

GOLD IN THE ALPS: A VIEW FROM THE SOUTH

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ABSTRACT. To the south of the Alpine watershed there are important primary gold ore deposits located in the Western Alps and in the Ligurian Apennines; during Roman and Medieval times the Po plain placers were panned for gold. This contribution will provide a general picture of the gold-bearing primary and secondary deposits at present recognized in Northern Italy (section 2). Their distribution is compared with that of prehistoric gold finds (section 3). The ancient workings attesting placer exploitation in the Bessa highlands are briefly discussed (section 4). The written evidence is examined as well: both references in the classical sources from the middle of the 2nd century B.C. onwards (section 5) and in the medieval documents from the IX to the XIV century (section 6) are taken into account. Pre-Roman gold finds are not numerous and do not date earlier than the Middle Bronze Age. The distribution of most of those finds does not suggest a precise link with the gold-bearing deposits.

1. Introduction

To the south of the Alpine watershed the primary gold deposits are mainly in the Western Alps and in the Ligurian Apennines, while the secondary deposits are found chiefly at the foot of the mountains and in the plain. It has been recorded that gold was panned in the Po River during Roman times and in many tributaries of the Po River during the Middle Ages. Some of these have gold-bearing sands even today.

In spite of this potential, prehistoric gold artifacts found in Northern Italy do not seem to date back any further than the Middle Bronze Age; gold objects appear here much later than in most areas North of the Alps. There does not appear to be any obvious geographical link between the well-documented western mining areas and the distribution of gold artifacts. A gold nugget from an Iron Age tumulus in the Aosta Valley could possibly be the first archaeological proof available at present that, at that time, gold was being recovered from western Alpine deposits. According to the classical historians gold was extracted on a large scale in the area lying between the Alps and the Po River from the 2nd century B.C. onwards and gold panning was widely practised in the Middle Ages.

2. The geological context

2.1 PRIMARY GOLD OCCURRENCES (BY M.C.)

The greatest concentrations of gold ore were found in the Western Alps (Graie and Pennine Alps in Northern Piedmont) and to a lesser extent in the Central Western Prealps (Lombardy and Canton Ticino in Switzerland). In the Apennines most gold ore was found in Liguria and in Southern Piedmont (Fig. 1).

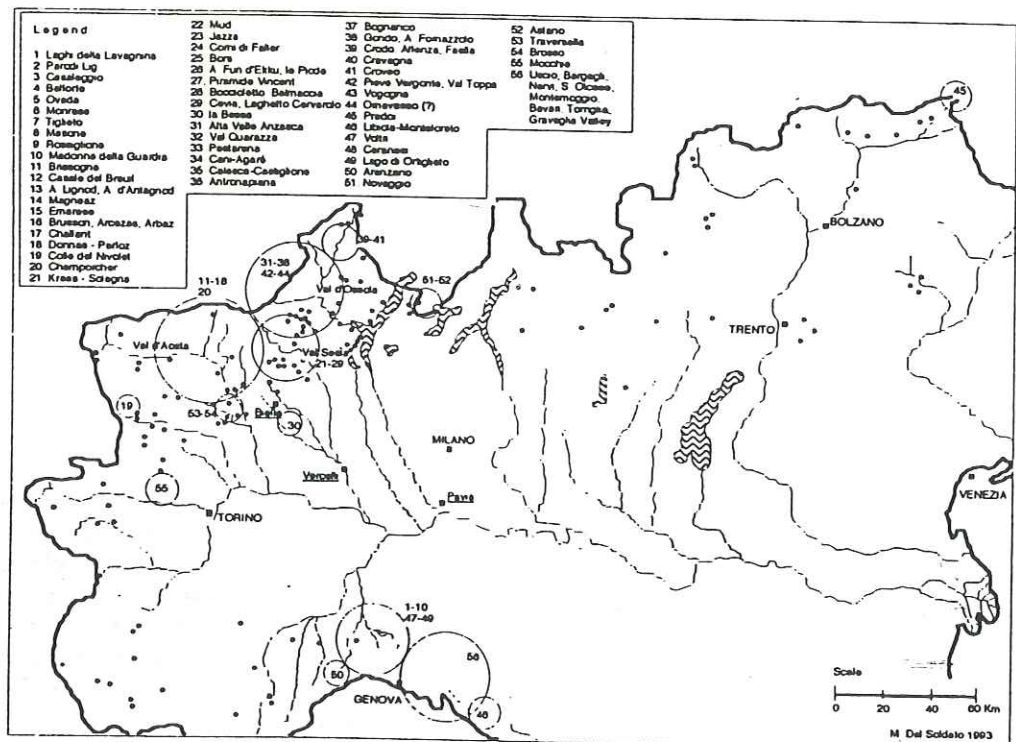
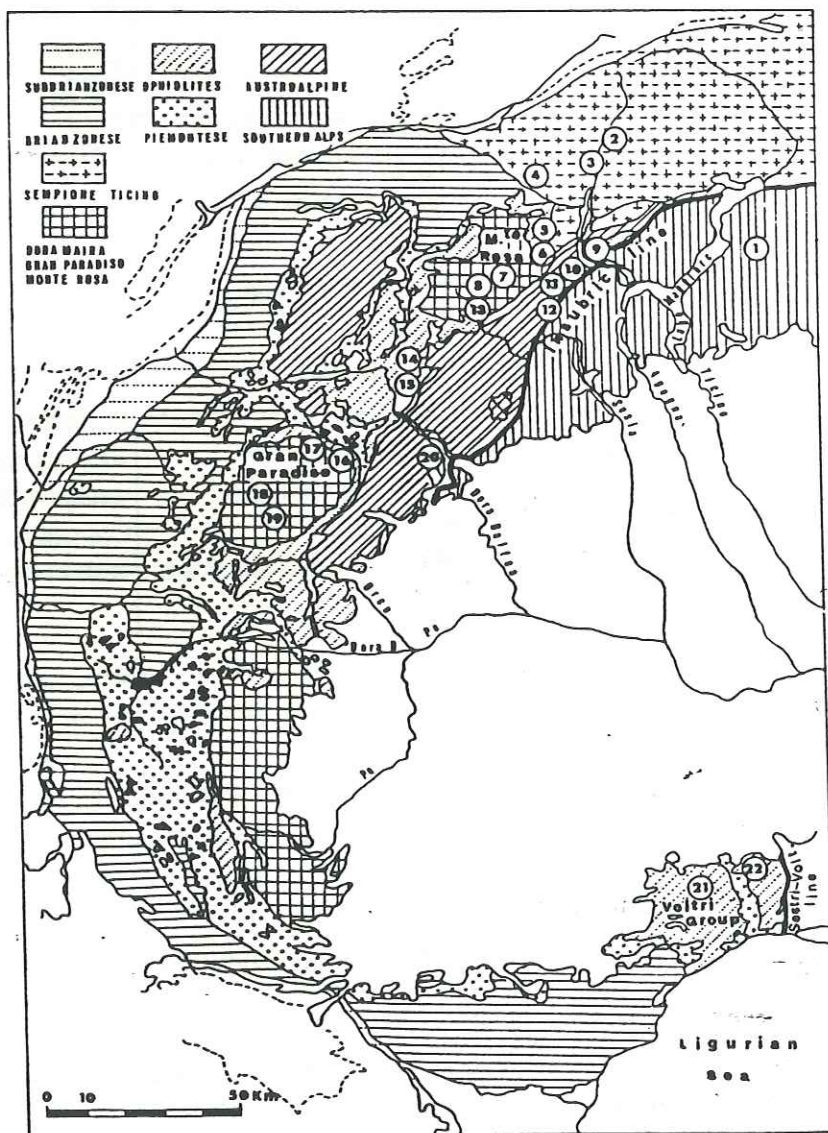


Fig. 1: Primary gold occurrences in Northern Italy.

In the 18th and 19th century, Di Robilant (1786) and Jervis (1873), observed that gold was quite widespread between the Western Alps and the Ligurian Sea and that it was concentrated mainly in the district between Gran Paradiso and Monte Ceneri. In the geological literature of the beginning of this century, this area was known as the "gold-bearing district of Monte Rosa", because most veins were located around the Monte Rosa massif (Fenoglio 1929, Novarese 1935, Huttenlocher 1934, Stella 1943). Today (Omenetto and Brigo 1974), one would rather make reference to the "gold-bearing province of the Western Alps", which also includes the smaller areas further to the west. Outside these areas, gold is rarely found in the Italian Alps. There are no deposits as such, but only isolated discoveries of gold in the pyrites of the Central and Central Eastern Alps: Introbio (Como), Bovegno (Brescia), in Valsugana (Trento), in Valle Aurina (Bolzano) (RIMIN 1987, Ogniben et al. 1988, Leonardelli and Suardi 1988).

In the Apennines the largest number of primary deposits lies to the west of Genoa. These are found in a rough square, marked out by Sestri Ponente, Varazze, Ponzone and Voltaggio, and are known as the "Voltri Group". Other small deposits lie to the east of Genoa in the region of ophiolitic rocks of the Bracco Pass (Ministero di Agricoltura etc. 1900, Giordano 1969) (Fig. 2).

Fig. 2: The gold district of the Western Alps. 1: Astano; Novaggio (Ticino); 2: Alpe Formazzola (Ticino); 3: Crodo (Alfenza, Faella, Maglioggio); 4: Gondo (Vallese); 5: Valle Antrona (Mottone, Mee); 6: Val Bianca (Cani, Agaré); 7: Valle Anzasca (Pestarena, Lavanchetto); 8: Val Quarazza (Quarazzola, Col Badile); 9: Vogogna; 10: Val Toppa, Vallaccia; 11: Val Segnara, Monte Capezzone; 12: Val Mastallone (Fobello); 13: Valsesia Alagna (Kreas, Mud); 14: Valle d'Ayas (Brusson, Arbaz); 15: Valle d'Ayas (Targed, Sache); 16: Val Soana (Rancio, La Reale); 17: Valeille; 18: Val Locana (La Cuccagna, Alpe Mei); 19: Val Locana (Bellagarda); 20: Tavagnasco; 21: Tiglieto; 22: Laghi di Lavagnina (after Mastrangelo et al. 1983).



2.1.1 Primary gold occurrences in Western Alps

The Alpine domains (Table 1, Fig. 2) with gold-quartz veins include: the Southern Alps, Austroalpine and Pennine tectonic domain, as well as the ophiolitic units of the "Voltri Group".

Table 1. Tectonical and geological situation as well as mineral association of primary gold occurrences in Northern Italy

Tectonic context	Deposit	Geological context	Form of deposits and ore texture	Ore elements
Strona Ceneri Zone	Astano (Ch)	"Sena del Lugh": micaschists and finegrained gneiss, diabases	concordant strata hydrothermal veins	pyrite, Aspyrite, (galena), (blende), Au and Ag (in sulphides), etc.
ibidem	Novaggio (Ch)	Schists	discordant strata veins with tectonic control	pyrite, (bismutinite, Aspyrite, galena, blende) and Au and Ag (in sulphides) etc.
Dioritic-Kinzigitic Zone	Monte Capio	"Ivrea Zone": gabbro-granulites (poxenites, peridotites), Kinzigitic complex (metamorphic siltstones, marbles, amphibolites)	stratabound mineralization in black schists interlayered with metamorphic siltstones	Fe-Cu-Au etc.
"Sesia Zone"	Tavagnasco	Brosso-Traversella's diorite in eclogitic micaschists	stockwork	quartz with sulphides etc.
ibidem	North of Brosso	Brosso-Traversella's diorite in eclogitic micaschists	=	Au native etc.
ibidem Canavese's sores	Mastellone and Strona Valleys	at the contact between Ivrea Zone and Fobello-Rimella's schists	stockwork (1) and tabular-lentiform, locally stockwork (2)	pyrite, chalcopyrite, pyrrhotite, blende, Au, mackinawite, rutile, cobaltite + galena, graphite and molybdenite and tetrahedrite (1) or Aspyrite and cubanite (2) etc.
ibidem Canavese's sores	Toppa Valley (Ossola Valley)	Fobello-Rimella's schists	tabular-lentiform strata concordant veins	pyrite, chalcopyrite, blende, galena, pyrrhotite, Aspyrite, Au, cubanite, mackinawite, cobaltite, rutile etc.
ibidem Canavese's sores	Vogogna-Pieve Vergonte		strata concordant veins and strata discordant veins	galena, blende, pyrrhotite etc.
Monte Rosa	Pestarena	K-feldspar Gneiss and mica-schists	tabular-lentiform discordant veins and strata concordant veins	galena, blende, Au, pyrite, chalcopyrite etc.
Monte Rosa	Alagna Valsesia	K-feldspar Gneiss, mica-schists and quartzites		Aspyrite, pyrite, galena etc.
Arceza-Brusson	Val d' Ayas	Arceza's ortho-gneiss and calc-schists with ophiolites	veins and stockwork	pyrite, chalcopyrite, pyrrhotite, blende, galena, mackinawite, Au, molybdenite, Aspyrite, and minors elements etc.
Gran Paradiso	Val Soana	metamorphic paragneisses and intrusions of granitoids	lenses or strata concordant veins in thin grained gneiss	pyrite, chalcopyrite, blende, galena, Au, tetrahedrite, Aspyrite, marcasite, bornite, Jamesonite, chalcocitibina etc.
Gran Paradiso	Val Locana	K-feldspar Gneiss	strata discordant veins or stockwork	ibidem etc.
Camughera - Monte Rosa - Moncucco - Antrona Zone	Valle Bianca (Anzasca Valley)	Antrona's amphibolites and ophiolites, Camughera's ortho-gneiss and Camughera-Moncucco's paragneiss and micaschists	strata concordant veins and strata discordant veins	pyrite, chalcopyrite, blende, galena, mackinawite, Au, Aspyrite, marcasite, bismutinite, Bi etc.
Camughera-Monte Rosa-Moncucco-Antrona Zone	Cani's mine (Anzasca Valley)	Camughera-Moncucco Zone	tabular-lentiform strata concordant veins	pyrite, Aspyrite, chalcopyrite, mackinawite, blende, galena, pyrrhotite, Au, rutile, graphite etc.
Antigono Nappe	Gondo	Antigono's Gneiss	tabular-lentiform strata concordant veins	pyrite and Aspyrite, Au bearing, blende, galena etc.
Antigono Nappe	Allenza (Antigono Valley)	Baceno's Mica schists	tabular-lentiform strata concordant veins	pyrite, chalcopyrite, pyrrhotite, hematite, Au, magnetite, boulangerite etc.
Antigono Nappe	Maglioggo (Antigono Valley)	Triassic marbles and paragneiss	stratabound mineralization	pyrite, chalcopyrite, pyrrhotite etc.
Antigono Nappe	Faella	Antigono's Gneiss	tabular-lentiform strata discordant veins	pyrite, chalcopyrite, hematite, Au etc.
"Voltri Group"	Lavagnina Lakes, Parodi Lig., Casaleggio, Belforte, Ovada, Monreale, Tigheto, Mesone, Fossiglione, M della Guardia, Voltri, Ceranesi, Lago di Ortigieto, Arenzano	Serpentinites from Lherzolites and Prasniti, calc-schists	disseminations and stockwork	Fe-Cu-Zn-Mo-Au-C-Pb etc.
"Bracco Pass Group"	Libiola-Monteloretomines	Ophiolites	massive mineralizations	pyrite, chalcopyrite, blende, galena, Au, Ag and sulphides etc.

The deposits in the Austroalpine (Sesia-Lanzo, Canavese, zone of Fobello-Rimella schists) and Pennine domains (Monte Rosa, Gran Paradiso, Camughera-Moncucco units, Antigono Nappe and Antrona zone) are more numerous than those in the Southern Alps (Strona-Ceneri and Dioritic-Kinzigitic units).

The lithologic and tectonic units containing the ore veins (Table 1) are of different kinds, such as:

- gneiss of the "ghiondone" variety (gneiss with K-feldspar) and mica-schists on the Gran Paradiso and Monte Rosa units;

- b) orthogneisses, mica and garnet schists, in the "Antigorio Nappe" and Camughera-Moncucco zone;
- c) fine-grained gneiss in the "Sesia-Lanzo" zone;
- d) schist formations in the "Fobello-Rimella" zone and with sericite in the "Canavese" zone;
- e) mica-schists in the so-called "Strona-Ceneri" zone
- f) amphibolite in the "Camughera-Monte Rosa" zone;
- g) serpentinite and other lithologies of the volcano-sedimentary "Voltri Group".

Several deposits are concentrated along faults and folds, particularly along the "Insubric Line" and along the "Sestri-Voltaggio Line" (Fig. 2). The gold-bearing veins in the Western Alps are probably of Alpine age. Scheiderhöhn (1952), Andreatta (1955), Omenetto and Brigo (1974) and Leonardelli and Suardi (1988) suggested that the veins formed by hydrothermal activity in areas of intense folding and tensional pull-apart that remobilized preexisting mineralizations found in the basement. The morphologies of the gold occurrences are (Table 1):

- 1) columns, pipes and randomly arranged discordant veins
- 2) veins concordant to the schistosity of the wall rocks
- 3) stockworks.

The gangue of the veins is often quartz with occasional small quantities of carbonates. Ore minerals are mainly pyrite, arsenopyrite and chalcopyrite with subordinate sulphides like sphalerite, galena, pyrrhotite. Accessory minerals are tetrahedrite and bismuthinite (Table 1). Gold seems to be linked mainly to pyrite and arsenopyrite. Gold is found also under particular conditions in quartz gangue associated with galena (Val Toppa).

2.1.2 Primary gold occurrences in the Ligurian Apennine (by M.D.S.).

In the so called "Voltri Group", which in spite of belonging geographically to the Apennines is geologically an Alpine lithotectonic unit, gold is found in thin quartz veins, or in quartz patches in the serpentinites belonging to the "Iherzoliti tettonitiche", or between "prasiniti" i.e. greenschists and calc-mica-schists. Those local gold mineralizations were exploited in historic times by local enterprises. A very interesting gold mineralization in sulphide bodies is found to the east of Genoa, in the ophiolitic sequence of the Bracco Pass area of Middle to Upper Jurassic age. The largest of these sulphide ore bodies has been mined at times since the Bronze Age as the so called Libiola copper mine (Maggi and Vignolo 1987). During the second half of the last century in the nearby Monte Loreto copper mine a few gold nuggets, one weighing 800g were discovered.

2.2 SECONDARY GOLD DEPOSITS (BY M.D.S.)

The secondary gold deposits to the south of the Alps belong to two types: morainal and alluvial or fluvial (Jervis 1873; Ministero di Agricoltura 1900) (Table 2, Fig. 3). Among the morainal gold deposits the most important example is "La Bessa", a terrace formed by the glacial moraine of the Dora Baltea glacier (Micheletti 1976, 107). This gold occurrence was exploited in the pre-Roman and Roman period (see section 4). Alluvial deposits or stream placers are found in the fine sediments of many Po Valley rivers. Here gold was panned in an-

cient times using the simplest form of sluicing called in Italian "pesca dell'oro" (gold fishing) (Table 2, Fig. 3 and the documents quoted in section 6).

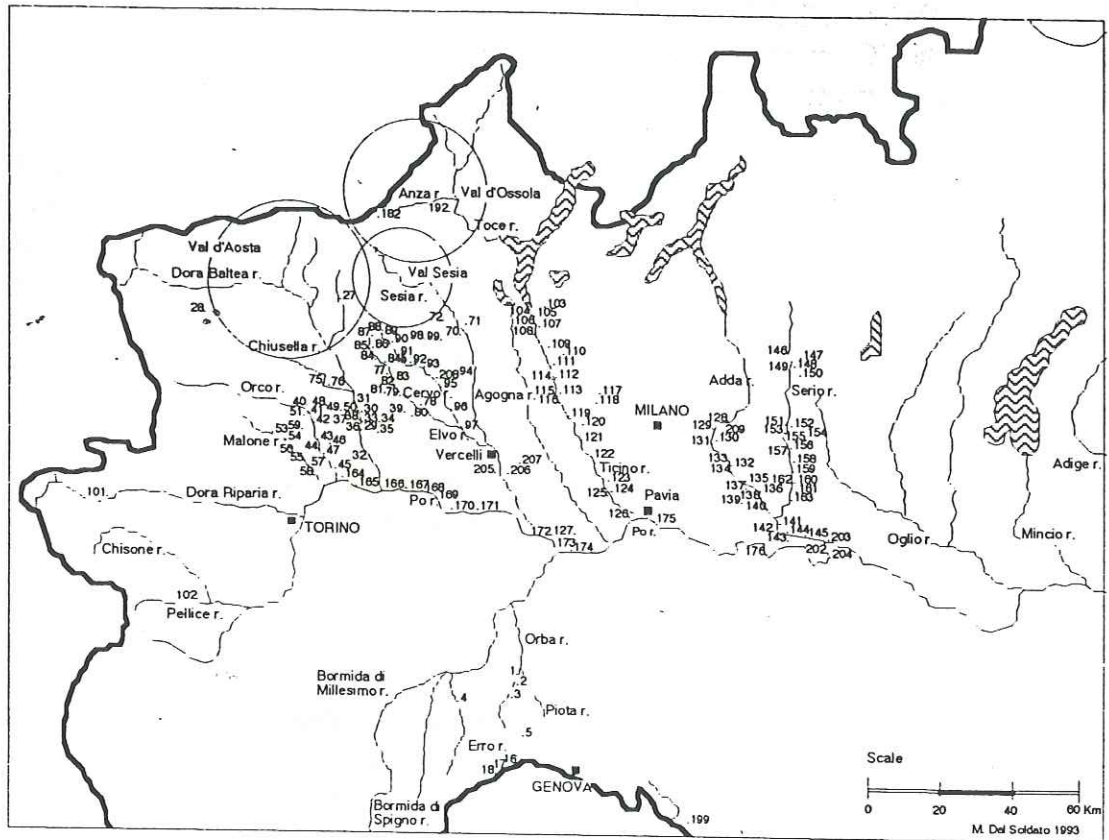


Fig. 3: Secondary gold occurrences in Northern Italy. The numbers refer to Tables 2 and 3. The circles are the areas of the main primary gold districts of NW Italy (see Fig. 1).

Gold-bearing sands were dug mainly in parts of Piedmont and Liguria (Jervis 1873; Issel 1892; *Annali di Agricoltura* 1887-1890; *Mostra Parigi* 1900; Giordano 1969):

- a) Placers found in the Ticino, Agogna, Sesia (with the tributaries: Sessera, Cervo and Elvo) and Dora Baltea river beds come from the Monte Rosa zone deposits.
- b) Placers found in the Canavese and in the whole area between the Orco and Malone rivers come from the Gran Paradiso zone deposits.
- c) Placers found in the Tanaro river bed with its left tributary Ellero and its right tributaries Bormida, Erro, Orba, Piota and Gorzente come from the "Voltri Group" deposits. These deposits appear to be rather small but they were exploited since the Middle Age up to the last century. The production from the Gorzente deposits during the nineteenth century, was significant (Leonardelli and Suardi 1988, 67, Fig. 3).

Table 2. Secondary gold occurrences in NW Italy.

River Basin	Place	Content
"Bracco Pass Group"	199. Monteloreto and Libiola	gold dust
"Voltri Group"	1. Carpeneto, 2. Tigliolo, 3. Ovada ; (Erro Stream) 4. Cartosio; (Vezzola R.) 5. Masone, Bormida River, Tanaro River, Secca Stream, (Varenna and Lupara Stream) 16. Arenzano, 17. Lerca, (Antra Stream) 18. Cogoleto;	0,293% - 1,039% 0,20 g/q
Po River	164. Chivasso, 165. Verolengo, 166. Crescentino, 167. Fontanetto Po, 168. Palazzolo Vercellese, 169. Camino, 170. Pontestura, 171. Morano, 172. Sartirana Lomellina 173. Suardi, 174. Pieve del Cairo, 175. San Martino Siccomario and Travacò Siccomario, 176. San Rocco al Porto;	
Pellice and Chisone R. Basin	102. Bricherasio;	
Dora Riparia R. Basin	(Val Susa) 101. Oulx	
Malone R. Basin	53. Barbania, 54. Front, 55. Lombardone, 56. Rivarossa, 57. S. Benigno, 58. Volpiano, (Viona R.) 59. Rivara and Busano ;	0,20 g/q
Orco R. Basin	(Canavese), 40. Courgné, 41. Valperga, 42. Salassa, 43. Lusigne-Feletto, 44. Foglizzo, 45. Montanaro, 47. Bosconero; 46. S. Giusto, 48. Castellamonte, 49. Bairo-Aglié, 50. Ozegna-S. Giorgio, (Gallega Stream) 51. Canischio;	also gold nugget
Dora Baltea R. Basin	<i>Val d'Aosta:</i> (Lys Stream), 27. Gressoney St. Jean, (Dora River) 28. Brissogne (Punta Laures Lakes); <i>Outside the Val d'Aosta:</i> (Val Chiusella) 75. Strambinello, 76. Parella; 29. Mazzé, 30. Vische, 31. Strambino, 32. Rondissone-Rivarotta; 33. Villareggia, 34. Moncrivello, 35. Cigliano, 36. Caluso-Candia, 37. Orio, 38. Barone, 39. Alice;	minor contents
La Bessa Highland	(Elvo Stream) 82. Salussola, 83. Cerrione, Borniana, (Lobbia Str.) 84b. Mongrando, (Viona Str.);	0,75 g/mc gold dust gold evidences
Cervo R. Basin	(Elvo Stream) 78. Casanova Elvo, 79. Carisio, 85. Occhieppo and Gaglianico, 86. Pollone, 87. Oropa, 80. Santhià, 81. Cavaglia, 84. Biella, 88. S. Paolo Cervo, 89. Scagliano Micca and Miagliano, 90. Andorno Micca and Tollegno, 91. Candelo, 92. Cossato, 93. Castelletto Cervo, Mottacciata, 94. Villarbóit, 95. Formigliana, 96. Collobiano, 97. Quinto Vercellese, 208 "Burontium"; (Sessera Stream) 98. Masserano, 99. San Maurizio;	
Sesia R. Basin	<i>Outside the Val Sesia:</i> (Hovasenda R.) 70. Gattinara-San Maurizio; 71. Romagnano, 72. Sostegno, 205 Pezzana, 206 "Rosascum", 207 "Castrum Novum";	
Agogna R. Basin	127. Lomello, Agogna River undetermined;	
Ticino R. Basin	<i>Val d'Ossola:</i> (Anzasca Valley) 182 Belvedere Glacier on Monte Rosa, Anza Stream, 192 Val Toppa; <i>South of Lago Maggiore:</i> 103. Somma Lombardo, 104. Golasecca and Coarezza, 105. Varallo P., 106. Pombia and Marano Ticino, 107. Vizzola Ticino, 108. Oleggio, 109. Turbigo, 110. Robecchetto con Induno, 111. Cuggiono, 112. Bernate T., 113. Buffalora, 114. Galliate, 115. Romentino, 116. Trecate, 117. Magenta, 118. Robecco sul Naviglio, 119. Cerano, 120. Abbiategrasso, 121. Cassolnovo, 122. Vigevano, 123. Bereguardo, 124. Torre d'Isola and Corpi Santi di Pavia, 125. Zerbolò, 126. Travacò Siccomario;	gold dusts always combined with small grains of titaniferous magnetite
Adda R. Basin	128. Rivolta d'A., 129. Comazzo, 130. Merlino, 131. Zelo Buon Persico, 132. Boffalora d'A., 133. Galgagnano, 134. Montanaso Lombardo, 135. Lodi, 136. Abbazia Cerreto, 137. Corte Peloso, 138. Cavenago d'A., 139. San Martino in Strada, 140. Turano Lodigiano, 141. Gombito, 142. Bertinico, 143. Castiglione d'A., 144. Formigara, 145. Camairgo, 202 Corno Giovine, 203 Lardara, 204 Roncarolo, 209 Bertario;	
Serio R. Basin	146. Grassobbio, 147. Cavernago, 148. Ghisalba, 149. Cologno S., 150. Martinengo, 151. Trezzolascio, 152. Vidolasco, 153. Sergnano, 154. Bottaiano, 155. Picengo, 156. Pianengo, 157. Crema, 158. Madignano, 159. Ripalta Nova, 160. Ripalta Guerima, 161. Ripalta Arpina, 162. Credera, 163. Moscazzano-Montodine	
Oglio R. Basin	(Mella River Val Trompia): Bovegno, Oglio River unprecised;	
Isarco-Adige R. Basin	Adige River unprecised;	

Table 3. Primary (P) and secondary (S) gold occurrences in Northern Italy.

River Basin	Place
"Bracco Pass Group"	P- 49. Monteloreto and Libiola mines; 56. Uscio, Nervi, Bargagli, Bavari, S. Olcese, Graveglia Valley (?), etc.; S- 199. Monteloreto and Libiola area, Graveglia Valley (?);
"Voltri Group"	P- Gorzente Stream: 1. Laghi della Lavagnina (Alcione, Maggetta, Moggia Ferraro, Cassinotto, Fresconi), 2. Parodi Ligure; 3. Casaleggio; Piota Stream: 4. Belforte; 6. Mornese; Orba Stream: 5. Ovada, 7. Tiglieto (Fresconi and M. Calvo), 8. Masone (Bric dell'Oro), Val Vesulla; 9. Rossiglione, 10. Madonna della Guardia, 47. Voltri, 48. Ceranesi, 49. Lago di Ortiglieto, 50. Arenzano; S- 1. Carpeneto; 2. Tigliolo; 3. Ovada; Erro Stream: 4. Cartosio; 5. Masone (Vezzola R.); Bormida River, Tanaro River, Secca Stream; Varenna and Lupara Stream: 16. Arenzano; 17. Lerca; 18. Antra Stream: Cogoletto;
Po River Basin	S- 164. Chivasso; 165. Verolengo; 166. Crescenlino; 167. Fontanello Po; 168. Palazzolo Vercellese; 169. Camino; 170. Pontestura; 171. Morano; 172. Sartirana Lomellina; 173. Suardi; 174. Pieve del Cairo; 175. San Martino Siccomario and Travacò Siccomario; 176. San Rocco al Porto;
Pellice and Chisone R. Basin	S- 102. Bricherasio;
Dora Riparia R. Basin	P- Val Susa: 55. Mochie (Rocca della Mina); S- Val Susa: 101. Oulx;
Malone R. Basin	S- 53. Barbania; 54. Front; 55. Lombardone; 56. Rivarossa; 57. S. Benigno; 58. Viona R.: Volpiano; 59. Rivara and Busano;
Orco R. Basin	P- [Gran Paradiso deposits] Val Locana: 19. Colle del Nivolet, La Cuccagna, A. Mee, Bellagarda; Val Soana: Valeille, Rancio, La Reale; S- Canavese: 40. Courgné, 41. Valperga, 42. Salassa, 43. Lusigné-Feletto, 44. Foglizzo, 45. Montanaro, 47. Bosconero, 46. S. Giusto, 48. Castellamonte, 49. Bairo-Aglié, 50. Ozegna-S. Giorgio; Gallega Stream: 51. Canischio;
Dora Baltea R. Basin	<i>Val d'Aosta:</i> P- Valtournanche: 12. Casale del Breuil; Evançon Stream/Val d'Ayas: 13. Alpe Lignod and Alpe d'Antagnod, 14. Magneaz, 15. Emarese, 16. Brusson (Fenillaz and Gae Blanche, Monsalé), Arcésas, Arbaz St. Anselme, 17. Challant-St. Anselme, Challant St. Victor (Obeglio, Grand Goleil, Targnod); 11. Dora Baltea River: Brissogne St. Marcel; 18. Arnaz, Bard, Donnaz-Perloz; Ayasse Stream: 20. Champorcher; S- Lys Stream: 27. Gressoney St. Jean; Dora River: 28. Brissogne (Punta Laures Lakes); <i>Outside the Val d'Aosta:</i> P- Tavagnasco; Val Chiusella: 53. Traversella, 54. Brosso; Vico Canavese, Quincinetto, Quassolo; S- Val Chiusella: 75. Strambinello, 76. Parella, 29. Mazze, 30. Vische, 31. Strambino, 32. Rondissone-Rivarotta, 33. Villareggia, 34. Moncrivello, 35. Cigliano, 36. Caluso-Candia, 37. Orio, 38. Barone, 39. Alice;
La Bessa Highland	S- Elvo Stream: 82. Salussola, 83. Cerrione, Borriana; Lobbia Str.: 84b. Mongrando; Viona Str.;
Cervo R. Basin	S- Elvo Stream: 78. Casanova Elvo, 79. Carisio, 85. Occhieppo and Gaglianico, 86. Pollone; 77. Biella, 80. Santhià, 81. Cavaglia, 87. Oropa, 88. S. Paolo Cervo, 89. Scagliano Micca and Miagliano, 90. Andorno Micca and Tollegno, 91. Candelo, 92. Cossato, 93. Castelletto Cervo, Mottacciata; 94. Villarboit, 95. Formigliana, 96. Collobiano, 97. Quinto Vercellese, 208 "Burontium"; Sessera Stream: 98. Masserano, 99. San Maurizio;
Sesia R. Basin	P- <i>Val Sesia:</i> Alagna (21. Kreas-Solegna, 22. Mud, 23. Jazza, Acqua Bianca, 24. Corni di Faller, 25. Bors, 26. A. Fun d'Ekku, Piode Gacier, Mammellone, Salati, 27. Piramide di Vincent, Rosita, Cimalegna, Garstelet, Salati II, Corno del Camoscio, Hochlicht, 28. Boccioletto, Balmaccia, 29. Cevia-Laghetto, Cervarolo); Val Mastellone: Fobello, M. Capio; S- <i>Outside the Val Sesia:</i> Rovasenda Stream: 70. Gattinara-San Maurizio; 71. Romagnano, 72. Sostegno, 205 Pezzana, 206 "Rosascum", 207 "Castrum Novum", Sessera Stream;
Strona R. Basin	P- Valle Strona: Campello Monti;
Agogna R. Basin	S- 127. Lomello, Agogna River undetermined;
Ticino R. Basin	<i>Val d'Ossola:</i> P- Valle Antigorio-Formazza: 39. Crodo, Alfenza, Faella, 40. Cravegna, 41. Croveo, Maglioggio; Val Divedro: 38. Gondo, A. Formazzolo (Canton Tessin); Val Bognanco: 37. Bognanco, San Lorenzo-A. Varcenio; Valle Antrona: 36. Antrona (Locasca, Praberndone, Mottone, Mée), Schieranco; Valle Anzasca : 31. Pestarena, 33. Lavanchetto, Val Quarazza: 32. Quarazzola, Col Badile; Val Bianca: 34. Cani, Agaré, 35. Calasca-Castiglione; Val Toce: Pieve Vergonte-Fomarco (Motta, Cropino, Ortofredo, Gerbidi della Piana dell'Asino); 42. Val Toppa : (Fontanelle and Tagliata), Val Segnara: Cortiiti, Capezone; 43. Vogogna (Fontane, Ronco, Genestredo, San Carlo, Giavinello Dresio); 44. Ornavasso; S- Valle Anzasca : 182 Belvedere Glacier on Monte Rosa, Anza Stream, 192 Val Toppa; <i>South of Lago Maggiore:</i> S- 103. Somma Lombardo, 104. Golasecca and Coarezza, 105. Varallo P., 106. Pombia and Marano Ticino, 107. Vizzola Ticino, 108. Oleggio, 109. Turbigo, 110. Robecchetto con Induno, 111. Cuggiono, 112. Bernate T., 113. Buffalora, 114. Galliate, 115. Romentino, 116. Trecate, 117. Magenta, 118. Robecco sul Naviglio, 119. Cerano, 120. Abbiategrasso, 121. Cassolnovo, 122. Vigevano, 123. Bereguardo, 124. Torre d'Isola and Corpi Santi di Pavia, 125. Zerbolò, 126. Travacò Siccomario;
Olona R. Basin	P- Monte Ceneri-Canton Tessin: 51. Novaggio, 52. Astano, Valganna; Brizio;
Adda R. Basin	S- 128. Rivolta d'A., 129. Comazzo, 130. Merlino, 131. Zelo Buon Persico, 132. Boffalora d'A., 133. Galgagnano, 134. Montanaso Lombardo, 135. Lodi, 136. Abbadia Cerreto, 137. Corte Peloso, 138. Cavenago d'A., 139. San Martino in Strada, 140. Turano Lodigiano, 141. Gombito, 142. Bertinico, 143. Castiglione d'A., 144. Formigara, 145. Caimargo, 202 Corno Giovine, 203 Lardara, 204 Roncarolo, 209 Bertario;
Serio R. Basin	S- 146. Grassobbio, 147. Cavernago, 148. Ghisalba, 149. Cologno al S., 150. Martinengo, 151. Trezzolasco, 152. Vidolasco, 153. Sergnano, 154. Bottaiano, 155. Picengo, 156. Pianengo, 157. Crema, 158. Madignano, 159. Ripalta Nova, 160. Ripalta Guerima, 161. Ripalta Arpina, 162. Credera, 163. Moscazzano-Montodine;
Oglio R. Basin	P- Mella River-Val Trompia: Bovegno; S- Mella River -Val Trompia: Bovegno, Oglio River unprecised;
Isarco-Adige R. Basin	P- Valle Aurina: 45. Predoi, Vetta d'Italia; S- Adige River unprecised;
Brenta R. Basin	P- Valsugana: Calceranica, Vetriolo, Val di Sella, Val Fersina: Viarago, Prementil, Palù del Fersina-- (Erdemolo, Knappenwald, Laner, Frotten);
Piave R. Basin	P- Valle del Cordevole: Voltago, Valle Imperina;

3. Prehistoric gold finds from Northern Italy (by G.B.)

Prehistoric gold artifacts from Northern Italy are being systematically inventoried. A fair quantity of gold items from the Bronze and Iron Ages was identified some years ago by von Hase (1975). In a recent paper Bergonzi and Cardarelli (1990-1991) list Middle Bronze Age finds.

3.1 THE BRONZE AGE

Gold seems to appear much later in Northern Italy than it does north of the Alps. The earliest Northern Italian gold objects are dated to the Middle Bronze Age. While two isolated Copper Age silver finds are well known (i.e. the pectoral from Villafranca Veronese and the hammer-headed pin from Remedello: Barfield 1971, 57, Fig. 24a, pl.24; Primas this volume), there are as yet no certain gold objects from either Copper Age or Early Bronze Age Polada sites. One should not forget, however, that Early Bronze Age archaeological sites found in Northern Italy are mainly settlements, together with a number of bronze hoards as well, while tombs are very few. In Italy to find gold artifacts which date back to the Copper Age one has to go as far as Sardinia, where gold armrings were found in a Beaker site (F. Lo Schiavo, personal communication).

As shown in Fig. 4a, where known occurrences are reported with no claim to be exhaustive, most Bronze Age gold finds are located in North-Eastern Italy. Their distribution suggests a relation with the Isarco-Adige valley, which during the Bronze Age was a well-known and important link to the Alpine copper mining areas and beyond that to Central Europe. In the west there is only the recently found, still unpublished, discovery from the Middle Bronze Age lake-settlement at Viverone (Vercelli) (F.M. Gambari, personal communication). Viverone, located next to the Bessa gold placers, is the only find which could be linked to an early exploitation of westalpine gold placers. The other sites do not seem to support the hypothesis that the western placers were already being exploited in the Bronze Age.

Middle and Late Bronze Age gold finds are small spiral rings or sheet discs. In addition one bronze fibula plated with gold foil is said to come from Peschiera (Verona) (von Hase 1975, 11 n.57 Fig. 4). Sheet discs are found in the Gualdo Tadino hoard (von Hase 1975, 101, n.6, Figs. 1, 2, tav.14) and in the settlements at Borgo Panigale (von Hase 1975, 105, tav.14) and Redu' (Bermond Montanari 1990; von Hase 1975, 111, n.56). The composition of the Redu' disc, examined by XRF spectrometry was: 84.94% Au, 10.0% Ag, 4.9% Cu, no trace elements mentioned. This composition seems to indicate that copper was intentionally added to the alloy, already a fairly common practice elsewhere in Europe. The small spiral rings are found in settlement such as Peschiera (von Hase 1975, 111 n.56), Fiavè (Perini 1987, 17, 36, Fig. 14a), Castione dei Marchesi (Mutti et al. 1988, 161) and in graves, such as those at Stenico (Perini 1987, 36, Fig. 15b), at Franzine (Aspes 1987, 99) at Fontanella Mantovana (von Hase 1975, 111 n.56). Several Late Bronze Age cemeteries are fairly well known, but a find like Frattesina Le Narde tomb 227 with a gold ring, bronze "buttons" inlaid with gold, and an Allerona type sword with gold rivets (Salzani 1990, 16-17, Figs. 16-17) stands out as a unique example.

During the Middle to Late Bronze Age silver finds appear to be even rarer than the gold ones; there are but a few heterogeneous tiny artifacts from settlements, including a bead from Castellaro Lagusello (Piccoli 1982, 471), a conical sheet object from Isolone del Mincio

(Capoferri 1988, 62, tav. 10-19), a hollow-headed pin from Sanpolo (Saeflund 1939, 63; tav. 61, 14). Pending analyses of the alloys, the identifications of the metal are those proposed by the authors but not confirmed.

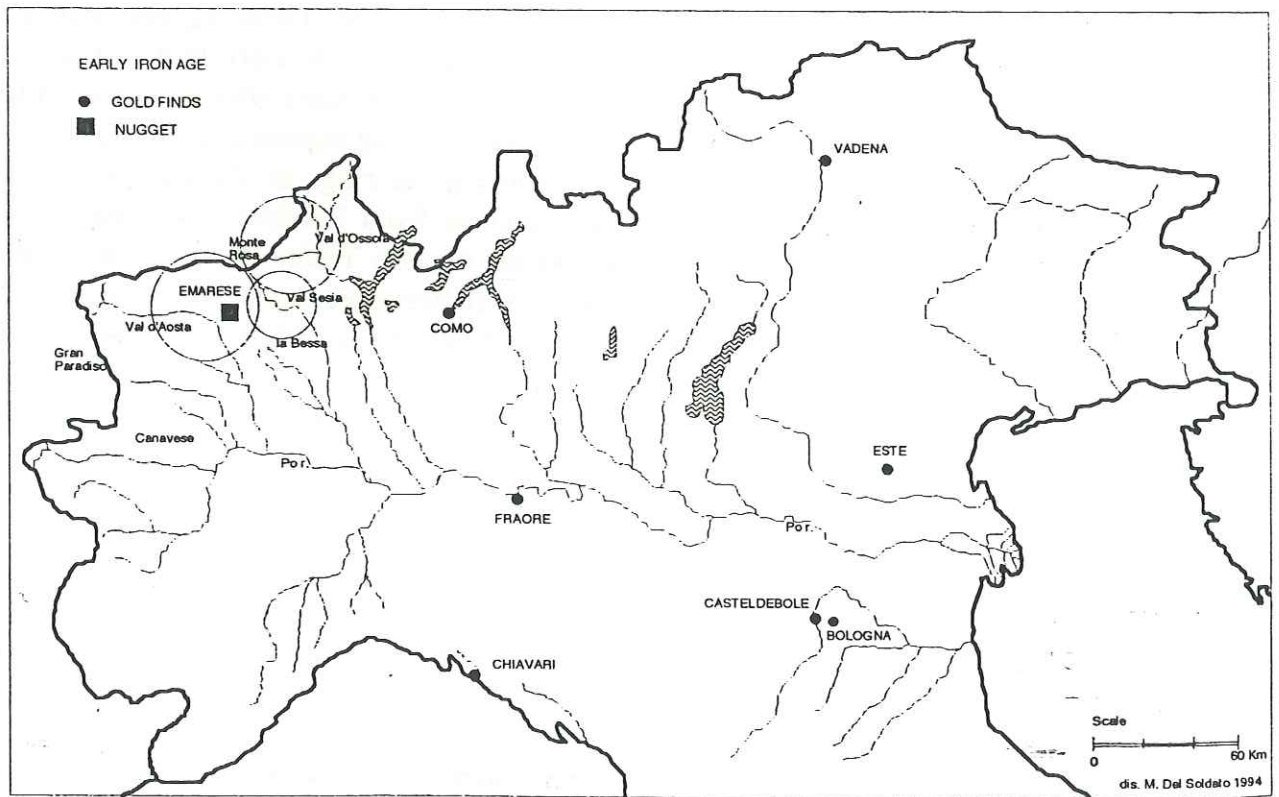
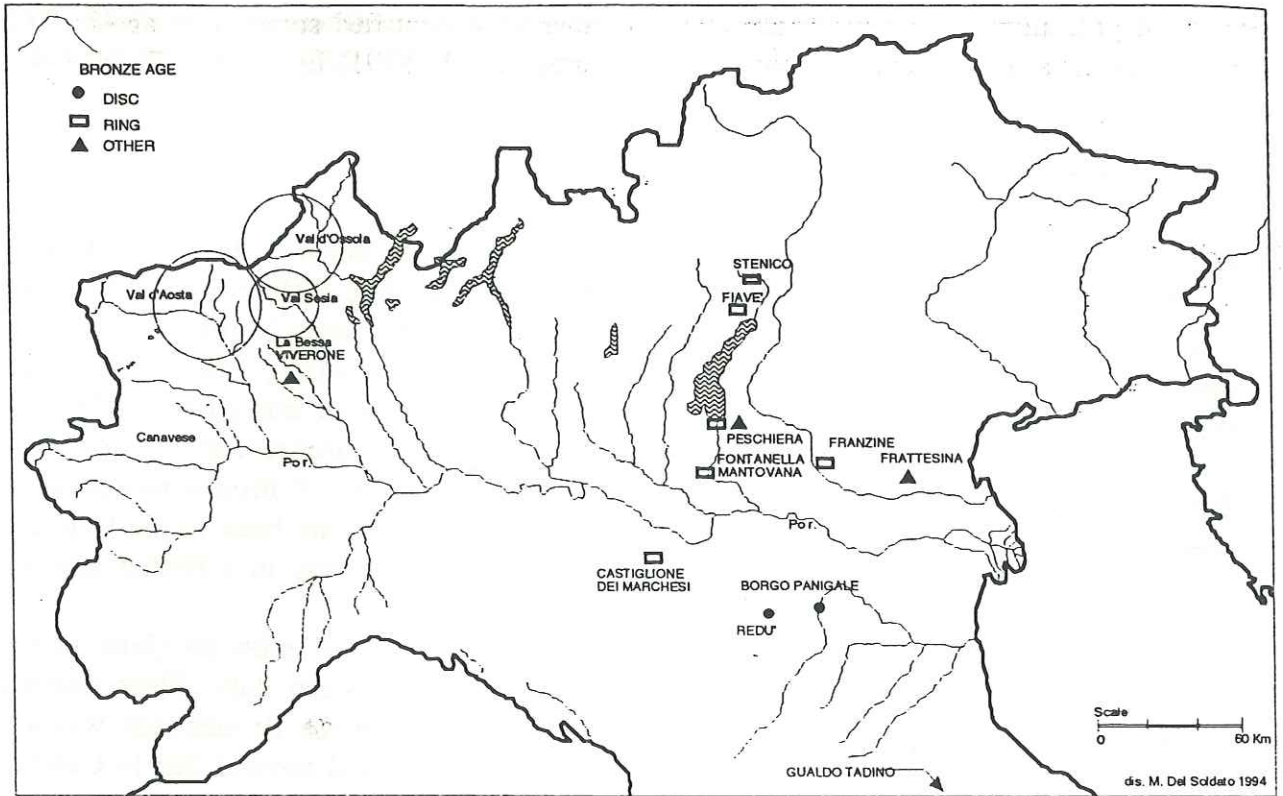


Fig. 4: Occurrences of Bronze (a) and Iron Age (b) objects in North Italy

3.2 THE EARLY IRON AGE

Fig. 4b, where known occurrences are reported with no claims to be exhaustive, shows that during the Early Iron Age gold finds are rather scattered, their distribution giving no clue to the provenance of gold. The earliest significant concentration of gold (and silver) ornaments is found in Early Iron Age Villanovan Bologna. There are little spirals often inserted into brooch pins, small rings, brooches, some of them decorated with granulation or filigree. The most outstanding among these objects are regarded either as imports or as imitations of Villanovan objects from Central Italy (Pincelli 1959; von Hase 1975). Later on, during the Arnoaldi and Certosa periods; there is a number of silver brooches, sometimes plated or otherwise decorated with gold foil (see for instance Cristofani and Martelli 1985, 123, 274). Gold brooches like the Certosa ones from Bologna and the serpentine bow ones from Fraore (Cristofani and Martelli 1985, 200, 303-305) are exceedingly rare, and bronze brooches plated with gold are also rather rare (Saltini 1992). Precious gold and silver objects are also occasionally found in minor sites like Casteldebole near Bologna (P. von Eles, personal communication) or Fraore.

Another remarkable concentration of gold (and silver) ornaments (mainly pendants and beads) is found in the Veneto, especially in the proto-urban center at Este (Padova) (Bergonzi et al. 1981, Chieco Bianchi and Calzavara Capuis 1985, Tosi 1992). The same types of objects are also occasionally made of bronze plated with gold foil. There are about a hundred such small finds, which however cannot be listed in detail here (A. Ruta Serafini, personal communication).

In Lombardy, in the so-called Golasecca area, gold is rare. Around Como, thin gold thread is used in the manufacture of a brooch with a long catch and coral segments inserted in the bow (De Marinis 1981, 223). There are also the toilet-set silver pendant from Rebbio with gold foil decoration (De Marinis 1988, 231, Fig. 191) and the gold ring found with a silver serpentine bow brooch in the tomb 1/1930 from Cà Morta near Como (De Marinis 1988, Fig. 189). Another gold ring was found on the Leuchtenburg of Vadena, Trentino Alto Adige. In Liguria in the cemetery at Chiavari, gold (as well as silver) is used for making small objects such as "earrings" or buttons (von Hase 1975, Guzzo 1975, Marini and Zucchi 1982, De Marinis 1988, 251-253, Fig. 195).

While the finds from Lombardy and Liguria could possibly be linked with the western Alpine and Ligurian Apennine mining areas, the largest concentrations are found in protourban centres which are far away from the ore deposits. The concentration of precious finds in these centres is likely to be a consequence of their central political position.

There is only one direct clue, still to be verified, to the possible exploitation of west Alpine sources during the Iron Age: a gold nugget is said to have been found inside the stone setting of an Iron Age tumulus at Emarese in Val d' Ayas (Val d'Aosta) in front of the entrance of an asbestos mine where traces of gold were found (Mezzena 1982). If confirmed, that could be a very interesting indication that the alpine ores were already being mined during the Iron Age. The distribution of gold finds during the Late Iron Age is discussed in some detail in Bergonzi (this volume).

mentioned that gold straw was recovered in the Po River (fluminum ramentis, ut in Tago Hispaniae, Pado Italiae etc.), and his report appears well-founded in the light of several medieval documents mentioning gold panning along the Po River, while giving no precise location. From the present perspective the extractive activities are likely to have taken place in the region of Victimulae near Vercellae and in the area near the Dora Baltea inhabited by the Salassi are more interesting. These regions are adjacent and rich in gold deposits: the former containing morainic and fluvial deposits; the latter, primary and secondary deposits.

Several authors were persuaded that all mentions found in the classical sources must have referred to the same area, since significant evidence for ancient extractive activities is found only between Biella and Ivrea in the La Bessa highland (De Sanctis 1923, IV/1, 417). Other authors have maintained the opposite, i.e. the classical writers distinguished between one area belonging to the Victimuli and Vercelli and another belonging to the Salassi (Pais 1918, 408, Gribaudo 1928, Artom 1935).

The ancient written sources were recently reexamined by Perelli (1981) and many of his conclusions appear convincing (Cresci Marrone 1987). As to the location of ancient mining activity, he maintains that the "*aurifodinae*" situated near Victimulae are to be identified with the morainic deposits in the Bessa, while on the other hand the mines belonging to the Salassi are, as Strabo reported, near the Dora Baltea, a river which is separated from the Bessa highlands by the ridge of the Serra. However, since no traces of extractive activities have been found along the Dora River, the identification of a site for the mines belonging to the Salassi is a question still to be resolved. Strabo supplies the following information:

- a. the gold mines had been exploited by the Salassi and continued to be used by the Romans after 143 - 140 B.C.;
- b. the waters of the Dora Baltea were employed in the working and washing of the ore; thus both activities were pursued in the vicinity of the river;
- c. the facilities for washing (*krusoplousia*) consisted of a network of canals constructed so as to capture all the water from the river;
- d. the Romans, intervening in 143 B.C. on the pretext of resolving the quarrel between miners and farmers concerning the rights on uses of the water from the Dora, took control of the gold mines but not of the waters necessary for the mining of gold because the Salassi still controlled the sources. Notwithstanding these observations, identifying a deposit that is consistent with Strabo's account is not easy. Unfortunately, it is not known whether in 143-140 B.C. the Romans conquered only the territory of the Salassi lying outside the Val d'Aosta, as suggested by Fraccaro (1941), or whether they were able to enter into the valley itself.

Another issue concerns the type of activity, whether panning or mining. Perelli (1981) is convinced that the Salassi quarried gold from mines, a view already supported by Gribaudo (1928) and Artom (1935). However, this view clashes with the notion that gold was collected only from placers, an opinion put forth by Pais in 1918 without having examined the question in great detail. According to the writings of Pliny (N.H. XXXIII, 66-79), the primary deposits were being mined in ancient times using water to transport the waste materials (Piaskowsky 1957). Moreover, the terms used by Strabo (*kruseia* and *krusourgeion*) (Stephan 1865, col. 1755 s.v. *krusorukeion* = "*aurifodina, locus ubi aurum foditur*"), indicate mining activities (Gribaudo 1928, Perelli 1981) as opposed to panning.

Perelli (1981) takes into account two possible locations for the mining by the Salassi. The first one is the Brosso mine in the Ivrea basin, close to but just outside the Val d'Aosta. Here there is evidence pointing to ancient working, but the site is too far from the Dora to have used water derived from that river. A mine not considered by Perelli (1981) is the Tavagnasco mine which is located nearer to the Dora. The second possible location of the mines Perelli (1981) proposes is inside the Val d'Aosta, in the Val d'Ayas, located in such a way that the water channels could have flowed through the field situated immediately further down stream into the Evançon, a tributary of the Dora.

Perelli (1981) is aware that the solutions proposed are not final. The water would not be derived from the Dora, but rather from Evançon, one of its tributaries. Any struggles between miners and farmers would have involved a very small area and would hardly seem likely to arouse the interest of the Romans to intervene and put an end to those struggles. Whether or not the mines in the Valle dell'Evançon-Val d'Ayas are those referred to by Strabo, in this area there are a few rich gold veins (the Ciamusera-Fenillaz Group including deposits of Lignod, Antagnod, Brusson-Arceza (Fenillaz, Gae Blanche, Monsalé mines) Arbaz-St. Anselme, Challant St. Anselme et Challant St. Victor (Orbeillaz, Grand Goleil, Targnod mines) (Servizio Geologico d'Italia, 1975, 22). A few among these mines could have been used during the pre-Roman period as evidenced by a gold nugget said to be found inside an Iron Age tumulus at Chassan near Emarese (Mezzena 1982, 57-58, Fig. 34).

There are gold deposits situated in other places which could fit Strabo's description better. Mines in the Val d'Aosta are numerous (see Fig. 3) and some have evidence of ancient working (Finocchi 1966). Leaving aside those which are situated in the high valleys and which were controlled by the Salassi up to the Augustan age (mines of Cogne, Gressoney, Ollomont-Champ de Praz, Courmayeur), it seems reasonable to consider the mines near the Dora River (Brissogne, Bard, Donnaz) or in lower Val d'Aosta (Champorcher in the Valley of Ayas Stream, which was used in 1279; Bottino et al. 1975, 21), if one holds that the Roman conquest in the years 143-140 went no further the lower Valley.

Clearly, much fieldwork remains to be done to clarify the picture of mining and panning activities during Roman times.

6. Medieval written documents (by M.T.)

Here is a selection of the earliest documents (up to the first half of the 14th century) that deal with gold mining and panning in Northern Italy. Quotation from documents which do not have an explicit mention of gold has been avoided because the sand and gravels quoted in such documents could have had other uses, for example as building materials:

- a. 28 September 872. The Emperor Ludwig II gives all the lands from Corno to Lardera between the rivers Adda and Po and the island of Roncarolo "*excepta auri lavatione quam camere reservavimus nostre*", to the Convent of Saints Sisto at Fabiano and of the Resurrection at Piacenza.
- b. The same grant is asserted again on the 31 October 1061 by the Emperor Henry III (Ficker 1868, 19-20 n.14; Vignati 1879, I, 66-67).

- c. 1 November 1000. The Emperor Otto III gives "*totum aurum quod invenitur et elaboratur intra Vercellensem episcopatum, et Vercellensem comitatum, et infra comitatum Sanctae Agatae, et infra iura et infra pertinentias S. Michaelis in Laucejo et infra alias terras ad episcopatum Vercellensem, et ad comitatum pertinentes*" to the bishopric of Vercelli (Durandi 1804, 142).
- d. 1002. The King Arduino gives "*omnem redditum auri, quod in amne levatur*" ... "in toto dominio castellorum Cavenaci et Galgagnani, qui redditus pertinere videntur Camerae Nostrae"... to the bishopric of Lodi (Milan) because of the "*paupertatem prefatae Ecclesiae Laudensis*". (Ughello 1719, IV, col.661, Vignati 1879, I, 42).
- e. 4 May 1039. The Emperor Conrad II gives and confirms to "*Uala de Casale filius quondam Antonii*" the following sites. "*Casauallonus, Pezana, Rosascum, Castrum novum, Castro Beluardi, Bulgari, Lerio, Burontium*" with their own rights, among which there are: "*aurilevam, navigium, rivaticum, ex utraque parte fluminum, que in eius predia, coherencia tenentur*". (Bresslau 1909, IV, 386-389).
- f. XI century. "*Sunt etiam omnes auri levatores qui mittunt rationem ad cameram Papiensem; et numquam debent alicui aurum venudare nisi per Sacramentum, et debent ad illud consignare et camerario. Et debent omne illud aurum comparare, gradinam solidos duos, id est octava parte unzie, id est denariorum solidorum (?) duorum cum dimidio, solidi sedecim, alias unam unziam, in fluminibus, ubi aurum levant, que sunt haec: Padus, Ticinus, Dorica, Sicida, Stura, Minor Stura, flumen Orco, Amalone et Amaloncello, Duria, Elavum, Urba, Sarvus, Sesedia, Burmia, Agonia, Ticinus a laco Maiori ubi intrat in Padum. Sunt etiam ista flumina: Abdua, Oglus, Mentius, Sarno, Atese, Brenta, Trebia. Et per omnia alia flumina predicta debent aurum levare.*" (Bruhl and Violante 1983, 20-21; 94-104).
- g. May 1172. Agreements about the sale of gold between Bertolotto Achiley and a group of people panning gold ("*aurilevas*") in the sands of river Adda, in the jurisdiction of the Bishop of Lodi (Milan) (Vignati 1883, II, 66).
- h. 1195. "*Hoc anno siccitas fuit magna, et tunc inventum fuit aurum in Bovagno*" (Bovegno, Brescia) (Bethmann 1863, 815).
- i. 20 May 1230. Umberto de Bulgaro and Bertolino de Saluzzola, with some relatives of theirs, hand over to the Comune of Vercelli all their rights "*in illa argenteria sive argenti, auri, azurri et aliarum rerum*" which is on "*mons Asolate*" (Biella). (Historiae Patriae Monumenta 1876, II, col.118, CCXXVII; Ordano 1970, II/1, 224-226).
- j. 1311?. Fragment of a petition sent by the Bishop of Lodi (Milan) to the Emperor Henry VII asking for the allotment of the "*reditus auri quod annue levatur in ripis fluminis Aduae ab utraque parte ipsius fluminis a Cornaiano Bertaro usque ad Castrum novum buce Aduae, vel saltem intra curtem Galgagnani et curtem Castioni*" (Vignati 1883, II, 474).

From these documents one can see that the emperors assert their rights on the mines and placers, that may be given to somebody only by special concession.

It is possible that the group of "*aurilevas*" mentioned in the document of the year 1172 formed a society. Mining societies are already known from many medieval Northern Italian documents, such as those about the silver mines in the district of Bergamo, but this is the earliest known at present about a society for gold panning. In the same document the prices for gold are quoted and they are low. This is not surprising since the economy and the monetary system of the period was based on silver and not on gold.

7. Current field researches on gold exploitation in Northern Italy

In Italy the last active gold mine at Pestarena in Val d'Ossola closed down as recently as 1962 when its activity appeared to be no longer profitable. During the last years geological field research concerning gold ores has been resumed by RIMIN Company both in the Alps and the rest of Italy (RIMIN 1987). There are also scientists and historians (affiliated both with both Universities and Museums) interested in the past exploitation of gold who are undertaking field research (Badino et al. 1992). A meeting on the Alagna gold mines organized in 1990 by a research team working in the Val Sesia (Piedmont), was supposed to be followed up by a conference wider in scope on the same subject (Cagna Pagnone et al. 1990). This however has not yet taken place. The Soprintendenza Archeologica del Piemonte is studying the deposit of the "La Bessa" highland (Vercelli) (see section 4).

In the Val d'Ossola (Novara) a multidisciplinary research project is under way. The primary aim is to study the mining and the processing of metalliferous ores in the pre-industrial age. Another of its purposes is to compile a comprehensive record of mining from geological and archaeological field evidence as well as historical and archival data. The study of archival documents (Milan, Novara, Turin, Pallanza States archives and some private ones) is the starting point for the fieldwork. "Mining topographical unit" records are being compiled in which geological and mineralogical data are registred and an attempt is made at assessing the impact on the environment (Cattin 1988, Del Soldato 1988, 1989a, 1989b, 1989c, 1991 a, 1991b).

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Prehistoric Gold in Europe

Mines, Metallurgy and Manufacture

edited by

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