

# Design and Implementation of Excel VBA-Based Charts with Optional Data Source in Analyzing Mineral Resources Data

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**Abstract**— In Mineral resource economics, a large amount of data stored in Excel files usually need to be calculated and transferred to various charts for analyzing. Excel VBA provides a fast and easy way to carry out the calculating works and to create various kinds of charts. This paper illustrates how to create a kind of chart with optional data source based on Excel VBA. Firstly, design the form window to select data source and the chart type. Secondly, activate the form and get it on focus. Thirdly, program the cmdOK button-click event to create the needed charts. And finally, create the charts with the selected data source. Every step of creating processes is illustrated in details and the Excel VBA codes are analyzed carefully. And the resulting charts are displayed to emphasize the effectiveness of Excel VBA. Then the conclusion is made that Excel VBA can create various charts with optional data source and chart types fast and provide great aid for researchers to do analyzing works.

**Keywords**- Excel VBA; chart; data processing; data source; mineral resource economics

## I. INTRODUCTION

Mineral resource economics deals with the supply, demand, and allocation of the Earth's mineral resources. One main object of it is to better understand the role of mineral resources in the economy in order to develop more sustainable methods of managing those resources to ensure their availability to future generations. A large amount of data are usually involved and often stored in Excel files. The data generally need to be calculated and transferred to various charts for analyzing. The calculating and charting procedures often are repeating work, boring and time-consuming. Excel VBA (Visual Basic Application) provides a fast and easy way to carry out the calculating work and to create powerful and intuitive charts.

## II. CREATE A CHART WITH OPTIONAL DATA SOURCE BASED ON EXCEL VBA

In mineral resource economics, the increasing regulations of mineral reserves usually should be found out for analyzing work. Before that, the calculation of annual increment for each mineral resource must be performed. Formulas and Excel VBA are the two popular methods for the calculation, and the latter is a much faster than the former.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Coal (t)	13.5	15.42	15.2	15.2	14.9	14.73	14.66	14.57	14.52	14.43	15.24	15.26	15.14	14.66	14.71	
Iron ore (t)	6.6	6.35	6.4	6.4	6.32	6.29	6.24	6.18	6.14	6.09	6.03	6.05	6.08	6.09	6.05	7.26
Magnetite (10 t)	4786	4741	4668	4630	4604.4	4563.6	4532	4507.7	4484.6	4461.4	4438.9	4416.7	4394.7	4372.7	4350.8	4328.9
Phosphorite (10 t)	60108	60102	61204	61204	61200	61200	61156.1	61111.8	61068.1	61024.7	60981.7	60938.7	60895.7	60852.7	60809.7	60766.7
Potassium shale (t)	80796	80796	80796	80796	80796	80796	80796	80796	80796	80796	80796	80796	80796	80796	80796	80796
Magnetite (10 t)	1450	1449	1445	1435	1432	1421	1421	1420	1418	1418	1417	1416	1415	1414	1413	1412
Quartzite (10 t)	94216	94216	94216	94216	94216	94216	94216	94216	94216	94216	94216	94216	94216	94216	94216	94216
Bentonite (t)	14925	14925	14925	14925	14925	14925	14925	14925	14925	14925	14925	14925	14925	14925	14925	14925
Zeolite (10 t)	10717	10716	10699	10672	10659	10636	10619	10619	10616	10613	10611	10609	10609	10609	10609	10609
Copper (t)	366973	366973	366973	366973	366973	366973	366973	366973	366973	366973	366973	366973	366973	366973	366973	366973
Lead (t)	227195	227195	227195	227195	227195	227195	227195	227195	227195	227195	227195	227195	227195	227195	227195	227195
Zinc (t)	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456	4451456
Limestone (10 t)	247073	247073	247073	247073	247073	247073	247073	247073	247073	247073	247073	247073	247073	247073	247073	247073
Gold (kg)	97069	97069	97069	97069	97069	97069	97069	97069	97069	97069	97069	97069	97069	97069	97069	97069
Glass sandstone (10 t)	4769	4742	4717	4693	4669	4645	4621	4603	4584	4567	4550	4533	4517	4501	4485	4469
Kaolin (t)	1257	1257	1257	1257	1257	1257	1257	1257	1257	1257	1257	1257	1257	1257	1257	1257

Figure 1. The mineral reserves data of XXX province in China

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Coal	0.00%	-0.52%	-1.43%	0.00%	-1.97%	0.00%	-1.14%	-0.48%	-0.61%	-0.27%	-0.19%	6.32%	-0.52%	-0.73%	-3.17%	0.34%
Iron ore	0.00%	-0.75%	-2.28%	0.00%	-1.25%	-0.47%	-0.75%	-0.36%	-0.65%	-0.21%	-0.39%	10.78%	0.00%	-1.35%	-0.63%	10.28%
Magnetite	0.00%	-0.34%	-1.96%	-0.34%	-0.60%	-0.38%	-0.40%	-0.33%	-0.33%	-0.08%	-0.34%	27.89%	-1.51%	0.00%	-0.09%	0.41%
Phosphorite	0.00%	-0.01%	-14.00%	0.00%	-0.01%	0.00%	0.00%	-0.01%	-0.11%	-0.12%	-0.16%	43.77%	-0.00%	-0.09%	-0.11%	-0.09%
Potassium shale	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Magnetite	0.00%	-0.41%	-0.20%	-0.42%	-0.49%	-0.77%	0.00%	0.00%	-0.02%	-0.13%	-0.55%	131.45%	-0.17%	-0.16%	-4.60%	-0.12%
Quartzite	0.00%	0.00%	0.00%	0.00%	-0.00%	-0.12%	-0.11%	-0.15%	-0.19%	-0.40%	-0.22%	-0.24%	-0.32%	-2.49%	-0.52%	-1.47%
Bentonite	0.00%	-0.03%	0.00%	-1.70%	-0.07%	-0.90%	-1.60%	-0.40%	-0.13%	-0.21%	-0.27%	4.77%	-0.19%	-0.37%	-0.33%	0.25%
Zeolite	0.00%	-0.10%	-0.07%	-0.25%	-0.12%	-0.31%	-0.07%	-0.01%	-0.02%	-0.08%	-0.02%	357.26%	0.00%	0.00%	-1.26%	15.15%
Copper	0.00%	-3.45%	-2.91%	-0.24%	-1.97%	-0.70%	-0.51%	-2.36%	12.97%	3.18%	-2.05%	-0.50%	-1.38%	-1.88%	-0.70%	-1.07%
Lead	0.00%	20.34%	-0.05%	42.75%	-2.12%	0.38%	-0.46%	-1.10%	4.53%	6.69%	8.82%	-9.70%	6.53%	7.73%	5.02%	-0.04%
Zinc	0.00%	1.45%	-0.01%	4.34%	2.04%	2.10%	-0.08%	-0.48%	3.49%	3.06%	0.10%	-0.57%	-0.24%	-1.77%	-2.43%	-0.07%
Limestone	0.00%	3.00%	5.22%	-4.55%	6.14%	1.32%	-0.24%	6.05%	5.41%	3.41%	6.25%	-5.14%	3.30%	20.13%	0.23%	15.46%
Gold	0.00%	-0.25%	87.63%	13.25%	12.00%	-10.75%	-9.22%	-1.01%	15.57%	5.39%	12.55%	-20.30%	-4.07%	-16.14%	-6.63%	-1.02%
Glass sandstone	0.00%	-0.57%	-0.53%	-0.51%	-0.60%	-1.69%	-0.72%	-0.59%	0.51%	19.60%	17.47%	6.73%	-0.44%	1.37%	-1.22%	5.61%
Kaolin	0.00%	0.00%	99.68%	0.00%	-5.90%	0.00%	-0.42%	-0.21%	0.00%	-0.64%	-0.21%	-0.50%	0.00%	-0.58%	0.00%	0.00%

Figure 2. The annual increments of mineral reserves of XXX province in China

The mineral reserves data from 1995 to 2005 of XXX province in China are showed in Fig. 1, and their annual increment data calculated by Excel VBA procedures are showed in Fig. 2. The former data reside in Sheet1 worksheet and the latter reside in Sheet2 worksheet. All the data have the same worksheet structure. There are 16 kinds of mineral resources and their names reside in column A from row 2 to row 17. The data of years are stored in the row 1 form column B to column Q. The data of mineral reserves and their annual increments reside in the range from cell B2 to cell Q17.

In order to observe the increasing trends of various mineral reserves from 1990 to 2005, the increment data of one or more mineral resources are often plotted in a chart for analyzing works. The chart is a comparative tool for analysis. It is easy to create a chart with one data series of

mineral data. However, if a chart contains two or more data series of mineral data, the creating process will be complex and be able to encounter errors on selecting various mineral data from disconnected ranges. Excel VBA is able to instruct Excel to automatically do thing that users normally do manually. That can save a lot of time and reduce errors. Excel VBA is able to create a form window with checkboxes for selecting data source for comparing charts easily.

#### A. Design of the form window

A form window is designed for selecting data source and the chart type showed in Fig. 3. It is named as "FrmSelData" and contains one frame control named "fraData" to enclose a range for checkboxes, a textbox control named "txtInstruct" for displaying prompting message for users, another frame control with two option buttons showing two chart types, and two buttons for confirm or conceal the selecting operation and quit the from widow.

The numbers of checkboxes in FrmSelData frame is changeable, and it depends on the numbers mineral resources in Fig. 2. For there are no one checkbox in the fraData frame, the checkboxes controls should be added to the frame control in the Excel VBA procedure. Excel provides a lot of kinds of chart types for users. Two typical chart types, 2D clustered column and line with data markers, are available for selecting. Two buttons named "cmdOk" and "cmdCancel" are captioned with "OK" and "Cancel" to confirm and quit the selecting operation. Most of the controls in this form window are needed to program their event procedures.

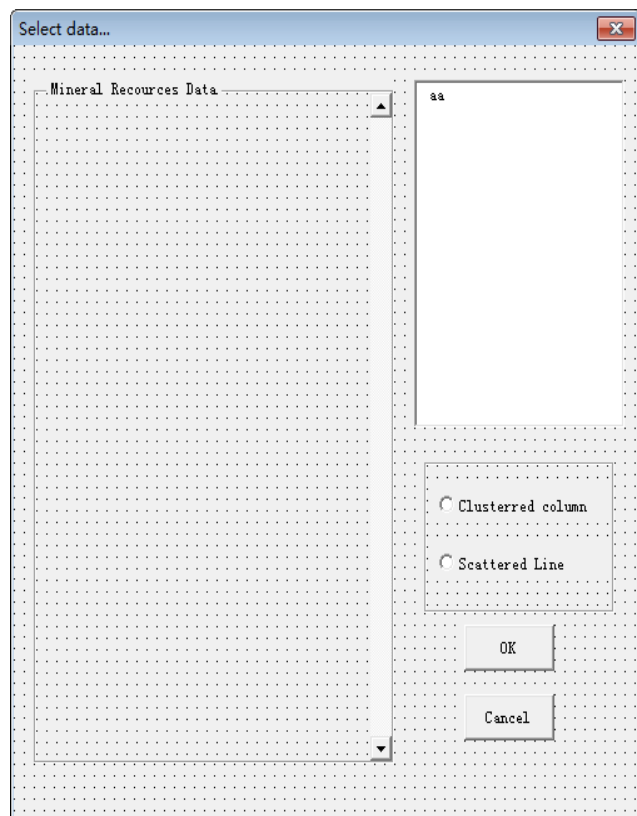


Figure 3. Design of FrmSelData form window

#### B. Activate the form and get it focus

The FrmSelData should be activated before using it. The following sub procedure named "UserForm\_Activate()" demonstrates its activation.

```
Private Sub UserForm_Activate()
    Dim i As Integer
    Dim j As Integer
    Dim int_row As Integer
    Dim int_col As Integer
    txtInstruction.Text = "Please select the chart data
    source you want to" & _
    "compare with from the left Frmae by checkboxes and
    select the chart type" & _
    "from the below Frame by optionboxes!"
    optColumn.Value = True

    int_row = Sheet2.UsedRange.Rows.Count
    int_col = Sheet2.UsedRange.Columns.Count

    For i = 2 To int_row
        Set cbx(i - 1) = _
        fraData.Controls.Add("Forms.Checkbox.1", _
        "cbx(" & (i - 1) & ")")
        With cbx(i - 1)
            .Visible = True
            .Value = False
            .Width = 200
            .Top = 18 * i - 28
            .Caption = Sheet2.Cells(i, 1)
        End With
    Next i
End Sub
```

It begins with definitions of four integer variables, and the prompting message is showed in "txtInstruction" textbox.

The numbers of mineral resources and the years should be known before creating charts. It can be seen that the numbers of mineral reserves is exactly equal to the result of the numbers of rows in the used ranged minus one, and the number of years is exactly equal to the result of the numbers of columns in the used range minus one. So the numbers of rows and columns should be obtained at first. The two integer variables *int\_row* and *int\_col* are assigned by the value of the number of rows and the value of the number of columns in the used range respectively. They are very useful, because they can make the procedure more flexible to process the data of variable kinds of mineral annual increments and variable years.

The procedure we talked in this paper have preliminary requirement that all the data must have fixed location in worksheets. The data of years are in row 1 and the names of mineral resources are in column A, and there are no empty cells in the used range. The procedure can deal with changeable numbers of years and mineral annual increments only if the data are in the fixed locations.

The checkboxes restored in an array are added to the *fraData* frame. The elements number of the array relies on the number of mineral resources. So the For-Next loop structure is used in this procedure. In the loop, each checkbox are named follow the array name and be added to the *fraData* frame, and several properties of them are specified and they are arranged in the frame from top to the bottom with average space of 18 points. The captions

of the checkboxes are assigned by the name of the mineral resources in the range of *Sheet2.Cells(2, 1)* to *Sheet2.Cells(int\_row, 1)*.

#### C. The codes of *cmdOk* button-click event

After selecting the mineral resources and the chart type, the *cmkOk* button can be clicked to create the needed chart. The following sub procedure demonstrates the operation of that.

```
Private Sub cmdOk_Click()
    Dim i As Integer
    Dim intdata As Integer
    Dim intcount As Integer
    Dim intseldata(1 To 100) As Integer
```

```
    intcount = 0
    intdata = fraData.Controls.Count
    For i = 1 To intdata
        If (cbx(i).Value = True) Then
            intcount = intcount + 1
            intseldata(i) = 1
        Else
            intseldata(i) = 0
        End If
    Next i
```

```
    If (intcount > 0) Then
        Call subAddChart(intseldata, intdata)
    Else
        MsgBox "The data should not be Zero! Please reSelect!"
    End If
End Sub
```

The integer variable *intdata* is used to store the number of checkboxes, which is as same as the number of mineral resources. The integer variable *intcount* is used to store the number of selected checkboxes, which refer to the mineral resources the user wanted to show in the chart. The integer array *intseldata* is used to store the selecting information. Its every index corresponds to the index of checkbox array. The value of its each element corresponds to the selecting situation of the checkbox. The value of 1 indicates that the checkbox is selected and 0 indicates that the checkbox is not selected. The For-Next loop structure does the traversal researches from all the checkbox and stores their selected information to the *intseldata* array.

The crating-chart operation are performed by the *subAddChart()* procedure with two parameters of *intseldata* and *intdata*.

#### D. The codes of *subAddchart()* procedure

The chart is created from the selected data by the sub procedure *subAddchart()* called in the *cmdOk\_Click()*.

```
Private Sub subAddChart(ByRef intseldata, ByVal intdata)
```

```
    ....
    Set chtMR = Charts.Add
    If (optColumn.Value = True) Then
        chtMR.ChartType = xlColumnClustered
    Else
        chtMR.ChartType = xlXYScatterLines
    End If
```

```
    j = 1
```

```
    For i = 1 To intdata
        If (intseldata(i) = 1) Then
            chtMR.SeriesCollection.NewSeries
            chtMR.SeriesCollection(j).Name = Sheet2.Cells(i + 1, 1).Value
            chtMR.SeriesCollection(j).Values = Sheet2.Range(Sheet2.Cells(i + 1, 2), Sheet2.Cells(i + 1, int_clm))
            chtMR.SeriesCollection(j).XValues = Sheet2.Range(Sheet2.Cells(1, 2), Sheet2.Cells(1, int_clm))
            j = j + 1
        Else
            End If
    Next i
```

```
    If (optLine.Value = True) Then
        chtMR.ApplyLayout (1)
    Else
        chtMR.ApplyLayout (9)
    End If
```

```
    ....
    For i = 1 To chtMR.SeriesCollection.Count
        chtMR.SeriesCollection(i).ApplyDataLabels
    Next i
```

```
    ....
    Unload FrmSelData
End Sub
```

At begin, a chart is added to the current worksheet and its chart type is specified by the selection of the two option buttons. The For-Next loop is used to check the selecting situation of the checkboxes. If one checkbox is selected, then add a new data series to the new chart with the data of the corresponding mineral annual increments, and the category values are the data of the years. Then type of the layout is specified according to the selection of the two option button, corresponding to the two different chart types. The data series in the chart are specified to show their data labels with the default colors. At last, the *frmSelData* form is unloaded and its memory is freed.

#### E. The resulting charts

When one user load the *frmSelData* form by using click one button in the worksheet or macros in Excel, and select several mineral resources in the *fraData* frame and the chart type from the two option buttons, then click the "OK" button, one new chart will be created. Fig. 4 shows some resulting charts with the data of different kinds of mineral resources.

In Fig. 4, the chart type of the left three charts is clustered column, and that of the right charts is line with data markers. From top to bottom, the numbers of the mineral resources in the charts are 1, 2 and 8. The charts with small numbers of mineral resources are seemed clearer than that with lot of numbers of mineral resources. When the chart contains three or more data series, some of their line charts and their data labels are often overlapped with each other, so it is not enough to observe the increasing trends and identify their accurate data labels clear. It is suggested to create the comparing charts with the data of less than 4 kinds of mineral resources.

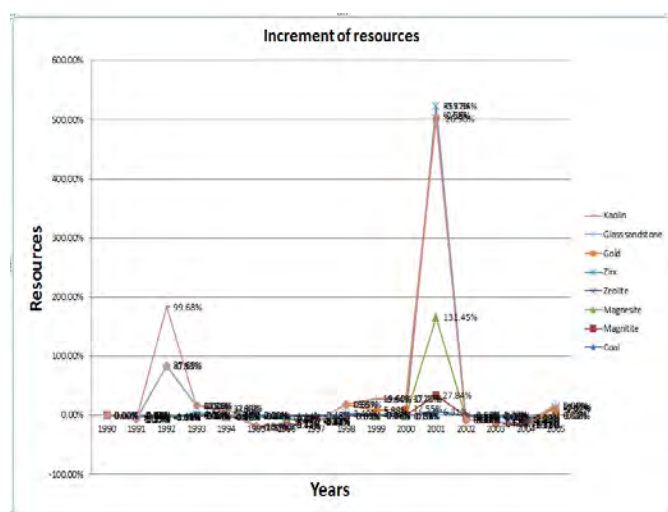
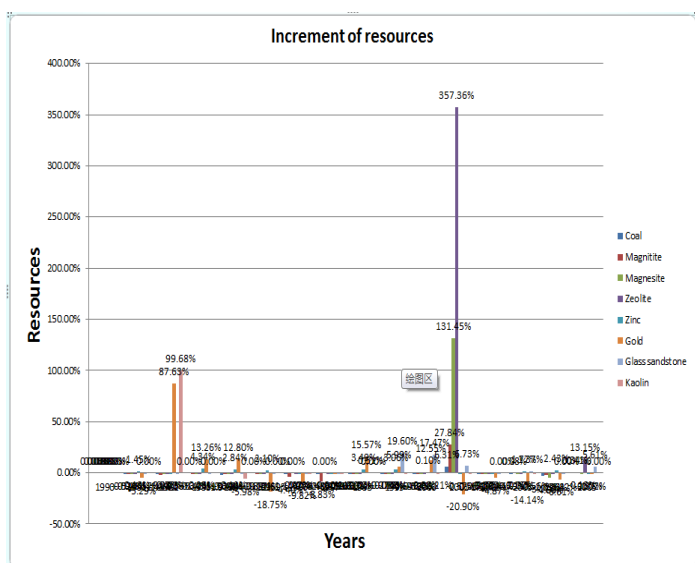
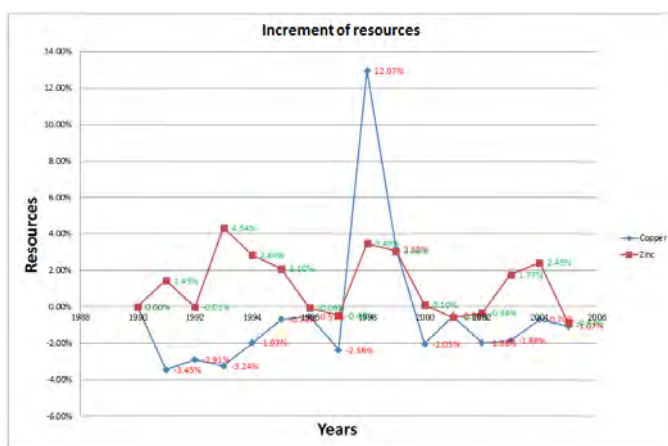
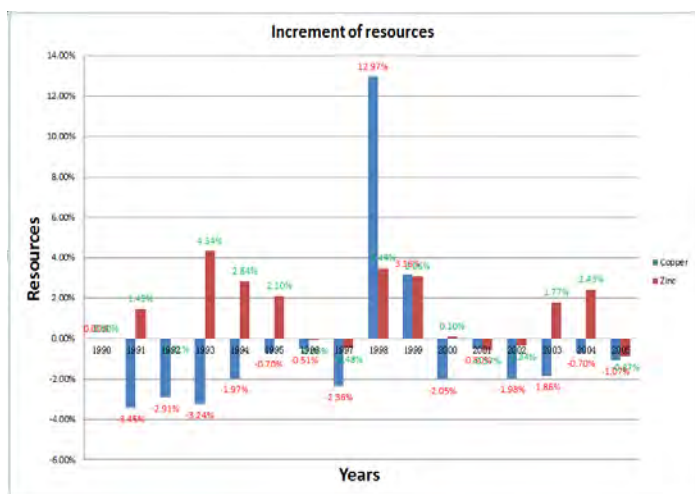
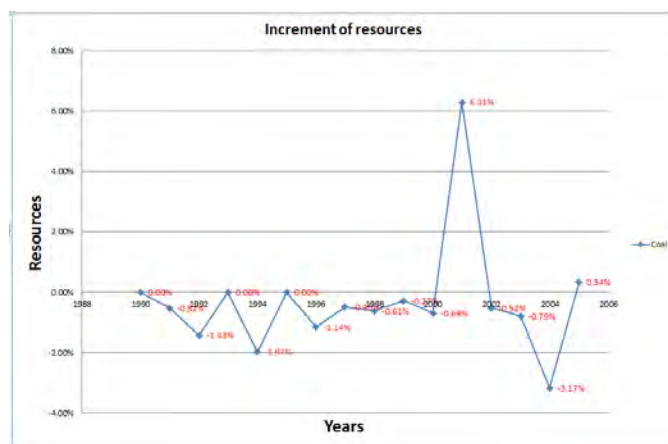
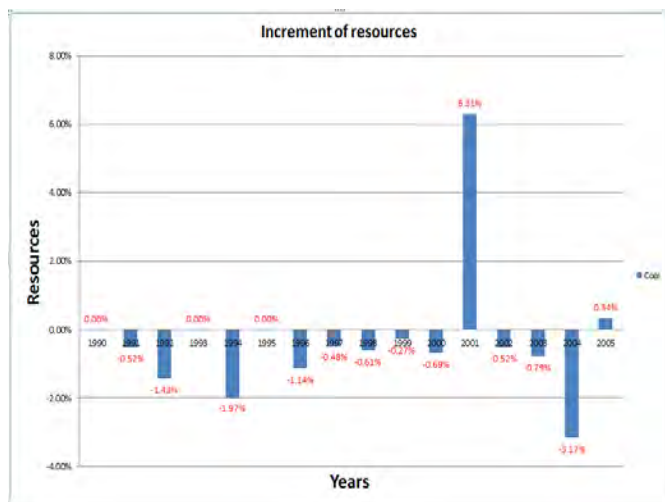


Figure 4. The resulting charts with the data of different kinds of mineral resources

## CONCLUSIONS

In mineral reserves economics, the data of mineral annual increments usually are displayed in a comparing chart for analyzing the increasing trends. Excel VBA can create these charts with optional data source and chart types fast and provide great aid for researchers to do analyzing works.

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