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洛南花石浪龙牙洞 1995 年出土石制品的拼合研究

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摘要: 本文是对洛南花石浪龙牙洞遗址洞内部分 1995 年发掘出土的 18608 件石制品的拼合研究结果。在纳入研究的 18499 件标本中(不含石料、石锤、石砧和烧石等标本 108 件) 共获得 94 个拼合组, 涉及 212 件石制品, 拼合率约 1115%。分析结果显示拼合研究不但可以帮助我们更深刻地理解龙牙洞遗址石制品的平面及垂直分布规律, 还是准确地判断遗址埋藏过程的有效手段。拼合研究在恢复早期人类石器制作技术上具有独到的优势, 石核) 石片拼合组合以及石片之间的拼合关系可以更清楚地显示早期人类所采用的剥片技术, 但以拼合石制品在洞穴中的分布距离判断具体的剥片方法有局限性。

关键词: 石制品; 拼合研究; 埋藏学; 技术行为; 花石浪龙牙洞

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1 研究目的、材料及方法

对考古遗址出土遗物进行拼合研究是探索遗址埋藏和形成过程必不可少的环节之一[1) 2]。对于旧石器时代遗址来说, 不同遗址之间石制品的拼合关系可以提供早期人类制作石器时在原材料获取、工具制造、搬运、使用以及交流范围的信息[3) 4]; 而同一遗址内的拼合研究则既能重建石制品从制作到废弃的/ 生命0 轨迹, 又能评判遗址地层及堆积后人为或生物扰动方面的情况[1, 5) 15], 有鉴于此, 拼合研究已被广泛地应用到旧石器考古遗址出土的石制品甚至于动物骨骼方面[7, 13]。

最早的石制品拼合研究历史可以追溯到 19 世纪末期。当时, 英国考古学家 F. C. J. Spurrell 在英格兰 Kent 郡著名的 Crayford 遗址首次将这一方法应用于史前人类技术行为的研究, 而后, 他在埃及 Medum 的发掘工作中又成功地将 17 件石叶与一件石核拼合起来[12]。尽管最初的拼合工作仅仅是为满足人们的好奇心, 并非出于针对石器制作工艺流程和遗址埋藏学的探索, 但考古学家却从长期的实践中感悟到石制品的拼合研究不但可以复原石器制作的工艺流程及史前人类技术行为的模式, 而且还能增进对遗址形成过程的理解。然而, 在很长一段历史时期, 对石制品进行拼合研究并未被大多数考古学家所采用, 由此而进行的石器制作的工艺流程分析、石制品的空间分布和地层控制等理论尚未建立。只是到 20 世纪

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70 年代末及 80 年代, 随着人们对考古学认识的进一步加深, 考古发掘技术及分析技术的日臻完善, 对遗址出土石制品进行拼合研究逐渐成为分析考古遗址埋藏学及探索早期人类技术行为的一种常规手段。

本文对洛南盆地花石浪龙牙洞遗址洞内部分 1995 年发掘出土的 18 608 件各类石制品进行了拼合研究, 这些石制品出自于龙牙洞内顶部扰动层堆积即第 10 层(含标本 3 994 件) 松散的黄褐色粉砂质亚粘土层及第 4 层上部红褐色粉砂质亚粘土堆积层上部, 它们属于龙牙洞遗址最晚一期的文化遗物[16) 18]。剔除早期人类搬运到洞内尚未使用的砾石石料以及石锤、石砧和部分烧石等 108 件勿须拼合的材料, 实际可供拼合的标本共 18499 件。所有标本在实验室先开包清洗、晾干, 然后逐一登记坐标、分类并进行属性统计和描述, 最后再按照岩性的不同进行拼合。拼合研究目的是: (1) 试图通过确定拼合石制品组合的水平及纵向位移探索遗址的埋藏形成过程; (2) 通过标识拼合石制品的分布认识早期人类对洞内空间的利用; (3) 探索石制品制作技术。文中借鉴了国外一些比较成熟的石制品拼合研究技术及对拼合类型的描述方法。

事实上, 所有石制品的拼合组合关系不外乎石核) 石片类(含断块) (图 1) 和石片) 石片(图 2) 两种类型。前者包括修理石片工具及其加工时产生的石片渣之间的组合关系, 后者包含完整石片之间或完整石片与断块、工具与废片渣、以及不完整石片之间或断块与断块之间的拼合关系。可以看出, 第二类组合中的不完整石片之间或断块之间的拼合关系所反映的技术和埋藏学意义是相同的, 但与其它拼合组合差异明显, 所以本文又分别用拼接(join) 和拼对(conjoin) 来区分它们与其它不同的拼合关系, 而拼合(refitting) 则是两种类型的总称。

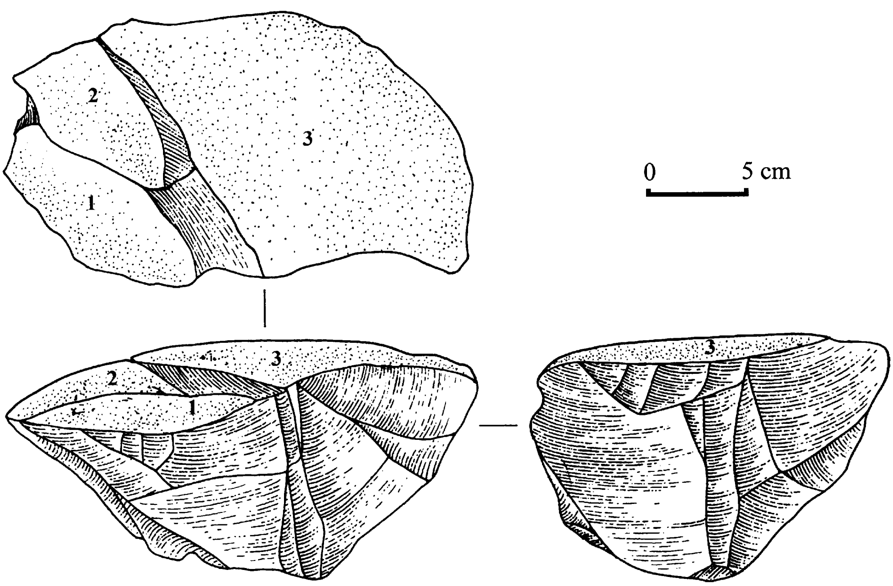

图 1　石核与石片拼对组

Conjoined core2flake elements

石核与两件石片拼合组, 3 为石核, 2 为完整石片, 1 为不完整石片上部

(Core with two flakes, one is a complete flake, another is a proximal snap broken flake)

拼接关系(join) 是指石片和断块在剥片过程中 (1) 因打击力度或台面受力不均匀等因素而从打击点处沿石片的长轴方向纵向破裂一分为二(半边石片) 或一分为三(图 2, e) , (2) 石片与受力方向垂直沿横轴断裂成两节或两节以上(图 2, c 1, d) , 或者 (3) 剥片过程中沿节理而破碎的断块之间互相拼合起来的情况。在洞内分布图中拼接关系石制品之间用虚线连接 (图 3) 5)。

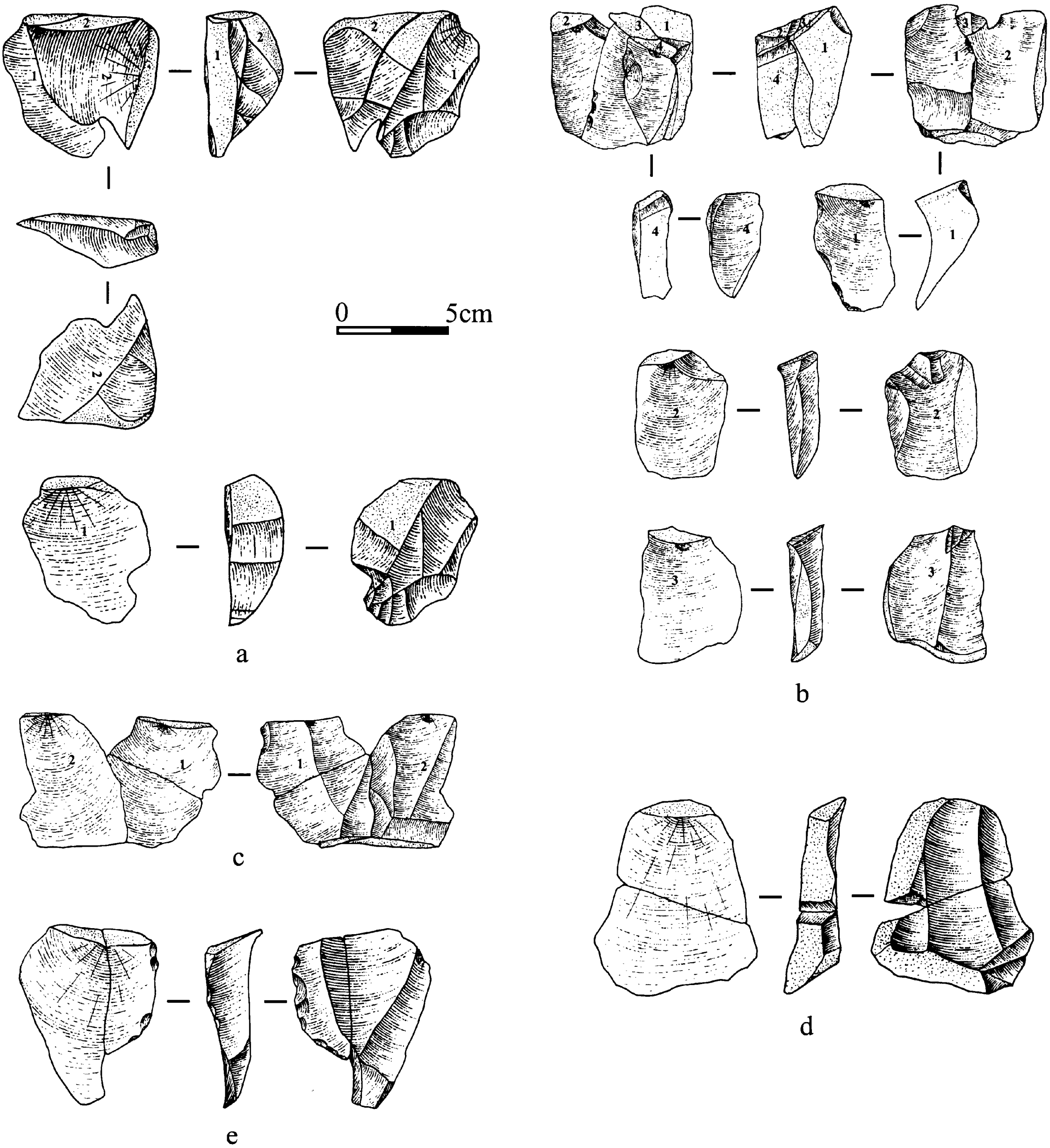

图 2　拼对组及拼接组石制品

Conjoined and joined groups

a. 2 件石片拼合组, 剥片时石核曾转向 90b(Two flakes conjoined, showing the use of cortical platform. It was rotated at 90b when knapped) ; b. 4 件石片拼合组(Conjoined group comprising of four flakes) ; c. 石片拼对和拼接组(Joined and conjoined flakes) ; d. 横向断裂拼接石片组(Joined snap broken flakes) ; e. 纵向破裂拼接石片组(Joined split broken flakes)

拼对关系(conjoin) 是指 (1) 石核与石片(含修理石片和断块) 之间(图 1), (2) 完整石片与石片(断块) 之间, 或 (3) 工具与修理过程中掉落的废片渣之间相互可以拼合的情况 (图 2, a) c) 。拼对关系在分布图中以实线表示, 并以箭头标明石制品产生的步骤(图 3) 5) 。

从时效上分析, 拼接关系的产品是同时产生的, 在某种意义上讲它们是孪生关系。拼对组的元素则是不同剥片步骤的产物, 它们的产生有清晰的时间上的先后次序。区分两类性

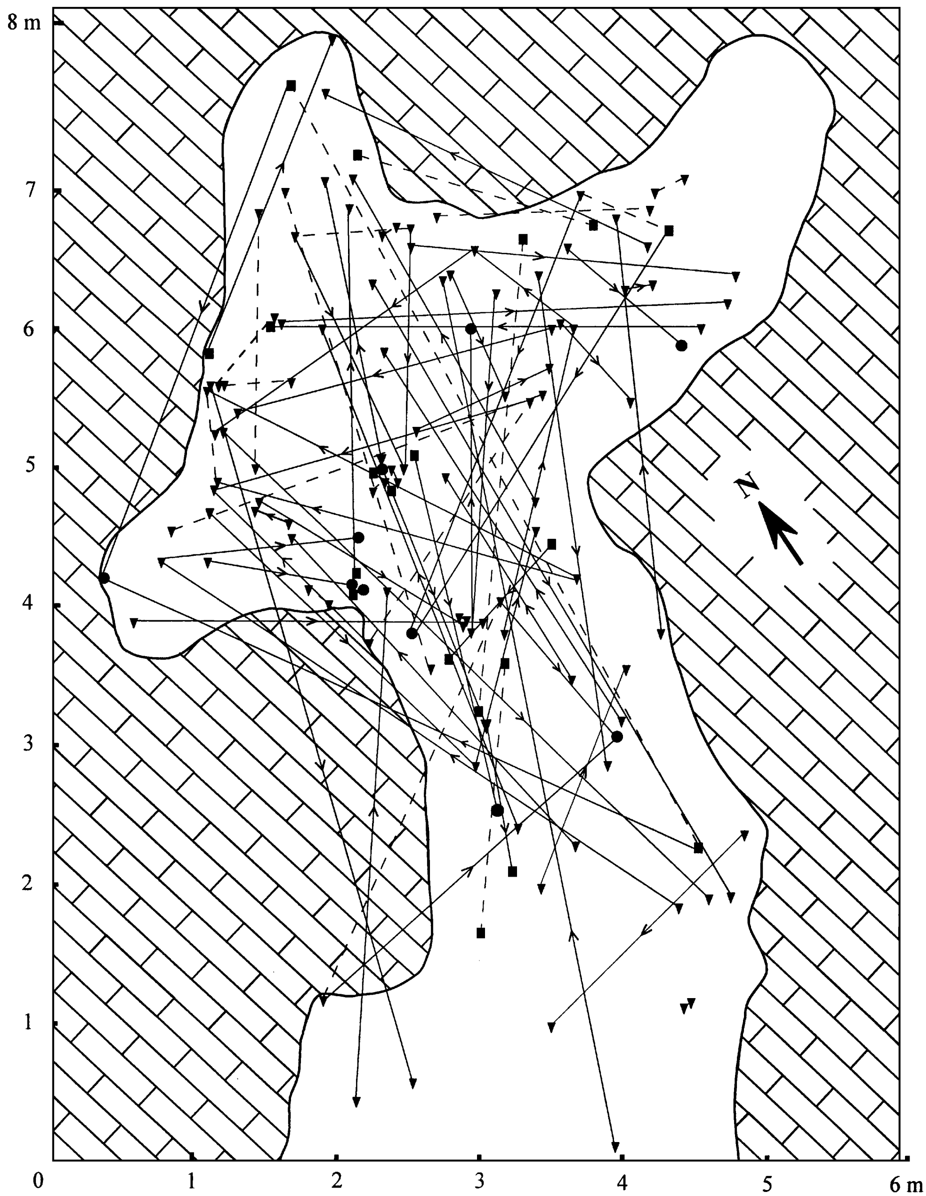

图 3　拼合石制品组在龙牙洞内的平面分布

The horizontal distribution of refitted artefacts in the Longyadong Cave

p) 石核(Cores) ; ") 石片(Flakes) ; u) 断块(Chunks) ; y) 拼对关系(Conjoin) ; - - - - 拼接关系(Join)

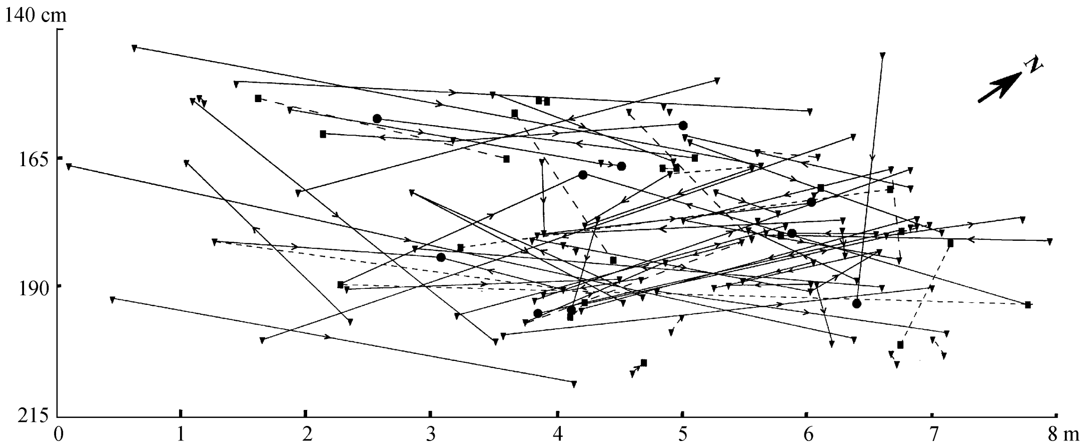

图 4　拼合组石制品在龙牙洞内沿纵长轴方向的垂直位移

The distribution of refitted artefacts in longitudinal vertical section

p) 石核(Cores) ; ") 石片(Flakes) ; u) 断块(Chunks) ; y) 拼对关系(Conjoin) ; - - - - 拼接关系(Join)

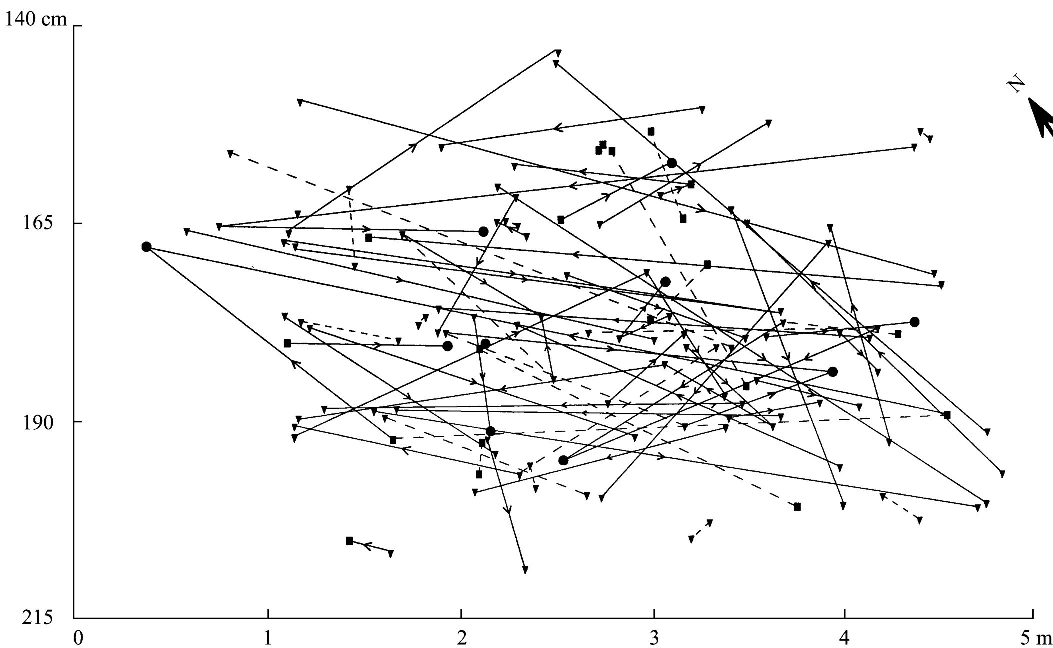

图 5　拼合组石制品在龙牙洞内沿横轴方向的垂直位移

The distribution of refitted artefacts in cross vertical section

p) 石核(Cores) ; ") 石片(Flakes) ; u) 断块(Chunks) ; y) 拼对关系(Conjoin) ; - - - - 拼接关系(Join)

质不同的组合关系对于了解遗址的埋藏过程有直接的意义。对于一个考古遗址来讲, 假若发现石制品的拼接关系组合中破裂和断裂石片之间距离小, 或者断裂部分相对、基本还处在原始的拼接状态时, 那便清楚地表明石制品在埋藏前后没有经历严重的扰动, 反之则说明遗址在使用过程中或使用后经历了比较严重的人为或生物扰动过程, 这对甄别出土遗物之间

的关系和研究当时人类的行为具有重要的价值。而拼对关系石制品在遗址的分布更多地体现出早期人类行为的影响, 一方面, 它清楚地记录了剥片过程, 利用石核与石片的形态特征能更加准确地判断早期人类采用的剥片技术; 另一方面, 拼对关系石制品的分布还可反映出人类行为习惯方面的信息, 如打片时是否移动以及剥片后的修理加工等。

2　石制品的拼合结果

从龙牙洞内纳入拼合研究的 18499 件标本中, 总计获得 94 个拼合组, 含 212 件石制品, 包括石核 27 个、石片 67 片、断裂石片 37 片、断块 71 块、小石片碎屑 1 个以及二次加工的石片工具 9 件。拼合石制品涉及浅色石英岩、深色石英岩、红色石英岩、石英砂岩、石英、砂岩、细砂岩、燧石、和火成岩等 9 种岩性的原料(表 1) 。石制品拼合率约 1115% 。考虑到文化层堆积下部以及洞外探方出土石制品的拼合工作尚未完成, 根据目前拼合工作的进展情况看, 整个龙牙洞遗址最终的石制品拼合率估计会超过这个数值。

在 94 个拼合组中, 78 组(82198%) 由两件石制品组成, 包括拼对的石核) 石片组、石片) 石片组、以及拼接的不完整石片或断块组合; 11 个拼合组(1117%) 由 3 件石制品组成; 4 个拼合组(4126%) 由 4 件标本组成; 1 个拼合组由 5 件标本构成, 占拼合组总数的 1106% 。拼合石制品多为自然台面者。图 1 和图 2 是部分石制品拼合组的示例。

表 1　不同岩性的石制品拼合数量

The number of refitted lithic artefacts in different raw materials

原料	石核	石片	不完整石片	断块	小片渣	修理石片	数量
深色石英岩	8	13	14	14	0	2	51
细砂岩	0	2	2	4	0	0	8
燧石	1	0	0	4	0	0	5
火山岩	2	0	0	2	0	0	4
石英	3	3	3	8	1	0	18
浅色石英岩	5	21	8	16	0	7	57
石英砂岩	4	13	6	14	0	0	37
红色石英岩	4	14	4	7	0	0	29
砂岩	0	1	0	2	0	0	3
总计	27	67	37	71	1	9	212
百分比	121 74	31160	17145	331 49	01 47	41 25	100100

3　拼合石制品的空间分布

311　拼合石制品的平面分布

图 3 是第 4 层所有可确定坐标的拼合石制品组在龙牙洞内的平面分布状况, 表 2 是拼合石制品之间的直线分布距离。

在未经扰动的情况下, 拼合石制品之间的直线距离应是剥片过程的直接反映。对于拼

对关系中的石核) 石片(修理石片工具、废片渣和断块) 而言, 它们之间的最大及最小直线距离的差值小于别的拼合类型, 石制品之间的平均距离介于其它拼对类型及不完整石片拼接关系之间。石片) 石片(包括单件二次加工修理的石片工具、废片渣和断块) 拼对组石制品之间的直线距离相对较大, 这说明人类在直接使用石片过程中、选择石片二次加工时、或者使用中将它们带离了原来的位置。

拼接组合的不完整石片之间平均距离最短, 表明它们形成以后所受扰动较少。对于距离很小的不完整石片组合来讲, 这种现象的发生一方面是因为石片在剥落时因磕碰破裂或断裂而原地埋藏(技术行为影响) 。另一方面, 可能与埋藏前暴露于地表, 因人为或自然营力导致破碎, 或者与埋藏后因上部地层压力挤压有关(埋藏过程影响) 。

总之, 距离很短的不完整石片组合客观上说明遗址埋藏形成前后所受扰动不剧烈。纯粹的修理石片工具拼对组合中器物相互之间相距最远, 其最小间距为 99130cm, 远大于别的拼合类型, 这种情况既可能产生于二次加工修理过程中, 也可能发生在石片修理成为工具之后, 埋藏前由于人类使用而将器物带离原地。

312　拼合石制品的纵向分布状况

图 4 和图 5 分别是所有可确定坐标的第 4 层拼合石制品组在龙牙洞内沿洞穴纵向(南北) 方向及短轴横向(东西) 的垂直位移状况, 表 3 则是不同拼合石制品类型之间的垂直位移距离。结果显示拼对的修理石片工具之间在垂直方向上位移最大, 平均纵向位移几乎是别的拼合类型的 2 倍, 这与其它拼合类型之间有着明显的差别。同时, 前文表 2 所反映的与此类似的石片工具拼对组合的水平位移在拼合石制品类型中也是最大的。

表 2　拼合石制品之间的直线距离

Rectilinear distance between refitted elements

拼合类型	数量	百分比	最大距离(cm)	最小距离(cm)	平均距离(cm)
石核和石片(工具)	20	22199	4561 84	22185	245148
不完整石片	24	27159	6181 19	1100	130170
石片	37	42153	6331 47	19103	253187
修理石片工具	6	6190	5181 48	99130	268165

图 3、图 4 和图 5 还显示大多数的拼合组是两件石制品之间的拼接或拼对关系。石制品之间的纵向位移从 0 到 20cm 不等。但是, 也有一些拼合组的石制品之间的纵向位移大于 20cm, 这种情况多发生在经二次加工的修理石片工具拼对组合中。

表 3　拼合石制品之间的纵向位移距离

Vertical separation between different refitted elements

拼合类型	数量	百分比	最大距离(cm)	最小距离(cm)	平均距离(cm)
石核和石片(工具)	20	22199	481 00	01 50	111 17
不完整石片	24	27159	291 00	01 00	61 58
石片	37	42153	371 00	01 50	101 58
修理石片工具	6	6190	401 00	81 00	191 33

4　分析与讨论

411　埋藏学分析

41111　平面分布

分析拼合石制品之间的平面分布状况可以提供更多的遗址埋藏学方面的信息,这方面现代模拟实验考古也对史前遗址中石制品的分布研究具有重要的参考价值。相关的研究结果显示有多种因素可以影响石制品在遗址的分布状况,比如穴居动物、植物根系、石制品数量、制作方法、剥片者的个人习惯(如剥片时手距地面的高度、站立位或坐位、加工过程中是否移动等) 、践踏以及工具使用的策略(诸如重复使用以前的废片和工具再加工修理)等等[8) 9, 19) 20]。鉴于自然营力及生物行为均可能影响石制品的位置,所以早期人类技术行为不是石制品平面分布现象的唯一解释。正如表 2 所示,一些拼合石制品之间的距离可达 6133m,而另一些则紧紧相连在一起,一种因素显然难以解释所有的分布情况,它们只能是多种因素综合作用下的结果。

在 94 组拼合石制品中有 87 组出自原生的第 4 层堆积,其余出自无法定位的扰动层即第 10 层。在第 4 层的 87 个组合中有 9 组 (912%) 拼合石制品之间相距 4m 以上。它们分别是总计 20 个拼对的石核) 石片组中的两组(10%)、24 个不完整石片拼接关系中的两组(8133%)、37 个拼对关系石片组合中的 4 组(10181%)以及 6 个修理石片工具组合中的 1 组(16167%)。这种情况一方面说明洞内部分石制品埋藏前曾经历过比较剧烈的搬运过程。另一方面,一些拼合组石制品之间的距离虽小于 4m,但从图 3 中可以发现,洞壁岩体将石制品清晰地分隔开来,这种现象显然是人类制作或使用工具等行为所致,自然和别的生物作用无法产生这种结果。

有的拼接组合中的不完整石片或断块在地层中紧密连接在一起。究其原因,可能是这些石制品要么埋藏在其原始剥片后破碎的位置,要么是由于践踏、洞顶掉落石块砸碎或者上部地层挤压破碎在地层中,后者反映了石制品废弃后在遗址埋藏前或埋藏后的事件。有 15 组不完整石片拼接组石制品之间的距离小于 1m。距离短却又互不相邻的不完整石片或断块拼接组几乎可以确定是起因于人类的剥片行为而非自然过程所致。

Villa(1982) 通过实验证明踩踏行为与石片的平面分布之间存在十分密切的关系[8]。地层学及年代学研究显示龙牙洞内堆积物的形成经历了数以万年计的历程。本文研究的石制品来自于第 4 层上部近 90cm 厚的堆积中,它代表了洞内近 10 万年的堆积建造,时代上介于 35616 ? 1718kyr 和 27319 ? 1317kyr 之间[16) 18]。由此观之,龙牙洞石制品可能在掩埋前相当长的时间内暴露于地表或处于半掩埋状态下,同时,第 4 层没有地层不整合关系和沉积间断发生说明埋藏过程是持续而缓慢进行的,所以,石制品必然经历了长期的人类或动物的践踏过程。

与踩踏行为一样,自然作用(如生物扰动和流水作用)也被视为影响石制品在遗址分布的因素。分析龙牙洞内地层,没有任何证据显示流水作用在洞内第 4 层堆积物形成时曾影响到石制品的分布,相反,洞内堆积中致密的、厚度 1) 2mm 踩踏面清楚地表明无主要的流水和别的生物扰动过程发生。

总之,龙牙洞内石制品的平面分布状况更大程度上是人为因素作用的结果。相距较远

的石制品拼合组是在早期人类剥片、或者选择石片使用时从一地转移到另一地, 而处于连接状态的拼对关系组说明它们形成于石器作业的原始位置, 也可能是在践踏或掩埋过程中外部压力挤压作用下的产物。

41112　纵向位移

相对于石制品平面的分布而言, 龙牙洞内石制品纵向位移的分析要复杂得多。不同类型考古遗址的埋藏学研究显示许多人为或掩埋后的事件均能影响到石制品在遗址地层的纵向位移[1) 3,5) 6,8) 10,21]。相关的实验也为我们提供了解释考古发掘出土品在地层垂直位移的新视角[9) 10,21]。图 4、图 5 和表 3 显示洞内绝大多数拼合组石制品之间的垂直距离在 0) 20cm 之间。最大的纵向位移发生在一组拼对的石核) 石片组合中, 其垂直相距达 48cm, 而另一组二次加工的石片工具之间的纵向位移也有 40cm 之多。另外, 在 87 个组合中有 4 组(416%)石制品之间垂直相距 30cm 以上, 10 组(11149%)在 20) 30cm 之间, 23 组(26144%)在 10) 20cm 之间。其余的 50 组(57147%)纵向分布距离小于 10cm。结果显示拼对关系组合, 特别是修理的石片工具拼对组合明显和别的拼合组不同, 它们之间的纵向位移几乎是别的石制品组的 2 倍。这与前文所观察的拼合石制品之间在平面分布的距离大于别的拼合关系如出一辙。

然而, 要准确地指出究竟是哪一种因素主导了石制品在龙牙洞内的纵向位移并非易事。对一些砂土状堆积类型遗址的发掘以及砂土状堆积的模拟埋藏学实验揭示, 当石制品废弃后, 较重的石制品有穿透沉积物、埋藏较深的趋势[6,8) 11,20) 22]。表 4 反映了龙牙洞内各种拼合石制品组合中轻重不同的石制品之间在地层中纵向位移的状况, 结果与 Villa 等在砂土状堆积类型遗址的观察与实验并不吻合。这种情况的发生很可能与石制品在遗址内分布位置不同以及地层堆积物的差异有关。龙牙洞内的亚粘土堆积有别于砂土状堆积物, 踩踏后粘土状堆积物会变得致密而坚硬, 这样, 较小而有棱角的石片类石制品可能更易于穿透地表土而掩埋较深。表 4 显示尽管石核) 石片拼对组中较重的石核趋于纵向埋藏更深一些, 但在不完整石片、石片以及修理石片工具三种拼合组合中, 反而有更多较轻的石制品比与其拼合的重石制品埋藏深一些。总体上, 龙牙洞的结果并不支持以前砂土堆积类型遗址研究得出的结论。

表 4　拼合器物重量与在地层间的纵向分布距离的关系

Relationship between refitted artefact weight and vertical separation

拼合类型	数量	百分比	重者较深(%)		轻者较深(%)		深度相同(%)	
石核和石片(工具)	20	22199	12	60100	8	40100	0	0100
不完整石片	24	27159	9	37150	14	58133	1	4117
石片	37	42153	15	40154	22	59146	0	0100
修理石片	6	6190	2	33133	4	66167	0	0100
总计	87	100100	38	43168	48	55117	1	1115

除上述因素外, 石制品本身的形状、重量及掉落时的惯性、遗址的原始地面状况、堆积物干湿变化、冷冻作用、人类行为(践踏及制造工具)、生物活动(如动物和植物根系影响)也被人认为是导致石制品产生纵向位移的因素[8) 9,11,20) 21]。生物因素大致可以排除在外, 因为既无宏观也无微观的证据可以证明这方面的影响。龙牙洞内地层沉积可以清楚地观察到 2) 3mm 的沉积序列, 尽管在第 4 层上部也有细小的树木根系发现, 但洞内第 4 层地层堆积

近乎平直,宏观层次的生物活动因素在石制品纵向位移方面并未发挥决定性的作用。

遗址中堆积物的干湿变化对石制品纵向位移的发生很可能起了关键性的作用。粘土类堆积物在干湿变化过程中形成的板裂缝隙可以使小的石片或石片碎屑轻易地穿透土壤表层、从而比大而重的石制品埋藏更深。如果相对较小的石制品与另一件较大的石制品拼合后,很可能出现两者在垂直方向上位置不一致的现象,小的石制品将埋藏更深。如在降雨量大的年份,从洞顶缝隙落下的渗水滴落到洞内堆积物上,将导致洞内部分地面软化。1996年夏季田野发掘时便遭遇到持续强降水,当雨季结束后,洞顶不再渗水时,地面变干,堆积物硬化。洞内中心部位的堆积物虽然也遭遇干湿变化过程,但因为长期的踩踏作用已使地层堆积物致密而坚硬,石制品纵向位移并不十分明显,相反,洞内东部及西北角落的石制品虽然不易受人类或动物踩踏的影响(洞顶低矮,潮湿而黑暗),但土质松软,石制品纵向位移差要大于别的区域,所以堆积物的湿度变化对石制品纵向位移的距离有重要的影响。

不少考古学家注意到人为踩踏也是影响石制品在遗址分布的重要因素[8) 10]。鉴于早期人类曾经长期占据龙牙洞,踩踏行为在石制品纵向位移方面无疑起了重要的作用。石制品在被掩埋前很可能长期暴露于地表。尽管龙牙洞内石制品的密度超乎想象的高,但石制品的分布并不均匀。在洞穴的中心部位石制品的密度要稍小于周边部分,而且堆积物的致密程度更高[17],这个区域的石制品显示更多地受到了人类踩踏的影响。

总而言之,石制品的自重、沉积环境、人类的踩踏、其它的生物扰动以及堆积物类型诸要素都可能影响了石制品在龙牙洞的分布。除早期人类行为外,其它因素也发挥了重要作用,但相对而言,洞内堆积物的干湿变化很可能起了至为关键的作用。

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石核)石片拼对组合以及部分石片之间的拼对组合无疑可以更准确地显示出早期人类所采用的具体剥片技术。如图1所示的石核与两件石片拼对关系,从石核的形态及与石片的连接关系很容易确认它们是一组锤击法剥片的产物。在判断具体的剥片方法上,拼合石制品组合得出的研究结论无疑比对单个石制品的研究结果更可信,在这方面拼合研究具有明显的优势。

根据模拟剥片实验,使用锤击法打片时,剥落的石片一般将散落在剥片者周围50cm的范围之内,另外打片过程中掉落的废石片渣大致也在此范围[19,23]。龙牙洞内现有的石核)石片拼对组合大多清楚地显示出早期人类采用了锤击法剥片技术。尽管要准确地指明遗址内出土的每一件石制品的剥片方法几乎是不可能的,但部分特征明确的石核与石片还是清楚地显示了龙牙洞生活的早期人类曾使用碰砧法、砸击法及锤击法等硬锤直接剥片技术[17,24) 25]。现场的剥片实验及与遗址出土标本对比表明碰砧法曾是早期人类常用的剥片方法之一。当以石英岩为原料用碰砧法剥片时,剥落的90%的石片及石片碎屑会散落在距剥片者前方70cm的扇形范围之内,其中距离最大的可达150cm。与龙牙洞内的实际情况对比,除去拼接不完整石片关系组,其余拼对组的石制品平均距离均超出150cm。假若以50cm作为锤击法直接打片时石片的散落距离标准,仅有12个拼合组(13179%)包括在这个范围之内。如以70cm作为碰砧法的标准来衡量,那么,仅16组(18139%)在这个范围之内。

另外,剥片者的姿态也与剥片产品的散落距离密切相关。当用锤击法剥片时,手的部位距地面位置较高,剥片产品散落范围相对也较广,一些石片甚至可飞到4m开外[11]。但是,当手的部位距地面较低时情况则会有所不同,这时锤击法又与取蹲坐位剥片的碰砧法和砸

击法近似, 剥片产品的散落范围将接近于剥片者。所以, 在拼合率较低的遗址中, 除非有完整的石核) 石片拼对组合可以准确地显示出所采用的剥片技术, 否则, 单依拼合石制品之间的距离来判断剥片方法有明显的局限性。

拼合石制品之间的距离无法用于判别具体的剥片方法还有另外的原因。在拼对的石核) 石片组合中, 石制品之间的距离较其它拼合关系要稍接近一些, 剥片时石片及碎屑将分布在一个扇形的范围之内, 石核和石片等产品之间的距离小于该扇形的半径。但是, 拼对关系的石片(包括断块和二次加工修理的石片工具) 之间却展现不同的景像, 它们之间的分布距离和范围变化很大, 没有任何一组局限在某一特定的扇形范围之内, 这说明掉落于地的一些石片很可能被剥片者捡起来直接投入使用或二次加工成工具, 这些石片还经历了剥片后的修整、使用及再废弃的过程。另外, 甚至无法排除拼合的工具可能废弃后被选择再使用或加工的可能性[26], 加工后它们可能被带出洞外使用。剥片者在工作时很可能在不断变换和移动位置, 将石制品从一地带到另一地(最新的龙牙洞内石制品与洞外探方发掘出土石制品拼合组合已完全证实了这一点) 。但对于拼接关系的不完整石片而言情况又有所区别, 一方面是它们可能直接产生于剥片过程中, 或者剥落后掉落时碰到地表物体而破碎, 另一种可能性是沉积过程中压碎或碰碎。除非不完整石片被挑选用于二次加工、或者遗址有严重的堆积后扰动现象发生, 否则, 在整体上拼接组合石制品之间的距离将小于拼对关系组石制品之间的距离。

Cziesla (1990) 在论述欧洲旧石器遗址的拼合研究时曾将 28 个不同遗址的石制品拼合率划分为 0) 7% 、9) 13% 和 15) 70% 三个等级[12], 显然龙牙洞内石制品的拼合率并不高。考虑到长期居住类型遗址与临时营地之间的差异, 结合前文统计数据表明龙牙洞内的石制品还是经历了程度不同的扰动过程, 人类行为对石制品的分布现状产生了显著的影响, 在这种情况下, 只能依据拼合石制品的特征复原剥片过程, 而无法将拼合石制品之间的距离运用于判断剥片技术方面。

5　结　论

龙牙洞遗址石制品的拼合研究结果可以归纳为下面几个方面:

(1) 在 18499 件石器标本中仅获得 94 个拼合组, 涉及 212 件石制品。拼合率不高, 仅约占石制品总数的 1115% 。

(2) 龙牙洞拼合石制品可以区分为拼对关系(conjoin) 的石核) 石片和石片) 石片(石片、工具、废片渣和断块) 以及拼接关系(join) 的不完整石片或断块两种类型, 这两种拼合组合关系反映的意义有所不同。拼对关系石制品的产生有时间上的先后次序, 石制品在遗址的分布更多地反映出受到人类行为的影响, 而拼接关系的不完整石片之间或断块之间则为孪生关系, 由于其产生的特殊性, 这种拼合组合关系更多地体现在对遗址埋藏学研究的价值上。

(3) 龙牙洞拼合组石制品之间平面分布和纵向位移差异较大。在平面分布方面, 虽然穴居动物、植物根系、石制品数量、制作方法、剥片者的个人习惯、践踏以及工具使用的策略等多种因素均可影响石制品在遗址的分布, 但综合分析, 人类行为对石制品的位移可能起了关键作用。在纵向位移方面, 石制品的自身重量、沉积环境、人类踩踏、其它的生物扰动以及

堆积物类型等要素都可能影响石制品在地层中的位置, 除早期人类行为外, 洞内粘土状堆积物类型及其干湿变化则可能是导致石制品发生纵向位移的最根本原因。

(4) 在石制品制作技术方面, 石核) 石片类型拼对组合以及石片之间的拼合关系无疑可以帮助我们更准确地判断早期人类所采用的剥片技术, 拼合研究在这方面具有独到的优势。但是, 根据拼合石制品之间的分布状况判断具体的剥片技术有明显的局限性, 这是因为不同的打片技术尽管会导致剥片产物在分布上的细微差别, 但剥片者的个人习惯以及剥片时是否移动等因素会严重影响到石制品的分布, 在研究过程中对这些不确定的因素必须给予认真考虑。

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The Refitting of Lithic Artefacts from the Longyadong Cave, Luonan Basin, China

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Abstract:

Introduction

A systematic refitting analysis was carried out in 1999 on the stone artefacts excavated from the Longyadong cave, Luonan Basin, China. 18 608 lithic artefacts excavated from the inner cave in 1995 were selected as the refitting unit. It included two strata: (i) Layer 10, the disturbed layer, and (ii) the upper part of Layer 4, a red clay soil layer, the principal sediment at the cave.

Out of a total of 18 499 stone artefacts (except the manuports, hammer stones, anvil stones, and some of the burnt stones), 94 refitted groups were identified. These sets included 212 elements, made up of 27 cores, 67 flakes, 37 broken flakes, 71 chunks, one small piece of flaking debris, and nine retouched flakes. The raw materials range from various coloured quartzite (cream, red, and dark grey colour etc.), quartz, sandstone, flint, and igneous rock. The refitting rate is about 11 15%.

There are two patterns of refitting in current work. The first is where flake(s) or chunk(s) can be refitted to a core, or flakes can be refitted together and represent a succession of removals but where the core cannot be identified. The second pattern identified is those artefacts that have broken either during the manufacturing process or through post2depositional disturbance. The former pattern will be referred to as conjoins, the latter as joins. Joins include all broken artefacts whether broken from the percussion point or medial snaps.

Seventy2eight groups, or 82198% in total of 94 refitted groups, consist of two elements, and include conjoined core with flake(s), conjoined flakes, or joined flakes and chunks. These refits usually possessed a cortical platform. Eleven groups (1117%) consist of three refitted elements. Four groups (4126%) consist of four refitted pieces. The largest refitted group conjoined together was made up of five elements. This comprised of 1106% out of the 94 refitted groups.

Spatial Distribution of Refitted Lithic Artefacts

For the core and flake(s) or chunk(s) conjoined sequences, the maximum and minimum horizontal separation distance is relatively narrow compared to the other refitted types. The horizontal rectilinear distance between conjoining flakes (chunks) is relatively longer than the other types. The joined broken artefacts have a lower mean distance suggesting that these are relatively more undisturbed than the other groups. The retouched type reveals the opposite pattern. The rectilinear distance between retouched flakes is the largest with the nearest rectilinear distance 9913cm, which is significantly greater than other refitted types.

The vertical separations of retouched flakes are significantly different and are separated over larger distances. Their mean vertical separation is nearly twice that of the other refitted types. Most of refitted artefacts are simple conjoins or joins of two artefacts. They have a vertical separation from one to 20 cm. However, some refitted groups are separated by over 20 cm, and are mostly associated with retouched flakes.

Taphonomic Issues

The results from experiments have shown that lithic scatter patterns are influenced by a number of factors, including the method of manufacture, the movements of the knapper, animals inside the cave, the amount of artefacts, the habits of the knapper (e. g., the height of knapper. s hand above the ground standing or sitting, etc.), trampling, and the strategies of tool use such as re2use of former blanks or tool re2sharpening. Because of the possible range of both natural and behavioural influences on the distribution of artefacts within the cave, alternative explanations must be considered. Technological explanations cannot be the only influences operating on horizontal distributions of refitted artefacts. As we have refitted that some refitted artefacts lay up to 6133 m apart, while some other sets lay close together.

There are 87 groups, in total of 94 refitted groups that have been measured in situ while the other artefacts came from the disturbed Layer 10. Nine refitted groups (912%) of 87 groups lay more than 4 m apart. The percentage of different refitted types is composed of two conjoining groups (10%) from a total of 20 core2flake groups, two joining groups (8133%) in a total of 24 groups of broken pieces, four groups (10181%) in total of 37 groups of conjoining flakes, and one group (16167%) in total of six groups of conjoining retouched flakes. The results suggest that serious artefact disturbance has taken place in the cave. However, the rectilinear distance of some refitted groups lay less than 4 mapart, their horizontal distribution pattern can be interpreted as representing part of a hominid knapping event, since it is clear that the inner cave wall configuration separates some of the refitted artefacts, and argues against simple natural process.

The horizontal distribution of related broken flakes or chunks, particularly, the elements that are the closest together, suggests that they lie near their original positions. Fifteen groups of refitted broken flakes are broken or separated by distances of less than one metre. In these cases their distribution in almost certainly the result of primary knapping. Here it is argued that they more likely reflect behavioural patterns rather than natural disturbance.

Analysis of the distribution of the broken pieces also provides important information about post2 depositional events. Several pieces lay close together without any gap between them indicative of trampling or some other external pressure such as pressure caused by the weight of the cave deposits.

The stratigraphy and the TL dating suggest that the deposit has been built up over a period of tens of thousands of years. Given that the thickness of the analytical unit is about 70) 90cm and built up nearly 100 kyr between 35616 ? 1718kyr and 27319 ? 1317kyr, it is likely that the lithic artefacts were exposed on the surface for a substantial period of time. No stratigraphic unconformity or sediment gap within the upper Layer 4 has been identified which would indicate that the artefacts were exposed for a considerable time before deposits covered them. The artefacts therefore have undergone a process of hominid or non2human animal trampling before they were buried.

Careful analysis of the sediments of the Longyadong cave shows that there is no evidence for significant fluvial action. The presence of intact, very thin 1) 2mm thick deposits interleaved with a number of 2) 3mm trampling strata in the inner cave, suggests no major disturbances. Fluvial action does not appear to have been a major influence on the artefacts distribution patterning.

Overall the evidence suggests that artefacts separated by large distance can be interpreted in terms of hominid behaviour. These appear to have been selected for use or transport to another location. Conversely, the joined broken pieces with distances less than 10cm suggested that they were formed during in situ lithic manufacture or broken through trampling.

The study and interpretation of the vertical movement of lithic artefacts in the Longyadong cave is relatively complex when compared to the horizontal distributions. The results show that most of the refitted artefacts at the cave underwent vertical movements from zero to 20 cm. However, the largest differential separation are those found in the conjoined core and flake(s) groups of up to 48 cm, while conjoined retouched pieces were found to be 40 cm apart. There are four refitted groups (416%) of the 87 refitted groups with vertical displacement of over 30 cm. Ten refitted groups (11149%) have vertical displacements of 20 to 30 cm. Twenty2three refitted groups (26144%) have vertical displacement of 10 to 20cm, while the other 50 groups (57147%) with have a vertical separation of less than 10 cm. The results suggest that conjoined groups, particularly the conjoined retouched flakes are significantly different from the other refitted groups. Their mean vertical separation is nearly twice that of the other refitted types.

It is impossible to indicate which agent was responsible for the vertical displacement of artefacts in the Longyadong cave. Some experiments and excavations of archaeological sites with sandy sediment matrix show that when artefacts were deposited, the heavier pieces tend to penetrate further. However, at the Longyadong cave, the relationship is reversed to some extent. This may be related to the surface area of lithic artefacts and the differing sediments in which these were deposited.

Only the heavier conjoined core and flake(s) group is displaced toward the lower levels. The other three refitted groups challenge the conclusion that heavier artefacts tended to travel further down into the deposits over time. Generally, the results show that the degree of vertical movement of refitted groups does not support the previous findings at the other sites with a fine sand matrix.

In an assessment of the principal factors, biological activities may be ruled out as a major agent. The cave site deposits have clear stratigraphic ordering with 2) 3mm thick strata preserved in the unit. Although some plant roots were found, the matrix was nearly horizontal, and the macro level biological activities do not seem to have played an important role in displacing artefacts.

A major factor in the formation processes is the alternate wetting and drying of the deposits that probably played a significant role in vertical movement of refitted artefacts. The clay soils are liable to wetting and drying, with a formation of cracks allowing smaller flakes to penetrate into lower layers more easily than larger, heavier artefacts. Rainfall slowly percolates from the cave roof in droplets wetting the sediments and allowing it to expand. When dry, it contracts and cracks. The artefacts located in the softer soil inside the cave in northwest corner have a deeper vertical distribution than other areas. The influence of differential clay moisture content appears to have a considerable effect on vertical displacement of artefacts. The cave deposits are loess and there is no evidence that shows regular flooding through the cave particularly in the Layer 4.

Trampling may have played a major role in vertical displacement, since the cave was occupied by early hominids and non2human animals for a very long period. It was quite probable that lithic artefacts had been exposed on the surface for a long time before they were buried. The density of artefacts in the central parts of cave was not as high as the surrounding areas and the fact that the soil here was more compact appears to have led to a greater displacement of artefacts due to trampling.

It appears that the effects of artefact weight, sedimentary environment, hominid trampling, other bio2disturbances, and soil properties have had a significant influence on artefact distribution inside the cave. Hominid behaviour is one factor but other site formation factors have been identified. The wetting and drying of sediment has played an essential role in the dispersal of lithic artefacts in the cave.

Technological Issues

Experimental replication of flint2knapping shows that the d bitage are scattered within 50 cm around the knapper. It has also provided information on how much dispersion of flaking debris can be expected in situ. Although the exact method of lithic reduction cannot be identified, the characteristics of special flakes show that the former occupants of the cave used anvil2chipping, bi2polar, and hard hammer percussion techniques for flake production. Based on experiments, it was found that anvil2chipping technique was used to detach flakes. Quartzite river cobbles were used and when struck scattered d bitage up to a maximum of 150 cm from the knapping site. Ninety percent of shatter was distributed within 70 cm of the knapper. It contrasts with the distribution of refitted artefacts in the cave, where the mean distance of all refitted groups except the broken flake type is greater than 150 cm. If 50 cm is used as the common criterion for hard hammer percussion, then there are only 12 refitted groups (13179%) that fall into this range. When the common criterion of 70 cm of rectilinear distance is used for anvil2chipping technique, only 16 groups (18139%) fall within this range.

It has been demonstrated that there is a close relationship between the position of knapper and the resultant d bitage scatter. That is, the further away from the ground surface the knapper is positioned, the greater dispersal of the d bitage, with some individual flakes travelling up to 4 m away. A more concentrated pattern is likely to result when the knapper is seated. This means that the rectilinear distance of dispersion of refitted stone artefacts might not be useful for identifying the specific knapping technique in the Longyadong cave.

Unfortunately the refitted groups cannot be used for studying specific lithic reduction technology, although other patterns can be identified through an analysis of refitting artefact groups. For example the distance between core and flake(s) or chunk(s) show a narrower range of dispersal when compared to other types. This implies that under some experimental circumstances, when the first flake is removed from a core in a sitting position, d bitage scatters in a fan where the distance between core and d bitage equals that of the radius of the fan. However, the conjoined results of flake(s) or chunk(s) show a different pattern. The distance between each set is variable. At face value the interpretation could be that the conjoining flakes were picked up and selected for re2sharpening or directly used as a tool after they were detached. It suggests that the flakes underwent post2knapping removal and discard. Moreover, since the conjoined retouched flakes were chosen for re2sharpening, the rectilinear distance between them suggests that even after retouching, the tools were taken away from the cave. It seems that the knapper did not work at same location during the knapping sequence. They appear to have moved from one area to another. Such activity would transport the artefacts from their original location to another work area.

However, the groups of joined broken flakes differ from retouched groups. They appear to have formed in two ways. One is the result of knapping processes, where the pieces were reduced by percussion processes or the detached flakes hit another object in percussion processes to made the flake break. The second is by post2depositional processes, such as trampling or striking another rock. It is not hard to imagine that the rectilinear distance for broken pieces remained short compared to the other refitted types unless they were chosen for further retouching or removed during heavy disturbance. The experiments and the analysis of the joined artefacts groups support this hypothesis.

Key words: Palaeolithic; Refitting analysis; Taphonomy; Technological behaviour; Longyadong cave