirick Henrick Mex [1]; with whom I left a memorandum for some yron worke, cheiflie (*above* 36 muskettes) ane yron chaine of 40 fathomes for which I aggried with the smithes for 3 lib. the fathome; and 30 roddes or fathomes of ane yron borrell [2] for the ground, with severall uther particulares conforme to ane speciall notte therof (for I found all grosse yron worke to be extreame cheape here) for which I aggried also for 60 florines in haille.

In our way up the syde of the river of the Maese wee did see, cheefelie at a village called Jonky,[3] severall houses for the concoction of alme.[4] In ther wayes of operatione, fornaces and uthers, I could perceave no difference from the aforesaid of vitrioll. Only besydes the alme lixive [5] (which in some of them was convoyed a myle and further in open wooden canalles from the mynes, of which heirefter) they use efter the concoction to cast in to 12 parts of lixive 1 of pisse for præcipitateing of the mater.[6]

29 Apr. The concoctione requyres 24 houres, and efterwards throwne into troches; and the mater efter it congealed is purified by a second concoction and then is cast into great barrelles lyke unto wyne pypes [7] which they take a sunder to take out the alme efter that it is congealed. About a ligge from Jonkye besyde the Castle of Engremont,[8] neere a litle burne that runnes in to the Maese, wee did

[1] Dirick Hendrick Meex was a cousin and neighbour of Gilles Vignette, the 'Mr. Wingett' of p. 176.

[2] a boring tool, wimble. Table of Rates, 1612, 'borrellis for wryghtis.'

[3] Now Chokier, on the Meuse, 16 km. from Liège.

[4] Cf. the process as described, with illustrations, in Dr. Charles Singer's *The Earliest Chemical Industry*, The Folio Society, 1948, pp. 210, 211.

[5] the liquor containing the dissolved salts.

[6] Pennant (*Tours.* edn. 1774, pp. 22-3) noted the same process and precipitant at alum works in Yorkshire. Cf. also Clow, *The Chemical Revolution*, p. 237.

[7] the roching casks, for which see Singer, *op. cit.*, pp. 211, 286.

[8] Le Château d'Aigremont.